Appendix to the monograph

Articles published after the publication of the monograph:

1. 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. www.arcjournals.org/ijarps/v5-i6/

2. Petro O. Kondratenko. The Evolution of the Universe in a Model with Minimal Initial Entropy // International Journal of Advanced Research in Physical Science (IJARPS). - Volume 6, Issue 3, 2019, pp 24-36.
https://www.arcjournals.org/ijarps/v6-i3/

3. Petro O. Kondratenko. Creation and Evolution of the Galaxy in the Universe Model with Initial Minimum Entropy // International Journal of Advanced Research in Physical Science (IJARPS). - Volume 6, Issue 6(6),, 2019, pp. 1-11
URL: https://www.arcjournals.org/pdfs/ijarps/v6-i6/1.pdf

4. Petro O. Kondratenko (П. Кондратенко). Начальный период в создании Вселенной (The Initial Period in the Universe Creation) // Scientific Light. 2019, Vol.1, No 28, p. 13-19. http://www.slg-journal.com/ru/archive/

5. Petro O. Kondratenko. Relict Radiation in the Model of the Universe with Initial Minimum Entropy // International Journal of Advanced Research in Physical Science (IJARPS) 7(3), pp.42-49, 2020 https://www.arcjournals.org/international-journal-of-advanced-research-in-physical-science/volume-7-issue-3/

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Formation of the Solar System

Petro O. Kondratenko
National Aviation University, Kyiv, Ukraine
pkondrat@ukr.net

Abstract

Based on the consideration of the formation of the solar system on the basis of the Standard Model in comparison with the model of the birth of the Universe with a minimum initial entropy, it is shown that taking into account the expansion of the Universe does not allow the formation of the Solar System in the Standard Model, but allows us to adequately describe the formation of the solar system in the Universe with the initial minimum entropy. In the latter model, both the mass of the cosmic body and the distance from the planet to the sun increase in proportion to time. This fact ensures that velocity of motion of the planet in its constantly moving away from the Sun orbit is constant over time. The new model assumes that the Oort cloud was first born, then the Kuiper belt and only after that there were conditions of resonance for the liberation from the periphery of the solar disk of the embryo of the future planet Neptune. Then according to the same scenario, the rest of the planets were born. The proposed model gives a correct estimate of the time of the emergence of multicellular organisms on Earth.

Keywords. Models of the birth of the Universe, resonance interaction, the birth of the planets of the solar system, the period of existence of life on Earth.

The history of ideas about the formation of the solar system has a large number of representations and models designed to describe this process. For example, according to the theory of P. Laplace, the solar system began to form about 10 billion years ago and was finally formed 4.6 billion years ago due to the gravitational compression of a giant molecular cloud.

According to modern ideas, the formation of the solar system began about 4.6 billion years ago from the gravitational collapse of *a small part* of a giant molecular cloud [1-4]. In this case, most of the substance of this cloud was in the gravitational

center of collapse and *began* to rotate, forming the Sun in the center of the nebula. The substance, which did not fall into the center of the collapse, formed a disk-like cloud, which formed the planets after some period of time.

There are a number of complaints about such ideas about the formation of the solar system. *First*, they pay attention only to secondary processes, forgetting about the primary birth of stars when creating the Universe or even rejecting this possibility. However, most of the stars were born in the primary process. Molecular clouds appeared only in secondary processes. If these clouds are formed as a result of the explosion of stars, then they move away, rather than shrink.

Secondly, the developed models do not take into account the expansion of the Universe. At the same time, when studying the mechanisms of receding galaxies, the expansion of the Universe is taken into account.

Thirdly, just as condensation of moisture in the clouds on Earth occurs, condensation of the molecular cloud in space must also occur. Consequently, we need a condensation center, in whose role only a fairly massive body can act. If this body moves in the cloud, its mass will increase due to accretion. Creating a disk from the elements of a thin cloud that would rotate around the body will be unlikely.

Fourthly, the second law of thermodynamics requires that the entropy of the system should grow. Consequently, the condensation of a molecular cloud must intensively blow the substance out of the cloud.

Fifth, the law of conservation of angular momentum is absolute. If the molecular cloud did not have a center which it was rotating around, angular momentum cannot appear. If there was no rotation, then the planets would not be created either. Consequently, the center of condensation must have a sufficiently large angular momentum at the very beginning. In addition, the molecular cloud should be fairly cold. Then the processes of accretion will not only increase the mass of the embryo, turning it into a star, but also draw near the molecular cloud layers into the rotational motion.

Thoughts mentioned above prompted the author to propose his own model of the birth of the solar system in the expanding Universe. We take into account the modern parameters of the Sun for the calculations:

Table 1. Parameters of the Sun nowadays.

equatorial radius	696 342±65 km
average density	1.408×10^3 kg/m^3 = 1.408 g/sm^3
density in the center (simulated)	1.622×10^5 kg/m^3
period of circulation at the equator	25.38 days
period of circulation at the poles	34.4 days
linear velocity of circulation at the equator	7.189×10^3 km/h = 1997 m/s.

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

Let us begin our consideration of the formation of the solar system from its present state.

In the Standard Theory of the Universe, the masses of the stars (M_0) and the planets (m) are unchanged. Therefore, the expansion of the Universe would lead to a decrease in the potential energy of interaction in the solar system, so that the kinetic energy of the planet would be greater than necessary for a stationary circular orbit. Therefore, the planet would have to move in a spiral, further increasing the distance from the star.

We fix the velocity of the planet in a certain circular orbit with a radius r0. It is determined by the formula

$$v_0^2 = \frac{GM_0}{r_0}$$

As the space is expanded ($r_1 = r_0 + dr_1$), the planet's velocity will be greater than necessary for a circular orbit, this will entail an additional increase in the distance to $r_2 = r_0 + dr_2$. Wherein

$$v_2^2 = \frac{GM_0}{r_2}$$

According to the law of conservation of energy, the change in kinetic energy will be equal to the change in the potential energy, that is,

$$v_0^2 - v_2^2 = 2GM_0\left(\frac{1}{r_1} - \frac{1}{r_2}\right) = GM_0\left(\frac{1}{r_0} - \frac{1}{r_2}\right)$$

From here

$$\frac{1}{r_0} + \frac{1}{r_2} = \frac{2}{r_1}$$

And, finally, $dr_2 = 2 \cdot dr_1$.

Consequently, an increase in the radius of the planetary orbit would significantly (by a factor of 2) exceed the expansion of the Universe. In this case, the speed of the planet's motion will decrease.

Considering this process in the opposite direction and remembering that in this case the change in the kinetic energy should be equal to half of the change in the potential energy, we find that at a small distance from the center of the Sun, for example $7 \cdot 10^5$ km, the velocity of the Earth along the circular orbit should be equal to 435 km/s.

Since the speed of the approach of the Earth (or another planet of the solar system) to the Sun is 2 times greater than the rate of change in the distance from the Sun to the planet due to the expansion of space, the time of such approximation should be 2 times less than the time of expansion of the Universe. Considering the time of expansion of the Universe equal to $13.25 \bullet 10^9$ years [5], we get time from the origin of the solar system ≈6.6 billion years. This time is much closer to the above accepted lifetime of the solar system than the time of existence of the Universe.

It is known that the tidal forces arising between the Earth and the Moon also exist between the Earth and the Sun. The closer the orbit of the planet to the Sun is, the greater is the magnitude of tidal forces. Consequently, these forces must act on the terrestrial planets. They contribute to an additional increase in the distance between

the Sun and the Earth [6]. Accounting for such forces will bring us closer to the time of the birth of the Earth.

However, this calculation says nothing about the time of the birth of the Sun. On the other hand, this calculation requires that planets are born within the Sun, and come out of it in an unknown way, having a huge initial velocity of the orbital motion. Rather, the above calculation corresponds to the tidal hypothesis of T. Chamberlain (1901), F. Multon (1905) and G. Jeffreys (1916), according to which the most part of his mass escaped from the Sun due to interaction with a star flying past the Sun. In this case, the relative velocity of the star υ_3 must be greater than the double velocity of the Earth's embryo, that is, υ_3 should be > 830 km/s. Otherwise, the substance torn from the Sun would be captured by a star. It is clear that there are no such velocities in the galaxy in the vicinity of the Sun.

Modern science treats unlikely such a mechanism of the formation of the planets of the solar system, while the usual is the presence of planets in other stellar systems. Therefore, modern specialists in cosmology prefer the theory of birth of the solar system from a gas-dust cloud.

In this case, the computer simulation of star formation from a gas-dust cloud (which should not be receding according to the description of the problem) shows that first a thick and then a thin gas-dust disk is formed around the future Sun, which for an unknown reason should have a large angular momentum. Fragmentation of the substance into clots of dust then takes place in the disk, which, above all, led to the formation of embryos of the terrestrial planets. The planets of the group of Jupiter were formed in around 200 million years. And only after 1 billion years Neptune and the trans-Neptune small planets were formed.

The model of the birth of the solar system in the Universe with the minimum initial entropy

According to the model of the birth and evolution of the Universe with the minimum initial entropy [5], our Universe is constantly expanding in such a way that its radius increases with the speed of light. At the same time, the masses of all cosmic bodies increase with time in proportion to the size of the modern mass:

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

where m_0 is the mass of the cosmic body nowadays, T_{U0} is the age of the Universe nowadays, t is the time that count starts now, $T_U = T_{U0} + t$ is the time that counts from the moment the Universe was created.

The circular orbit of planets around a star with a mass M is currently described by formula

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

If we take into account the expansion of the Universe at a constant speed, then the radius r will increase in proportion to the time of existence of the Universe . From here

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

Consequently, the speed of the planet's orbital motion will be constant, and the radius of the orbit will increase with the speed corresponding to the speed of expansion of the Universe on the scale of the planet's orbit. At the same time the duration of the year increases with time.

The radius of the Universe is $R_U = 1.25\cdot10^{26}$ m, the expansion velocity is equal to the speed of light [5]. The radius of the Earth's orbit is $1.5\cdot10^{11}$ m. From the proportion we find the rate of expansion of space within the Earth's orbit:

$$V_3 = 3\cdot10^8\cdot\frac{1.5\cdot10^{11}}{1.25\cdot10^{26}} \approx 3.6\cdot10^{-7}\ m/s.$$

For the year it will be 11.36 m.

$\ln V_3 = -14.83716$.

After investigating the motion of the planets in the opposite direction of time, we see that at the birth of the planetary system, the star embryo rotated with a large angular velocity, which provided separation of the peripheral regions and the formation of planets. This conclusion agrees with the conclusions of [7].

We fix the modern parameters of the solar system to find the mechanisms of the birth of the planetary system (Table 2).

Table 2. Parameters of the planets of the solar system nowadays.

n	Body	Weight m_{i0}, kg	T_n, earth years and days	Distance to the Sun, million km	$a_i = R_{ave}$ 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
	The Sun	$1.9891 \cdot 10^{30}$		Radius of the Sun	0.696

Let us consider the problem in the approximation of the spherical shape of the Sun during the creation of the planets to simplify the calculations. With this approximation, the results of calculations will be approximate. However, with increasing distance from the Sun to the planet, the shape of the Sun will not matter. In the future, these results can be clarified.

Weight of the Sun $M = \frac{4}{3}\pi R^3 \rho = A \cdot T_U$.

From here $A = \frac{M}{T_U} = \frac{1.9891 \cdot 10^{30}}{4.18 \cdot 10^{17}} = 0.4759 \cdot 10^{13}\ kg/s.$

$$4\pi\rho = \frac{3M}{R^3} = \frac{3 \cdot 1.9891 \cdot 10^{30}}{(0.696)^3 \cdot 10^{27}} = 17.7 \cdot 10^3\ kg/m^3$$

$$R^3 = \frac{3 \cdot A \cdot T_U}{4\pi\rho} = \frac{3 \cdot 0.4759 \cdot 10^{13} \cdot T_U}{17.7 \cdot 10^3} = 8 \cdot 10^8 \cdot T_U$$

$$R = 928 \cdot \sqrt[3]{T_U}$$

$$F_S = ln(R) = 6.833 + \frac{1}{3} ln(T_U) = 6.833 + x/3 \qquad (4)$$

As you can see, the expansion of a massive body is much slower than the expansion of space. This is worth remembering when researching the expansion of galaxies, which are being carried out recently [8].

These studies have shown that the diameter of the Milky Way galaxy is expanding at a speed of about 500 m/s. If this expansion was caused only by the expansion of space, then from the proportion it follows that the radius of the Earth's orbit would expand at a speed of $0.83 \cdot 10^{-7}$ m/s, which is 4.34 times less than the speed found in the new model of creation of the Universe [5]. Consequently, the gravitational interaction between stars in the galaxy slows the expansion of the galaxy. On the other hand, the presence of an expansion of the galaxy with the found velocity indicates the validity of the assumption about the rate of expansion of space made in the new model [5].

For planets, the magnitude of the major semi axis of the elliptical orbit

$$a_i = V_i \cdot T_i\ ,$$

where the magnitude of the local speed of increasing the distance from the Sun to the *i*-th planet V_i is determined from the proportion, assuming that the radius of the Universe expands at the speed of light [5].

$$f_i = ln(a_i) = ln(V_i) + ln(T_i) = ln(V_i) + x_i \qquad (5)$$

Planets are created at a time when the radius of the Sun and the radius of the orbit of the planets are the same:

$$ln(R_i) = ln(a_i)$$

From here

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

Then

$$6.833 - ln(V_i) = \frac{2x_i}{3}$$

$$x_i = \frac{3}{2} \cdot [6.833 - ln(V_i)] \qquad (6)$$

The calculated time of planet creation is given in Table 3, and the distance from the Sun to the planets at the time of their creation and the rate of increase of these distances (V_i) is given in Table 4. The calculated values of the radius and mass of the Sun at the moments of the birth of the planets are given in Table 5. The dependence of the distance from the Sun to the planets and the radius of the Sun on the time of existence of the Universe is shown in Fig. 1.

Table 3. Time of the planets birth of the solar system. Countdown to the Big Bang.

(1 year = 31556926 s = $3.1556926 \cdot 10^7$ s.)

n	Body	x_i	T_i, s	T_i, years
1	Mercury	33.9381	$5.484 \cdot 10^{14}$	17379286
2	Venus	32.9997	$2.146 \cdot 10^{14}$	6799994
3	Earth	32.5140	$1.320 \cdot 10^{14}$	4183734
4	Mars	31.8824	$7.020 \cdot 10^{13}$	2224607
6	Jupiter	30.0398	$1.112 \cdot 10^{13}$	352393
7	Saturn	29.1244	$4.452 \cdot 10^{12}$	141077
8	Uranus	28.0794	$1.566 \cdot 10^{12}$	49617
9	Neptune	27.4071	$7.993 \cdot 10^{11}$	25330

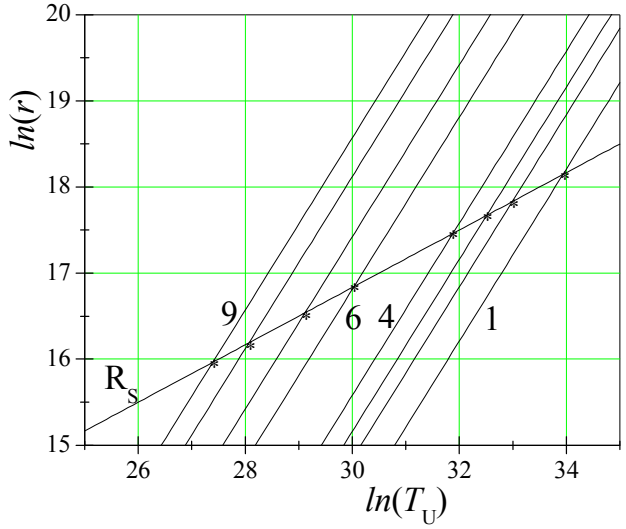

Fig. 1. Dependence of the radius of the Sun RS and the distance from the Sun to the planets from the time of existence of the Universe (the time of the creation of the planets is the intersection point of the straight lines 1-9 and R_S). Data for the belt of asteroids are absent.

As follows from Table 5, the radius of the solar disk in the creation of planets varied from 1% to 10% of the present value of the radius of the Sun. It should be remembered that at the time of the creation of Neptune, the shape of the Sun was completely disk-shaped. In the future, a spherical core was formed, so that when Mercury was created, the contribution of the disk-like shape to the shape of the Sun was minimal. Therefore, after the creation of Mercury, new planets were not created.

Table 4. Parameters of the orbits of the planets of the solar system at the time of their birth

n	Body	a_i, km	ln($\mathbf{a_i}$)	V_i, m/s	ln(V_i)
1	Mercury	75959	18.1457	$1.385 \cdot 10^{-7}$	-15.7924
2	Venus	55557	17.8329	$2.589 \cdot 10^{-7}$	-15.1668
3	Earth	47252	17.6710	$3.579 \cdot 10^{-7}$	-14.8430
4	Mars	38281	17.4605	$5.453 \cdot 10^{-7}$	-14.4219
6	Jupiter	20713	16.8463	$1.863 \cdot 10^{-6}$	-13.1935
7	Saturn	15266	16.5411	$3.429 \cdot 10^{-6}$	-12.5832
8	Uranus	10776	16.1928	$6.882 \cdot 10^{-6}$	-11.8866
9	Neptune	8612	15.9687	$10.774 \cdot 10^{-6}$	-11.4384

Table 5. Parameters of the Sun at the moment of the birth of the planets

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

From the linear relationship between the number of the planet and the logarithm of the distance to it, it follows that the next planet, if it was created, should be 30 million km from the Sun. However, it could not be created as a result of the fact that the Sun increased its mass and radius, its shape became spherical, and the angular velocity of rotation decreased substantially (see the data given above on the rotation of the Sun at the present time).

Since the mass of the body increases in proportion to time, it is easy to find out the mass of the planets at the time of their creation (Table 6).

From Table 6 it can be seen that at the moment of birth, even Jupiter had a mass, much less than the mass of Mercury in our time. The found masses of the planets at the time of birth are so small that the tidal forces between these planets and the Sun could not significantly affect the distance between the planets and the Sun. Of course, it is possible that over time such forces need to be taken into account, and they will probably contribute to the rate of change in the distance between the Sun and the planets. However, it should be noted that this process will be impeded by the resonance between the orbits of the planets, which has been preserved forever.

Now let's describe in detail the creation of the solar system.

Table 6. Mass of the planets of the solar system at the time of their birth.

n	Body	Birth weight m_i, kg
1	Mercury	$4.33 \cdot 10^{20}$
2	Venus	$24.985 \cdot 10^{20}$
3	Earth	$18.862 \cdot 10^{20}$
4	Mars	$1.078 \cdot 10^{20}$
6	Jupiter	$504.946 \cdot 10^{20}$
7	Saturn	$60.509 \cdot 10^{20}$
8	Uranus	$3.258 \cdot 10^{20}$
9	Neptune	$1.958 \cdot 10^{20}$

As follows from the model of creation of stars [5], at the beginning of its existence the future star consisted of heavy atomic nuclei, which rapidly multiplied and decayed with the release of electrons, protons and α-particles. These charged particles escaped beyond the embryo of the star at high speed. At the same time, the embryo of the star rotated with great speed. Since it was a carrier of a large number of charges, the rotation of the nucleus created a strong magnetic field. In this field, charged particles ejected from the surface of the star embryo would move in a circular orbit, returning to the star. The radius of this orbit is determined by the formula:

$$R = \frac{m}{e'} \frac{\upsilon}{B},$$

where B is the magnetic induction, υ is the particle velocity, e' is its charge.

From the model of the creation of the universe [5], we know that the mass of particles with a certain probability increased due to the creation of a bineutron in the vicinity of the particle. This will cause a significant increase in the radius of the orbit. In this case, the particle will return to the point where its mass has increased. Over time, the mass of the particle will increase, increasing the radius of the orbit. On the average, the orbit of particles will be close to the plane of the disk. However, the orbits of individual particles can deviate substantially from this plane.

Thus, the embryo of the future Oort cloud will form.

At the first moments of the appearance of this cloud, the gravitational interaction of the particles of the cloud with the star embryo will be insignificant in comparison with the magnetic interaction. However, as the orbit of cloud particles expands, the gravitational interaction becomes predominant, and then the only one. It is clear that over time the cloud becomes electrically neutral, capturing the electrons emitted by the embryo of the star.

The embryo of a future star does not need to have cylindrical symmetry. This follows from the fact that multiple stars can be formed from this embryo [7]. Therefore, it is not surprising that the Oort cloud embryo should not have cylindrical symmetry. Moreover, massive bodies, localized in a certain area of the orbit, will be formed in it, over time, predominantly from light atoms. These massive bodies under certain conditions will create a resonant interaction with the embryo of the star, helping to pull out of it massive particles that contain many atoms with different atomic masses. As a consequence, another cloud of particles will be created whose properties will significantly differ from those of the Oort cloud. This cloud is called the Kuiper belt.

In the Kuiper belt, small planets formed on the initial massive particles, capable of entering into resonant interaction with the nucleus of the star, the mass and dimensions of which have increased substantially at the present time. As a consequence, a clot of matter was born in the bowels of the star, which, when a resonance with small planets was reached, emerged as a separate planet. Increasing the mass and moving away from the star, this planet became Neptune. Consequently, Neptune was created in the Solar System not the last, but the first.

As the mass and radius of the orbit of Neptune increased, its resonant interaction with the Sun increased and ended with the birth of the embryo of the planet Uranus. Both planets moved away from the Sun and increased their mass. At the same time, the resonance interaction of Uranus with the volume of the solar disk began to

manifest itself, as a result of which a much more massive planet Saturn was born. In turn, Saturn, when it reached resonance with the volume of the Sun, gave rise to an even more massive planet, Jupiter.

It would seem that Jupiter should generate an even more massive planet if its resonant interaction covered a certain area inside the solar disk. However, its large mass excited the entire mass of the solar disk, which resulted in the appearance of a large number of embryos of mini-planets, which together formed a belt of asteroids. This belt became, as it were, a filter for the gravitational action of Jupiter with the Sun. Removing from the Sun, Jupiter stopped to interact resonantly with it. Therefore, a weak resonance formed the belt of asteroids. Because of this resonance, Mars was born from the depths of the solar disk, a planet of much less mass and radius, but much denser than large planets.

Further history repeats itself. Mars generates a similar planet Earth, which has an increased mass and a larger radius. In turn, the Earth should generate an even larger planet (from the comparison of the masses of the newborns of the Earth and Venus, it follows that the mass of the Venus embryo exceeds the mass of the embryo of the Earth). However, at the time of the birth of Venus, the Earth's mass turned out to be somewhat larger than the mass of Venus. And Venus gave birth to a very small planet - Mercury. The reason for such deviations in the last two cases is that the shape of the Sun gradually changed from disc-shaped to spherical. In addition, the equatorial velocity of the Sun has decreased substantially (Table 1). The latter is due to the fact that the angular momentum of the Sun's embryo was distributed between the Sun and the planets. The axial rotation of the Sun is only 2% of the angular momentum of the entire solar system, although the mass of the Sun is more than 99.8% of the total mass. The emission of the embryos of the planets from the peripheral region of the solar disk led to a decrease in the angular velocity of the equatorial rotation of the sun in comparison with the angular velocity of the axial rotation.

And the last thing you should pay attention to is the time of creating life on Earth. It is known that in the event that the distance from the Earth to the Sun was less by 5%, this would be enough for the unrestrained development of the greenhouse effect and an increase in the average annual temperature that would ruin life on Earth. If the distance to the Sun were greater by 1%, then an uncontrolled glaciation of the entire surface of the Earth would be observed [9]. It is easy to calculate that the distance to the Sun was less by 5% 660 million years ago, and an increase in distance by 1% will occur after 132 million years. In this case, the first digit corresponds to the time of the birth of multicellular organisms, preceding the Cambrian explosion [10]. The second figure gives an estimate of the period of the future existence of life on Earth.

Conclusions

Based on the consideration of the formation of the solar system based on the Standard Model and the model of the birth of the solar system in the universe with the initial minimum entropy, the following conclusions are drawn:

1. Modern theories of the formation of the solar system from the gas-dust cloud do not take into account the expansion of the universe and the possibility of primary star formation in the creation of the universe, and also contradict the laws of physics with respect to the growth of the total entropy and the appearance of the torque of the system.

2. Taking into account the expansion of the Universe in the Standard Model requires that the Earth be born from the volume of the Sun 6.6 billion years ago and has an initial speed of 435 km/s, which is impossible by any of the known mechanisms. Accounting for the tidal forces between the Earth and the Sun can bring the Earth's creation date closer. However, this calculation does not say anything about the time of the birth of the Sun.

3. According to the model of the birth and evolution of the universe with the initial minimum entropy, the universe expands at a constant rate. 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 provides a constant in time velocity of the Earth's motion in its orbit, which is constantly moving away from the Sun.

4. The new model assumes that the Oort cloud was first born, then the Kuiper belt and only after that there were conditions of resonance for the liberation from the periphery of the solar disk of the embryo of the future planet Neptune. This nucleus, moving away from the solar disk and increasing its mass, reached resonance with the Sun, which led to the formation of the embryo of the planet Uranus. Acting in the same scenario, Uranus causes the creation of Saturn, and Saturn - Jupiter. In this case, the mass of each next planet increases. However, Jupiter does not resonate with a certain area of the Sun, but with the whole volume, as a result of which the asteroid belt arises.

5. As Jupiter moves away from resonance with the Sun, the further history of creating the planets resembles the one that began with the Kuiper belt. At the same time, a small planet Mars was first created, then a more massive planet Earth.

6. After the birth of the Earth's embryo, the conditions for the resonance creation of planets get worse due to the gradual acquisition by the Sun of a spherical shape and a decrease in the equatorial velocity on the Sun. As a result, Venus was smaller than Earth, and Mercury was very small. After this, the conditions for the subsequent creation of the planets disappeared.

7. The proposed model of the formation of the solar system gives a correct estimate of the time of the appearance of multicellular organisms (plants and animals) on Earth, and also foresees the period of the future existence of life on Earth.

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Creation and Evolution of the Galaxy in the Universe Model with Initial Minimum Entropy

Petro O. Kondratenko

National Aviation University, Kyiv, Ukraine

Corresponding Author:** ***Petro O. Kondratenko, *National Aviation University, Kyiv, Ukraine*

Abstract: *In this article, based on the model of the creation of the Universe with the initial minimal entropy, the structure of spiral galaxies and in particular the Milky Way Galaxy is considered. It is shown that the Galaxy from the time of the birth of the Universe expands by expanding the space at a constant speed of ~1100 m/s, and its shape evolves so much that at present the velocity of the orbital motion of stars within the galactic disk is approximately the same. In the center of the Galaxy, due to the development of chaos caused by the great density of stars, a spherical region with a constant density of matter is formed; resulting in a period of rotation around the center of the Galaxy in this part of the Galaxy is a constant value for all the stars. Due to the chaos in the movement of stars in the center of the Galaxy, which lasted a limited time billions of years after the birth of the Universe, there was a collision of stars, resulting in the formation of a black hole or a few black holes in the center of the Galaxy. In the formation of the halo two processes are involved. The first one was manifested immediately after the birth of the galaxy due to the collapse of atomic nuclei in the nucleus of the stars. The second process involves the development of chaos in the central part of the Galaxy, in which the upper layers of the interacting stars were thrown outside the Galaxy. The absorption of a substance by a central black hole causes the ejection of the Scalar Field from the black hole poles. The Scalar Field generates the fluxes of the fast particles that feed the Fermi bubbles. Galactic Arms of varying power and central bar originated in pairs as a result of the absorption of lighter black holes by the central black hole. In this case, the excess kinetic energy forms streams of the Scalar Field, which in turn forms Galactic Arms and central bar. The configuration of Galactic Arms remains unchanged, since the shock waves are not related to the orbital motion of stars around the center of the Galaxy.*

Keywords: *galaxy evolution, black holes, halo, mechanism of Galactic Arms creation, Fermi bubbles.*

1. INTRODUCTION

In the model of the Universe with initial minimal entropy, it is shown that our four-dimensional Universe is part of the Super-Universe represented by the layered space [1]. Layers of the Super-Universe are a zero-dimensional space (fundamental multidimensional sphere), one-dimensional space, two-dimensional space and three-dimensional space. All of these spaces (except for zero-dimensional) are branes of spaces, the size of which is one unit higher.

Whole Super-Universe is created at the same time. However, its filling with substance comes from the step by step. Scalar Field enters through zero-dimensional space. It carries information about all physical interactions and the ability to create matter and field in all layers of the Super-Universe. It follows that the dimension of the multidimensional sphere, which corresponds to the size of the Scalar Field, should include all measurements of one-dimensional, two-dimensional and three-dimensional spaces, as well as time and information measurements. In [1] it is shown that the Super-Universe, and hence the fundamental multidimensional sphere, has 14 measurements.

Initially, the Scalar Field fills the one-dimensional space in which diones (particles that have both electrical and magnetic charges simultaneously) are localized. These diones are Planck's particles. Then two-dimensional space is filled with particles. These are the currently known quarks of two types. And only in a time $\Delta t = 3 \cdot 10^{-5}$ s begins to fill the three-dimensional space with particles of three-dimensional space.

The velocity of filling the spaces with particles is the same and constant in time, and the radius of the branes of the corresponding spaces expands with the speed of light. Therefore, in the course of the evolution of the Super-Universe, the concentration of diones remains constant, the concentration and density of time in the two-dimensional space decreases inversely proportional to the time of the

existence of the Super-Universe T_U, and in the three-dimensional space is inversely proportional to the square of time T_U.

Since the Scalar Field is not a carrier of charges, the total charge of the time created by it in all the spaces in particular is zero.

According to the model of the Universe with initial minimal entropy, the Scalar Field has the ability to immediately give birth to a pair of neutrons in a singlet state. A substance that is born in a three-dimensional space has a fractal structure from the very beginning. At the same time, each element of this structure (future star) is rapidly rotating. The stars are immediately merged into future galaxies. With the expansion of space, the mass of stars increases with constant speed. The size of the stars and galaxies is generally increasing. However, the radius of the star increases with time in proportion to the cubic root from time, and the distance between the stars increases in proportion to time. Therefore, the stars are removed from each other.

If we take as a basis the existence of the Universe for 13.25 billion years ($4.18 \cdot 10^{17}$ sec) [1], and the modern radius of the Galaxy Milky Way 50 thousand light years ($4.73 \cdot 10^{20}$ m) [2-5], then it is easy to calculate that the magnitude of the radius of the Galaxy increases at a speed of 1132 m/s, which corresponds exactly to the velocity of expansion of the space within the Galaxy. We note that according to the modern estimates [2] the magnitude of the radius of the Galaxy increases at a speed of about 500 m/s, which, in magnitude, coincides with our calculations.

When created, the Galaxy has a disk shape. Over time, this form evolves, increasing the average density of matter closer to the center due to the gravitational interaction between the stars within the Galaxy. In addition, gravitational interaction causes an increase in the thickness of the disk [4, 5]. Let's illustrate this evolution.

2. The Motion of Stars in a Discoid Galaxy

Consequently, the model of the creation of the Universe with minimal initial entropy requires that, at the beginning of the existence of the Galaxy, it had a discoid shape. Since all star embryos have a great momentum of impulse, it is logical to assume that the corresponding momentum of opposite direction has a group of stars, which is the mass of the Galaxy.

If the initial disk was thin with a constant density of star germs ($\rho_1(r) = \text{const}$) at a certain time t_1, then the mass of the nucleus of the Galaxy at that moment was

$$M_1 = \pi R_1^2 \rho_1$$

We have already noticed that the radius of the Galaxy increases in accordance with the speed of space expansion. However, the gravitational interaction between the stars, masses of which are continuously increasing leads to the evolution of the shape of the galactic disk, which causes the star density to increase as they approach the center of the Galaxy, and besides that, the thickness of the disk will continuously increase [4, 5].

In the scientific literature, based on the astronomical observations of distant galaxies, it was concluded that the galaxy originally had the form of a disk, and eventually a thickening was created in the center of the galaxy and a bulge was formed by the creation of new stars [6,7]. Nothing is said about the mechanisms of the birth of new stars. We note that the results of astronomical observations are described in [6,7], match the model of the Universe with minimal initial entropy.

Assume that such a form of a galactic disk is established, at which, for an arbitrary moment, the mass dm of stars entering a stratum of width dr at a distance r from the center of the Galaxy is the same for all distances r. In this case

$$\frac{dm}{dr} = const = 2\pi\rho_2(r) \cdot r = A, \quad (1)$$

where $\rho_2(r)$ is the average density of the substance (per unit area) at a distance r, and

$$\rho_2(r) = \frac{A}{2\pi r}. \quad (2)$$

Consequently, we consider an idealized case where the density of a substance depends only on the radius r.

In this case, the mass of the Galaxy of the radius R_G.

$$M_G = \int_0^{R_G} \rho_2(r) \cdot 2\pi r \cdot dr = AR_G \quad (3)$$

Hence $A = M_G/R_G$, and the mass of the central part of this disk with radius R

$M(R) = AR = M_G R/R_G$ (4)

If the galactic disk was formed so that $\rho = B/r^2$, then

$$M(R) = \int_{r_0}^{R} \frac{2\pi B}{r} dr = 2\pi B \cdot ln\frac{R}{r_0}, \quad (5)$$

where r_0 is the minimum distance from the center of the Galaxy, which must be introduced in the transition from discrete to continuous mass distribution.

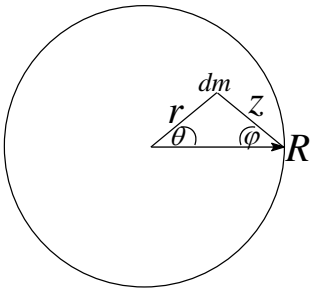

Fig1. *Illustration to calculation of the force acting at a distance R from the center of the galaxy.*

Now consider the forces acting on the stars, drawing them to the center of the Galaxy.

It is clear that in an idealized model, the force acting on a mass element at a distance R from the center will be directed strictly to the center of the Galaxy.

Let us consider the projection of the intensity of gravity on the radius R, which acts on the side of the mass element $dm = \rho r dr d\theta$, located at a distance r from the center at an angle θ to radius R (Fig. 1).. In this case, the magnitude of the tension will be determined by the general formula (we will not write the constant values before the integral):

$$I_k(R) = \int_0^R \int_0^\pi \frac{r^{1-k}(R - r\cdot cos\theta) dr d\theta}{(R^2 + r^2 - 2Rr\cdot cos\theta)^{3/2}} \quad (6)$$

The value k represents the dependence of the density on the radius: $\rho = Ck/r\ k$, where C_k = const. In formula (6), we neglected the contribution of force from the mass of stars outside the radius R. Therefore, the contribution of this force will insignificantly change the functional dependence of $I_k(R)$.

In the process of integration, one must remember that in a discrete space the force acting on a star with the number i will be determined by the formula

$$\vec{F_i} = \sum_{\substack{j=1, \\ j\neq i}}^{N} \frac{G m_i m_j}{r_{ij}^2} \vec{e}_{ij}, \quad (7)$$

where e_{ij} is a unit vector directed along r_{ij}

Consequently, the star does not attract itself to the Galaxy. Hence it follows that in the integral (6) one can not use a point that makes the denominator zero.

Introducing in the integral (6) the replacement of the variables $x = r/R$, we write the magnitude of the intensity of the gravitational field in the form

$$E_k(R) = D_k/R^k, \quad (8)$$

where D_k = const.

For $k = 0$, ρ = const, the magnitude of the intensity of gravity does not depend on the distance. For $k > 0$, this value decreases with distance according to the formula (8).

The motion of a star at a distance R from the center of the Galaxy will be described by the formula

$$\frac{M_\odot \upsilon^2}{R} = M_\odot D_k/R^k \quad (9)$$

With such a distribution of the density of stars, we find the orbital velocity of the star's motion, which is at a distance R from the center of the Galaxy,

$$\upsilon^2 = D_k R^{1-k}. \quad (10)$$

From formula (10) it follows that at $k = 0$ the star velocity will increase with increasing distance R ($\upsilon \sim \sqrt{R}$), and the period of rotation of the star around the center of the Galaxy will be proportional to

$\sqrt{R}$. For $k = 1$, the velocity of a star does not depend on the distance R. In this case, the star's period of rotation will be proportional to the radius of the orbit R.

In ancient times, when the distance between the stars was several orders of magnitude smaller, and their mass has grown sufficiently, the gravitational interaction between them caused a change in the trajectory of the motion of stars in the Galaxy, which led to an increase in the thickness of the galactic disk. With the expansion of space, the thickness of the galactic disk increases. A projection of force appears, directed perpendicularly to the plane of the disk. In the direction of this force appears and the movement of the star, which resembles the oscillatory process.

The case $k = 1$ is important in the sense that the independence of the velocity of the star from the distance to the center of the Galaxy qualitatively corresponds to the observation data [4, 8, 9].

3. The Concentration of Stars in the Galaxy

Proceeding from the estimation of the magnitude of the mass of the Galaxy [3], we find an effective magnitude of the number of stars in the Galaxy

$$N_G = M_G/M_\odot = \int_0^{R_G} n(r) \cdot 2\pi r \cdot dr = \frac{R_G A}{M_\odot} = 6.82 \cdot 10^{11}, \quad (11)$$

where

$$n(r) = \frac{\rho(r)}{M_\odot} = \frac{A}{2\pi r M_\odot} = \frac{N_G}{2\pi r R_G} = \frac{6.82 \cdot 10^{11}}{6.28 \cdot 50000 \cdot r} = \frac{2.17 \cdot 10^6}{r} - \quad (12)$$

concentration of stars (per square light year).

Hence $A = \frac{N_G M_\odot}{R_G} = 6.82 \cdot 10^{11} \cdot 1.99 \cdot \frac{10^{30}}{50000} = 2.714 \cdot 10^{37}$ kg/(light year).

At $r = R_G$, the concentration of stars $n(R_G) = 43.4$ stars/(light year)^2.

Taking into account the fact that the disk thickness is about 1,000 light years [4,5], we obtain a bulk density of stars of 0,0434 stars/(light years)^3. Consequently, one star has a volume of 1/0,0434 = 23 (light years)^3, and the average distance between the stars will be 2.85 light years The fact that in the region of the solar system the distance between the stars is several times greater is easily explained by the fact that the solar system is located between the Galactic Arms of Sagittarius and Perseus, where the concentration of stars is significantly reduced.

On the other hand, at $r = 0.5$ light years we obtain $n(0.5) = 4.34 \cdot 10^6$ stars/(light year)^2. In this case, the volume density will be $4.34 \cdot 10^3$ stars/(light year)^3, and the average distance between the stars will be 0.061 light years, which is only 2 orders of magnitude more than the distance from the Sun to Neptune. If we take the period $(0,1 \div 0,3) \cdot T_U$, then the usual was the critical approach between the stars and the development of chaos in the central part of the Galaxy. It was a period of rapid evolution in the formation of the central part of the Galaxy. The chaos caused a change in the orbit of stars and their exclusion beyond the galactic disk, as well as the transformation of the central part of the Galaxy into the sphere.

4. Spherical Shape of the Galaxy Center

The rapid evolution resembles a complete chaos in the movement of stars, which can result in the movement of the star to the center of the Galaxy. This will cause the collision and sticking of stars, in which the resulting mass of the star grows much faster than the birth of a new substance [1]. In this case, the stars evolve to the black hole. At the same time there is the ejection of large masses of matter beyond the star and there is the formation of large clouds of space gas and dust. It is clear that with the approach to the center of the Galaxy, the probability of the formation of a black hole is increasing. Therefore, a black hole is formed primarily in the center of the Galaxy. The black holes creation becomes unlikely with the distance from the center. It is possible that there are cases when only one black hole is formed in the galaxy.

Note that manuscript [10] describes the chaos, which should exist in the period from 3.6 to 8 billion years from the birth of the Universe. The result of this chaos was the creation of spiral Galactic Arms, such as the Milky Way or Andromeda galaxies.

Assume that in this area the condition under which the average volume density of a substance $\rho_3(R)$ is constant is realized. Then the star speed around the masses center will be determined from the condition:

$$\frac{M_\odot v^2}{r} = \frac{GM(r)M_\odot}{r^2} = \frac{4\pi\rho_3 GM_\odot}{3r^2}\cdot r^3 = \frac{4\pi\rho_3 GM_\odot}{3}\cdot r.$$

From here

$$v = r\sqrt{4\pi\rho_3 G/3}. \quad (13)$$

In this case, the period of rotation of the star around the center

$$T = \frac{2\pi r}{v} = \sqrt{\frac{3\pi}{\rho_3 G}} = \text{const}. \quad (14)$$

This result resembles the rotation of the star around its own axis, where all its parts have approximately the same period of rotation. In the case of the Galaxy center, which has a spherical shape, there is no such axis, and the stars move almost independently in their orbits[1].

In this case, trajectories of stars will intersect each other. Stationary state can only be achieved thanks to full synchronization of trajectories, which is achieved after completion of the turbulent evolution of the Galaxy. However, in this case, the interaction between the stars will influence the form of the stars motion trajectory.

If the spherical shape of the Galaxy center formed without a rapid evolution from a discoid shape, where the dependence of the density of stars from the distance to the Galaxy center was described by the formula

$$\rho = \frac{A}{2\pi r},$$

then in the transition to a spherical shape we would receive a density distribution:

$$\rho = \frac{3B}{4\pi r^2}.$$

Here the constant is $B = M(r)/(3r)$. In this case, the velocity of the stars in orbit around the Galaxy center would be constant:

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

Comparison of the obtained results with the observation data [4, 8, 9] shows that approximately the first version of the distribution of stars in the galaxy spherical region is implemented, with the result that the velocity of the stars increases with distance.

After aligning the density of the distribution of stars from the distance, their association becomes unlikely as a result of expanding space and increasing the distance between the stars. Consequently, there is a certain period of time that begins billions of years after the birth of the Universe and can last billions of years. In this period, among the stars in the center of the Galaxy a black hole or even a few black holes may be born [4]. Conditions for the emergence of a black hole in the first billion years since the birth of the Universe are absent.

This conclusion is consistent with recent astronomical studies [11] aimed at identifying small black holes, the existence of which is the Standard Model of the Birth of the Universe of Singularity [12]. These studies did not reveal the presence of small black holes, confirming the erroneousness of the conclusions based on the Standard Model.

Since in the spherical region of the Galaxy the velocity of stars decreases with a decrease in the distance to the center of the Galaxy, this leads to the fact that stars which orbits are located at a critical distance from the center of the Galaxy will be absorbed by a central star or a black hole. Therefore, the largest mass among black holes will have a central black hole [4].

[1] The presence of an axis in a galactic disk and an axis of rotation in a central black hole in this case does not affect the trajectory of stars in the central part of the galaxy.

Despite the equalization of the density of stars in the spherical region, the interaction between them does not disappear, resulting in the possibility of replenishing with the stars of the critical region in the vicinity of the central black hole and, as a consequence, capturing them with a black hole. This process must exist continuously since the creation of a black hole. At present, the mass of the central black hole is $4.31 \cdot 10^6$ solar masses [4, 13].

Halo

Halo is an invisible part of the Galaxy that has a spherical shape. The radius of this sphere exceeds the radius of the Galaxy several times [14, 15]. The halo consists of sparse gas, massive bodies, as well as stars that contain only light atoms.

The study of the halo of the Andromeda Nebula with the help of the spacecraft "Hubble" [14, 15] made it possible to conclude that the halo only includes old stars with the age of 11-13,5 billion years and 6-8 billion years. Any manifestations of stellar activity in the halo are extremely rare.

To understand the nature of the halo, we draw attention to the model of the solar system [16] in the Universe with minimal initial entropy. According to this model, the active decomposition of super-heavy nuclei in the star's nucleus leads to the ejection of electrons, protons, and nuclei of helium and lithium beyond the embryo. And since a magnetic field was formed around the nucleus, the charged particles move along closed trajectories, returning to the point where they were created. The increase in the mass of discarded particles, which effectively occurs at the initial moments of the evolution of stars, increases the radius of the trajectory, resulting in the appearance of satellites of light particles around the nucleus of the star, which mass grows over time. At the same time, these particles can not contain heavy atomic nuclei. Thus, the Oort cloud is formed. The orbit of this cloud is close to the equatorial plane of the nucleus of the star.

A similar process will occur in the case of the nucleus of the Galaxy. And in the initial galactic magnetic field, the clouds of light atoms and atomic nuclei will be formed. Since atomic nuclei are emitted from the nucleus of a galaxy at a sufficiently high speed, the resulting radius of halo should be several times greater than the radius of the galactic disk, which expands exclusively by expanding the space. The primary orientation of the orbit of this cloud will be close to the plane of the Galaxy.

At the second stage, when the processes of chaos dominate in the center of the Galaxy, the stars approached each other, causing a change in the trajectory of motion, and also throwing large masses of matter from the upper layers of stars into outer space. Consequently, light atoms and rather massive objects consisting of light atoms were emitted.

Both first-generation particles and second-generation particles most likely have an elongated elliptical orbit, from time to time approaching the center of the Galaxy, where processes of chaos continued. The latter caused a change in the orbit of these particles, resulting in the formation of a spherical halo. When the active processes of chaos in the center of the Galaxy were completed, the formation of the halo and objects in it ended. Such a mechanism for the formation of the halo was due to the fact that all the stars in it are old enough and, moreover, do not contain heavy chemical elements.

Galactic Arms

What do we know about Galactic Arms? The discs of galaxies, like ours, have the most notable formations - spiral branches (or Arms). Along the Arms are mainly concentrated the youngest stars, many scattered star clusters and associations, as well as chains of dense clouds of interstellar gas, in which stars continue to form. In spiral branches there are a large number of variables and flare stars, they are most often observed explosions of some types of supernovae. The galactic magnetic field that penetrates the entire gas disk is also concentrated mainly in the Arms. Each Galaxy's spiral Arm describes a logarithmic spiral with a slope of approximately 12°[2].

The Solar System is located in a comfortable, quiet and cozy place between the Arms of Sagittarius and Perseus in the area called the Orion Arm.

[2] Considering the shape of the Galactic Arms in different galaxies [17], it is easy to see that this form is far from always described by a logarithmic spiral. In that part of the Galactic Arms, which is located on the periphery of the galaxy, often there is no distance, but the approach of the Arm to the center of the galaxy. In the Galaxy Milky Way [3] this fact is also noticed.

Let's take a closer look at the Galactic Arms. The first thing to notice is the symmetry of the Arms, that is, you can rotate the image to 180° and get the same structure of the Arms. The Scutum-Centaur Arm corresponds to Perseus's Arm, the Sagittarius's Arm meets the Norms Arm, and so on. In addition, Galactic Arms never go beyond the Galaxy.

It is clear that such a high symmetry of Galactic Arms can not be described, based on considerations of the existence of chaos [10]. And no fluctuations will ensure the appearance of symmetric entities.

To understand the processes of Galactic Arms, let's sequentially consider some simplified models of evolution of objects in the Galaxy.

When the star has a fairly large mass, and its evolution has led to the fact that the internal pressure does not restrain its collapse, there is a phase transition, which is, first of all, in the rapid reduction of the radius of the star. In this case, the law of conservation of energy is fulfilled: an increase in the absolute value of the potential energy of interaction between the particles of a star equals the increase of the kinetic energy of the particles of the star. However, for central-symmetrical objects there is a law (the viral theorem), according to which, in stationary state kinetic energy should equal half the potential energy with the opposite sign. Consequently, there is a large surplus of kinetic energy.

When there is compressing of a star, the density of matter in its central part continuously increases and is always higher than on the periphery. When the density in the center reaches the density of the nuclear material, it no longer increases, forming the nucleus of the future neutron star. In this case, the radius of the neutron nucleus will increase, and the region of matter with high kinetic energy will be displaced beyond the limits of the neutron core, while continuing to increase kinetic energy. At a certain stage of such an evolution, there is an explosion of the star, that is, excessive kinetic energy drops its upper layers from the star, leaving an almost intact central part that becomes a neutron star.

The second process worthy of attention in this section is the absorption of a black hole of an ordinary star. When a star meets a black hole, first of all its substance is extracted in the equatorial region of a black hole, covering it with a ring. Since we are dealing with a deep gravitational well, energy levels such as atomic are likely to exist. In this case, the reduction of the energy of the massive ring around the black hole must be accompanied by visible radiation and the release of gases simultaneously from the entire ring. The final step is to absorb the substance of the ring with a black hole. In such a process there is again an excess of kinetic energy of a substance absorbed by a black hole. So, you should expect the substance or energy to be ejected by a black hole. Since the substance is absorbed in the equatorial region, providing the cylindrical symmetry of the system, the separation of matter or energy must happen from the poles of the black hole or symmetrically from the equatorial region.

It can be argued that a substance can not leave a black hole. In this case, let us consider the possibility of illumination of excess energy from the poles of a black hole. Imagine that the illumination of electromagnetic waves with frequencies ν_o occurs from the gravitational surface of a black hole along its radius. In this case, you can write the equation:

$$\frac{GM_b m_p}{r^2} dr = \frac{GM_b h\nu}{c^2 r^2} dr = d(h\nu), \tag{15}$$

where M_b is the mass of the black hole, m_p is the mass of the photon.

Integration from r_g to ∞ gives

$$\int_{r_g}^{\infty} \frac{GM_b}{c^2 r^2} dr = \frac{1}{2} \int_{r_g}^{\infty} \frac{r_g}{r^2} dr = \int_{\nu_0}^{\nu} \frac{d\nu}{\nu} \tag{16}$$

We get it

$$2 = ln\left(\frac{\nu_0}{\nu}\right), \tag{17}$$

that is, the frequency of the electromagnetic wave decreases only in $e^2 = 7.39$ times.

However, in this case there is one non-matching thing: the symmetry of processes in time is disturbed. The matter is that the substance is absorbed, but an electromagnetic wave is radiated, which, in principle, can generate only a pair of antiparticle-particles that are again annihilated. Consequently, the energy of an electromagnetic wave will only dissipate, remaining electromagnetic wave.

In order to get out of the situation, which led to reflections on the processes, and to return the substance to space, one must assume that the wave that emitted is not actually the electromagnetic, but the Scalar Field [18]. Since the Scalar Field is capable of creating a substance, we will return to the initial state: the substance was absorbed and eventually radiated substance. Such a mechanism will

allow us to understand the process of radiation of hot matter and energy at a certain distance from the poles of a black hole, which is observed in astronomical studies (see article [19] and the references therein). This radiation feeds the Fermi bubbles [20].

Finally, we came to the consideration of the mechanism of the formation of Galactic Arms.

We are talking about the absorption by the central massive black hole of smaller black holes, resulting in shock waves [21] that create Galactic Arms.

We have already realized that the interaction of a star with a black hole will form a disk in the equatorial part of the black hole. Unlike this case, the contact interaction between two black holes will not be able to stretch a smaller black hole into the disk around a massive black hole. A symmetry axis appears that connects the centers of the masses of two black holes. Then there will be an absorption by a massive black hole of a light hole. As in the previous cases, when converging and combining black holes, there will be a large surplus of kinetic energy equal to half the change in potential energy. Let's evaluate the change in the magnitude of the potential energy:

$$\Delta E_p = \frac{GM_1M_2}{r_{g1}} = \frac{1}{2}M_2c^2 \qquad (18)$$

Here M_1 is the mass of a massive black hole; M_2 is the mass of a small black hole. At the same time it is believed that, when capturing a small black hole by the massive distance between their centers will be equal to the gravitational radius of a massive black hole. In addition, to determine the gravitational radius of a black hole, not a relativistic, but a classical formula is used.

From formula (18) it follows that the excess of kinetic energy when combined with black holes will be about a quarter of the mass of a light hole. This energy value should be distinguished by combining black holes. The result is **new and unexpected**, but it explains the process of creating Galactic Arms.

We drew attention to the existence of the axis of symmetry in the interaction of two black holes. In addition, it should be noted that the pulse of the system was close to zero, and the momentum that corresponded to the rotation of the small hole around the large at the time of their union could be large. As a result, the union of two black holes will cause the birth of two shock waves [21], that is, the ejection of two equal in magnitude flows of the Scalar Field, characterized by the components of motion: radial in the equatorial plane, and azimuthal. The ratio between the azimuthal and radial velocity of the flows will determine the tangent of the angle of the logarithmic spiral of Galactic Arms. Different forms of Galactic Arms are currently well-structured [17]. Looking at the Hubble Camerton, one can see that no black hole has been created in elliptical galaxies E0-E7, or only one light black hole has been created. In galaxies SBa and SBb there was an association of a light black hole with a central massive black hole. Moreover, in both cases, the azimuthal projection of the velocity of matter in the Galactic Arms far exceeds the radial projection. In the case of the SBc, the situation is the opposite, that is, the radial velocity projection significantly exceeds the azimuthal. At the same time, the central bar is collinear to the Galactic Arms. Therefore, it is not visible. In this example it is clearly seen that the gravitational field of the galaxy affects the form of Galactic Arms.

If the mass of a small black hole was 10^5 solar masses, then two generated shock waves will be carried on 12500 solar masses of matter. Such streams will really be visible as powerful Galactic Arms. They will be able to provide a fairly large magnetic field in Galactic Arms and cause active processes of evolution of matter within Galactic Arms. Similar properties of Galactic Arms can provide processes for absorption of a massive black hole of the lungs (10^4 or even 10^3 solar masses) of black holes. It is clear that in these cases the power of the Galactic Arms will be much lower. And such Galactic Arms are really observed. A strong pair of Galactic Arms are Scutum-Centaurus and Perseus's Arms, the Arms of the Norma and Sagittarius are significantly weaker, and two 3-kiloparsec Arms are very weak. At the same time, a central bar forms together with the spiral arms.

It is worth noting yet another feature of the creation of Galactic Arms. The fact is that from a massive black hole radiated only the Scalar Field, which carries with it a lot of energy. After some time, the Scalar Field generates a substance, starting with bineutrons or bineutron associates. Consequently, the substance of the Galactic Arms is not born immediately after the radiation of the Scalar Field, but at a distance from the central black hole. As a result, the central bar of our Galaxy, whose length (~ 27,000 light years = 2.55×10^{17} km [22, 23]), substantially exceeds the diameter of the massive black hole (25.46×10^6 km [13]) Judging by the classification of galaxies, the length of the central bar and the

number of galactic sleeves in different galaxies depend on the mass of the central black hole and the number of absorbed light black holes.

The surprise, at first glance, causes too much of the length of the central bar of our Galaxy. One of the explanations for this phenomenon is the removal of the onset of Galactic Arms from the center of the Galaxy. For billions of years of existence of Galactic Arms, such a distance (~ 13500 light years) is quite possible. However, in this case, the central bar should not be created.

Another version is related to the properties and dimensionality of the Scalar Field[3] [18]. Since the Scalar Field covers all layers of the layered Super-Universe space, it has the ability immediately to capture a light black hole with a heavy black hole to generate Galactic Arms at a distance of 13500 light years, with the preservation of information about the energy and momentum of a substance generated in the Galactic Arms. In addition, such a distance allows you to create Galactic Arms with a diameter much larger than the diameter of a massive black hole.

Thus, the onset of Galactic Arms appears outside the central spherical part of the Galaxy. Otherwise, the central part could be destroyed.

To explain the mechanisms of creating a central bar and transferring the beginning of Galactic Arms far beyond the spherical part of the Galaxy, we will consider simple examples. If we take the pebbles and cast them horizontally above the surface of the water, then we will see how it bounces many times from the water until it loses its speed. If the pebble throw over a viscous liquid or mud, then notice that the pebble will make a mark on the surface and stopped, drowning.

In the case of the Scalar Field, it has the ability to propagate in a two-dimensional space, each point of which is informally connected with a delocalized point of a three-dimensional space. In this way, the Scalar Field is instantly transferred to the point of birth of Galactic Arms, while forming the trace of its displacement in a three-dimensional space.

There is another idea that arises when considering the properties of Galactic Arms. The impression is that they have a constant configuration in time, like the knitting needles in the wheel, although their form and influence the gravitational field of the Galaxy. That is, the Galactic Arms has the same configuration, since the shock wave is not connected with the orbital motion of stars around the center of the Galaxy. In this case, it will be clear why the stars in the orbital motion around the center of the Galaxy, on the one hand, enter the Galactic Arms region, and on the other get out of it. Since the central bar is created at the same time as the Galactic Arms, its configuration must also remain constant. However, it is created as a matter of course moving the Scalar Field, and not as a result of a shock wave. As a result, the central bar actually stabilizes the position of the Galactic Arms.

There is a chaotic stream of matter to the central black hole, forming a ring of gas and dust in the equatorial plane of a black hole. At the same time there is a capture of matter with a black hole. As a result, part of the substance from the ring is thrown to all sides in the region of the galactic disk. If there are central bars, then the substance will be thrown mainly on the bars, like water from a crowded basin on the river. Such jets of matter will feed Galactic Arms. And since the flow of matter in a black hole is chaotic, then the stream of matter in the region of Galactic Arms will have an oscillating nonperiodic character. These oscillating jets will reach especially large amplitude when a black hole captures a star.

Somewhat different properties have the process of radiation of hot matter and energy from the poles of a black hole that feeds the Fermi bubbles. These fluxes of particles are too weak to influence the structure of the spherical part of the Galaxy, so they are created at relatively small distances from the poles of a massive black hole, but outside the critical region, which provides the possibility of returning the hot substance to a black hole. In addition, it is possible that along the central bar in both directions, there are immediate streams of hot matter that exist simultaneously with the fluxes fed by the Fermi bubbles.

[3] The fundamental space, through which the Scalar Field enters, has twelve rough spatial coordinates, one time and one informational. The scalar field carries with it the energy and program of creating the Super-Universe and matter in separate layers of the layered space. Therefore, after the radiation of the Scalar Field by a massive black hole, it has the ability to create Arms in a random place that corresponds to the program.

5. CONCLUSION

Based on the consideration of the processes of creation and evolution of the Galaxy in the model of the Universe with the initial minimal entropy, the following conclusions were made.

- At the birth of the Universe there is immediately created galaxy's germ in the form of a disk with a constant density of matter. The germ of the galaxy has a fractal structure, the elements of which are the embryos of the stars. The germs of the galaxy and stars have a rotational moment.
- The diameter of the galaxy increases over time solely by expanding the space.
- The increase in the mass and size of stars and galaxies causes a change in the dependence of the average density of matter from the distance to the center of the galaxy, including our Galaxy. In the center of the Galaxy, due to the development of chaos caused by the large density of stars, a spherical region with a constant density of matter is formed; resulting in a period of rotation around the center of the Galaxy in this part of the Galaxy is constant. Galactic disk is formed beyond the spherical region. The density of the substance in disk depends approximately in proportion to the distance to the Galaxy center. Such a distribution of stars in the Galaxy will cause a weak dependence of the stars velocity from the distance to the Galaxy center.
- The increase in the mass of stars over time and the gravitational interaction between them led to an increase in the thickness of the galactic disk. In this case, a projection of force appeared, directed perpendicular to the plane of the disk.
- Due to chaos in the movement of stars in the Galaxy center there was a collision of stars and the unification of their mass, resulting in the stars evolved to a black hole, which was formed primarily in the center of the Galaxy. The conditions for the formation of black holes appear after billions of years after the birth of the Universe and last a limited time. However, the weak process of capturing stars with a central black hole must exist continuously.
- Two processes are involved in the formation of the halo. The first one was manifested immediately after the birth of the galaxy due to the collapse of atomic nuclei in the nucleus of the stars. The second process involves the development of chaos in the central part of the Galaxy, in which the upper layers of the interacting stars were thrown outside the Galaxy. Both processes caused birth in halo of massive objects, in which there are no heavy chemical elements.
- The absorption of a substance by a central black hole causes the fluxes of fast particles, which feed on the Fermi bubbles, from the black hole poles.
- Galactic Arms of varying power flow in pairs, spreading the central black hole of light black holes. In this case, the superficial kinetic energy forms streams of the Scalar Field, which in turn forms the Galactic Arms. Simultaneously with Galactic Arms central bars also appeared.
- The configuration of Galactic Arms remains unchanged, since the shock waves are not related to the orbital motion of stars around the Galaxy center. Therefore, the stars on the one hand enter the region of the Galactic Arms, and on the other hand, they emerge from it.

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Creation and Evolution of the Galaxy in the Universe Model with Initial Minimum Entropy

Petro O. Kondratenko

National Aviation University, Kyiv, Ukraine

Corresponding Author:** ***Petro O. Kondratenko, *National Aviation University, Kyiv, Ukraine*

Abstract: *In this article, based on the model of the creation of the Universe with the initial minimal entropy, the structure of spiral galaxies and in particular the Milky Way Galaxy is considered. It is shown that the Galaxy from the time of the birth of the Universe expands by expanding the space at a constant speed of ~1100 m/s, and its shape evolves so much that at present the velocity of the orbital motion of stars within the galactic disk is approximately the same. In the center of the Galaxy, due to the development of chaos caused by the great density of stars, a spherical region with a constant density of matter is formed; resulting in a period of rotation around the center of the Galaxy in this part of the Galaxy is a constant value for all the stars. Due to the chaos in the movement of stars in the center of the Galaxy, which lasted a limited time billions of years after the birth of the Universe, there was a collision of stars, resulting in the formation of a black hole or a few black holes in the center of the Galaxy. In the formation of the halo two processes are involved. The first one was manifested immediately after the birth of the galaxy due to the collapse of atomic nuclei in the nucleus of the stars. The second process involves the development of chaos in the central part of the Galaxy, in which the upper layers of the interacting stars were thrown outside the Galaxy. The absorption of a substance by a central black hole causes the ejection of the Scalar Field from the black hole poles. The Scalar Field generates the fluxes of the fast particles that feed the Fermi bubbles. Galactic Arms of varying power and central bar originated in pairs as a result of the absorption of lighter black holes by the central black hole. In this case, the excess kinetic energy forms streams of the Scalar Field, which in turn forms Galactic Arms and central bar. The configuration of Galactic Arms remains unchanged, since the shock waves are not related to the orbital motion of stars around the center of the Galaxy.*

Keywords: *galaxy evolution, black holes, halo, mechanism of Galactic Arms creation, Fermi bubbles.*

1. INTRODUCTION

In the model of the Universe with initial minimal entropy, it is shown that our four-dimensional Universe is part of the Super-Universe represented by the layered space [1]. Layers of the Super-Universe are a zero-dimensional space (fundamental multidimensional sphere), one-dimensional space, two-dimensional space and three-dimensional space. All of these spaces (except for zero-dimensional) are branes of spaces, the size of which is one unit higher.

Whole Super-Universe is created at the same time. However, its filling with substance comes from the step by step. Scalar Field enters through zero-dimensional space. It carries information about all physical interactions and the ability to create matter and field in all layers of the Super-Universe. It follows that the dimension of the multidimensional sphere, which corresponds to the size of the Scalar Field, should include all measurements of one-dimensional, two-dimensional and three-dimensional spaces, as well as time and information measurements. In [1] it is shown that the Super-Universe, and hence the fundamental multidimensional sphere, has 14 measurements.

Initially, the Scalar Field fills the one-dimensional space in which diones (particles that have both electrical and magnetic charges simultaneously) are localized. These diones are Planck's particles. Then two-dimensional space is filled with particles. These are the currently known quarks of two types. And only in a time $\Delta t = 3 \cdot 10^{-5}$ s begins to fill the three-dimensional space with particles of three-dimensional space.

The velocity of filling the spaces with particles is the same and constant in time, and the radius of the branes of the corresponding spaces expands with the speed of light. Therefore, in the course of the evolution of the Super-Universe, the concentration of diones remains constant, the concentration and density of time in the two-dimensional space decreases inversely proportional to the time of the

existence of the Super-Universe T_U, and in the three-dimensional space is inversely proportional to the square of time T_U.

Since the Scalar Field is not a carrier of charges, the total charge of the time created by it in all the spaces in particular is zero.

According to the model of the Universe with initial minimal entropy, the Scalar Field has the ability to immediately give birth to a pair of neutrons in a singlet state. A substance that is born in a three-dimensional space has a fractal structure from the very beginning. At the same time, each element of this structure (future star) is rapidly rotating. The stars are immediately merged into future galaxies. With the expansion of space, the mass of stars increases with constant speed. The size of the stars and galaxies is generally increasing. However, the radius of the star increases with time in proportion to the cubic root from time, and the distance between the stars increases in proportion to time. Therefore, the stars are removed from each other.

If we take as a basis the existence of the Universe for 13.25 billion years ($4.18 \cdot 10^{17}$ sec) [1], and the modern radius of the Galaxy Milky Way 50 thousand light years ($4.73 \cdot 10^{20}$ m) [2-5], then it is easy to calculate that the magnitude of the radius of the Galaxy increases at a speed of 1132 m/s, which corresponds exactly to the velocity of expansion of the space within the Galaxy. We note that according to the modern estimates [2] the magnitude of the radius of the Galaxy increases at a speed of about 500 m/s, which, in magnitude, coincides with our calculations.

When created, the Galaxy has a disk shape. Over time, this form evolves, increasing the average density of matter closer to the center due to the gravitational interaction between the stars within the Galaxy. In addition, gravitational interaction causes an increase in the thickness of the disk [4, 5]. Let's illustrate this evolution.

2. The Motion of Stars in a Discoid Galaxy

Consequently, the model of the creation of the Universe with minimal initial entropy requires that, at the beginning of the existence of the Galaxy, it had a discoid shape. Since all star embryos have a great momentum of impulse, it is logical to assume that the corresponding momentum of opposite direction has a group of stars, which is the mass of the Galaxy.

If the initial disk was thin with a constant density of star germs ($\rho_1(r) = \text{const}$) at a certain time t_1, then the mass of the nucleus of the Galaxy at that moment was

$$M_1 = \pi R_1^2 \rho_1$$

We have already noticed that the radius of the Galaxy increases in accordance with the speed of space expansion. However, the gravitational interaction between the stars, masses of which are continuously increasing leads to the evolution of the shape of the galactic disk, which causes the star density to increase as they approach the center of the Galaxy, and besides that, the thickness of the disk will continuously increase [4, 5].

In the scientific literature, based on the astronomical observations of distant galaxies, it was concluded that the galaxy originally had the form of a disk, and eventually a thickening was created in the center of the galaxy and a bulge was formed by the creation of new stars [6,7]. Nothing is said about the mechanisms of the birth of new stars. We note that the results of astronomical observations are described in [6,7], match the model of the Universe with minimal initial entropy.

Assume that such a form of a galactic disk is established, at which, for an arbitrary moment, the mass dm of stars entering a stratum of width dr at a distance r from the center of the Galaxy is the same for all distances r. In this case

$$\frac{dm}{dr} = const = 2\pi\rho_2(r) \cdot r = A, \quad (1)$$

where $\rho_2(r)$ is the average density of the substance (per unit area) at a distance r, and

$$\rho_2(r) = \frac{A}{2\pi r}. \quad (2)$$

Consequently, we consider an idealized case where the density of a substance depends only on the radius r.

In this case, the mass of the Galaxy of the radius R_G.

$$M_G = \int_0^{R_G} \rho_2(r) \cdot 2\pi r \cdot dr = AR_G \quad (3)$$

Hence $A = M_G/R_G$, and the mass of the central part of this disk with radius R

$M(R) = AR = M_G R/R_G$ (4)

If the galactic disk was formed so that $\rho = B/r^2$, then

$$M(R) = \int_{r_0}^{R} \frac{2\pi B}{r} dr = 2\pi B \cdot ln\frac{R}{r_0}, \quad (5)$$

where r_0 is the minimum distance from the center of the Galaxy, which must be introduced in the transition from discrete to continuous mass distribution.

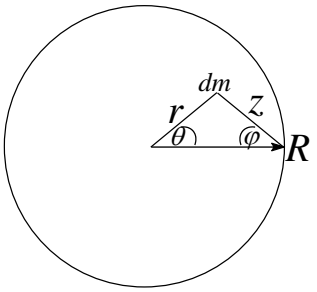

Fig1. *Illustration to calculation of the force acting at a distance R from the center of the galaxy.*

Now consider the forces acting on the stars, drawing them to the center of the Galaxy.

It is clear that in an idealized model, the force acting on a mass element at a distance R from the center will be directed strictly to the center of the Galaxy.

Let us consider the projection of the intensity of gravity on the radius R, which acts on the side of the mass element $dm = \rho r dr d\theta$, located at a distance r from the center at an angle θ to radius R (Fig. 1).. In this case, the magnitude of the tension will be determined by the general formula (we will not write the constant values before the integral):

$$I_k(R) = \int_0^R \int_0^\pi \frac{r^{1-k}(R - r\cdot cos\theta) dr d\theta}{(R^2 + r^2 - 2Rr\cdot cos\theta)^{3/2}} \quad (6)$$

The value k represents the dependence of the density on the radius: $\rho = Ck/r\ k$, where C_k = const. In formula (6), we neglected the contribution of force from the mass of stars outside the radius R. Therefore, the contribution of this force will insignificantly change the functional dependence of $I_k(R)$.

In the process of integration, one must remember that in a discrete space the force acting on a star with the number i will be determined by the formula

$$\vec{F_i} = \sum_{\substack{j=1, \\ j\neq i}}^{N} \frac{G m_i m_j}{r_{ij}^2} \vec{e}_{ij}, \quad (7)$$

where e_{ij} is a unit vector directed along r_{ij}

Consequently, the star does not attract itself to the Galaxy. Hence it follows that in the integral (6) one can not use a point that makes the denominator zero.

Introducing in the integral (6) the replacement of the variables $x = r/R$, we write the magnitude of the intensity of the gravitational field in the form

$$E_k(R) = D_k/R^k, \quad (8)$$

where D_k = const.

For $k = 0$, ρ = const, the magnitude of the intensity of gravity does not depend on the distance. For $k > 0$, this value decreases with distance according to the formula (8).

The motion of a star at a distance R from the center of the Galaxy will be described by the formula

$$\frac{M_\odot \upsilon^2}{R} = M_\odot D_k/R^k \quad (9)$$

With such a distribution of the density of stars, we find the orbital velocity of the star's motion, which is at a distance R from the center of the Galaxy,

$$\upsilon^2 = D_k R^{1-k}. \quad (10)$$

From formula (10) it follows that at $k = 0$ the star velocity will increase with increasing distance R ($\upsilon \sim \sqrt{R}$), and the period of rotation of the star around the center of the Galaxy will be proportional to

$\sqrt{R}$. For $k = 1$, the velocity of a star does not depend on the distance R. In this case, the star's period of rotation will be proportional to the radius of the orbit R.

In ancient times, when the distance between the stars was several orders of magnitude smaller, and their mass has grown sufficiently, the gravitational interaction between them caused a change in the trajectory of the motion of stars in the Galaxy, which led to an increase in the thickness of the galactic disk. With the expansion of space, the thickness of the galactic disk increases. A projection of force appears, directed perpendicularly to the plane of the disk. In the direction of this force appears and the movement of the star, which resembles the oscillatory process.

The case $k = 1$ is important in the sense that the independence of the velocity of the star from the distance to the center of the Galaxy qualitatively corresponds to the observation data [4, 8, 9].

3. The Concentration of Stars in the Galaxy

Proceeding from the estimation of the magnitude of the mass of the Galaxy [3], we find an effective magnitude of the number of stars in the Galaxy

$$N_G = M_G/M_\odot = \int_0^{R_G} n(r) \cdot 2\pi r \cdot dr = \frac{R_G A}{M_\odot} = 6.82 \cdot 10^{11}, \quad (11)$$

where

$$n(r) = \frac{\rho(r)}{M_\odot} = \frac{A}{2\pi r M_\odot} = \frac{N_G}{2\pi r R_G} = \frac{6.82 \cdot 10^{11}}{6.28 \cdot 50000 \cdot r} = \frac{2.17 \cdot 10^6}{r} - \quad (12)$$

concentration of stars (per square light year).

Hence $A = \frac{N_G M_\odot}{R_G} = 6.82 \cdot 10^{11} \cdot 1.99 \cdot \frac{10^{30}}{50000} = 2.714 \cdot 10^{37}$ kg/(light year).

At $r = R_G$, the concentration of stars $n(R_G) = 43.4$ stars/(light year)^2.

Taking into account the fact that the disk thickness is about 1,000 light years [4,5], we obtain a bulk density of stars of 0,0434 stars/(light years)^3. Consequently, one star has a volume of 1/0,0434 = 23 (light years)^3, and the average distance between the stars will be 2.85 light years The fact that in the region of the solar system the distance between the stars is several times greater is easily explained by the fact that the solar system is located between the Galactic Arms of Sagittarius and Perseus, where the concentration of stars is significantly reduced.

On the other hand, at $r = 0.5$ light years we obtain $n(0.5) = 4.34 \cdot 10^6$ stars/(light year)^2. In this case, the volume density will be $4.34 \cdot 10^3$ stars/(light year)^3, and the average distance between the stars will be 0.061 light years, which is only 2 orders of magnitude more than the distance from the Sun to Neptune. If we take the period $(0,1 \div 0,3) \cdot T_U$, then the usual was the critical approach between the stars and the development of chaos in the central part of the Galaxy. It was a period of rapid evolution in the formation of the central part of the Galaxy. The chaos caused a change in the orbit of stars and their exclusion beyond the galactic disk, as well as the transformation of the central part of the Galaxy into the sphere.

4. Spherical Shape of the Galaxy Center

The rapid evolution resembles a complete chaos in the movement of stars, which can result in the movement of the star to the center of the Galaxy. This will cause the collision and sticking of stars, in which the resulting mass of the star grows much faster than the birth of a new substance [1]. In this case, the stars evolve to the black hole. At the same time there is the ejection of large masses of matter beyond the star and there is the formation of large clouds of space gas and dust. It is clear that with the approach to the center of the Galaxy, the probability of the formation of a black hole is increasing. Therefore, a black hole is formed primarily in the center of the Galaxy. The black holes creation becomes unlikely with the distance from the center. It is possible that there are cases when only one black hole is formed in the galaxy.

Note that manuscript [10] describes the chaos, which should exist in the period from 3.6 to 8 billion years from the birth of the Universe. The result of this chaos was the creation of spiral Galactic Arms, such as the Milky Way or Andromeda galaxies.

Assume that in this area the condition under which the average volume density of a substance $\rho_3(R)$ is constant is realized. Then the star speed around the masses center will be determined from the condition:

$$\frac{M_\odot v^2}{r} = \frac{GM(r)M_\odot}{r^2} = \frac{4\pi\rho_3 GM_\odot}{3r^2}\cdot r^3 = \frac{4\pi\rho_3 GM_\odot}{3}\cdot r.$$

From here

$$v = r\sqrt{4\pi\rho_3 G/3}. \quad (13)$$

In this case, the period of rotation of the star around the center

$$T = \frac{2\pi r}{v} = \sqrt{\frac{3\pi}{\rho_3 G}} = \text{const}. \quad (14)$$

This result resembles the rotation of the star around its own axis, where all its parts have approximately the same period of rotation. In the case of the Galaxy center, which has a spherical shape, there is no such axis, and the stars move almost independently in their orbits[1].

In this case, trajectories of stars will intersect each other. Stationary state can only be achieved thanks to full synchronization of trajectories, which is achieved after completion of the turbulent evolution of the Galaxy. However, in this case, the interaction between the stars will influence the form of the stars motion trajectory.

If the spherical shape of the Galaxy center formed without a rapid evolution from a discoid shape, where the dependence of the density of stars from the distance to the Galaxy center was described by the formula

$$\rho = \frac{A}{2\pi r},$$

then in the transition to a spherical shape we would receive a density distribution:

$$\rho = \frac{3B}{4\pi r^2}.$$

Here the constant is $B = M(r)/(3r)$. In this case, the velocity of the stars in orbit around the Galaxy center would be constant:

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

Comparison of the obtained results with the observation data [4, 8, 9] shows that approximately the first version of the distribution of stars in the galaxy spherical region is implemented, with the result that the velocity of the stars increases with distance.

After aligning the density of the distribution of stars from the distance, their association becomes unlikely as a result of expanding space and increasing the distance between the stars. Consequently, there is a certain period of time that begins billions of years after the birth of the Universe and can last billions of years. In this period, among the stars in the center of the Galaxy a black hole or even a few black holes may be born [4]. Conditions for the emergence of a black hole in the first billion years since the birth of the Universe are absent.

This conclusion is consistent with recent astronomical studies [11] aimed at identifying small black holes, the existence of which is the Standard Model of the Birth of the Universe of Singularity [12]. These studies did not reveal the presence of small black holes, confirming the erroneousness of the conclusions based on the Standard Model.

Since in the spherical region of the Galaxy the velocity of stars decreases with a decrease in the distance to the center of the Galaxy, this leads to the fact that stars which orbits are located at a critical distance from the center of the Galaxy will be absorbed by a central star or a black hole. Therefore, the largest mass among black holes will have a central black hole [4].

[1] The presence of an axis in a galactic disk and an axis of rotation in a central black hole in this case does not affect the trajectory of stars in the central part of the galaxy.

Despite the equalization of the density of stars in the spherical region, the interaction between them does not disappear, resulting in the possibility of replenishing with the stars of the critical region in the vicinity of the central black hole and, as a consequence, capturing them with a black hole. This process must exist continuously since the creation of a black hole. At present, the mass of the central black hole is $4.31 \cdot 10^6$ solar masses [4, 13].

Halo

Halo is an invisible part of the Galaxy that has a spherical shape. The radius of this sphere exceeds the radius of the Galaxy several times [14, 15]. The halo consists of sparse gas, massive bodies, as well as stars that contain only light atoms.

The study of the halo of the Andromeda Nebula with the help of the spacecraft "Hubble" [14, 15] made it possible to conclude that the halo only includes old stars with the age of 11-13,5 billion years and 6-8 billion years. Any manifestations of stellar activity in the halo are extremely rare.

To understand the nature of the halo, we draw attention to the model of the solar system [16] in the Universe with minimal initial entropy. According to this model, the active decomposition of super-heavy nuclei in the star's nucleus leads to the ejection of electrons, protons, and nuclei of helium and lithium beyond the embryo. And since a magnetic field was formed around the nucleus, the charged particles move along closed trajectories, returning to the point where they were created. The increase in the mass of discarded particles, which effectively occurs at the initial moments of the evolution of stars, increases the radius of the trajectory, resulting in the appearance of satellites of light particles around the nucleus of the star, which mass grows over time. At the same time, these particles can not contain heavy atomic nuclei. Thus, the Oort cloud is formed. The orbit of this cloud is close to the equatorial plane of the nucleus of the star.

A similar process will occur in the case of the nucleus of the Galaxy. And in the initial galactic magnetic field, the clouds of light atoms and atomic nuclei will be formed. Since atomic nuclei are emitted from the nucleus of a galaxy at a sufficiently high speed, the resulting radius of halo should be several times greater than the radius of the galactic disk, which expands exclusively by expanding the space. The primary orientation of the orbit of this cloud will be close to the plane of the Galaxy.

At the second stage, when the processes of chaos dominate in the center of the Galaxy, the stars approached each other, causing a change in the trajectory of motion, and also throwing large masses of matter from the upper layers of stars into outer space. Consequently, light atoms and rather massive objects consisting of light atoms were emitted.

Both first-generation particles and second-generation particles most likely have an elongated elliptical orbit, from time to time approaching the center of the Galaxy, where processes of chaos continued. The latter caused a change in the orbit of these particles, resulting in the formation of a spherical halo. When the active processes of chaos in the center of the Galaxy were completed, the formation of the halo and objects in it ended. Such a mechanism for the formation of the halo was due to the fact that all the stars in it are old enough and, moreover, do not contain heavy chemical elements.

Galactic Arms

What do we know about Galactic Arms? The discs of galaxies, like ours, have the most notable formations - spiral branches (or Arms). Along the Arms are mainly concentrated the youngest stars, many scattered star clusters and associations, as well as chains of dense clouds of interstellar gas, in which stars continue to form. In spiral branches there are a large number of variables and flare stars, they are most often observed explosions of some types of supernovae. The galactic magnetic field that penetrates the entire gas disk is also concentrated mainly in the Arms. Each Galaxy's spiral Arm describes a logarithmic spiral with a slope of approximately 12°[2].

The Solar System is located in a comfortable, quiet and cozy place between the Arms of Sagittarius and Perseus in the area called the Orion Arm.

[2] Considering the shape of the Galactic Arms in different galaxies [17], it is easy to see that this form is far from always described by a logarithmic spiral. In that part of the Galactic Arms, which is located on the periphery of the galaxy, often there is no distance, but the approach of the Arm to the center of the galaxy. In the Galaxy Milky Way [3] this fact is also noticed.

Let's take a closer look at the Galactic Arms. The first thing to notice is the symmetry of the Arms, that is, you can rotate the image to 180° and get the same structure of the Arms. The Scutum-Centaur Arm corresponds to Perseus's Arm, the Sagittarius's Arm meets the Norms Arm, and so on. In addition, Galactic Arms never go beyond the Galaxy.

It is clear that such a high symmetry of Galactic Arms can not be described, based on considerations of the existence of chaos [10]. And no fluctuations will ensure the appearance of symmetric entities.

To understand the processes of Galactic Arms, let's sequentially consider some simplified models of evolution of objects in the Galaxy.

When the star has a fairly large mass, and its evolution has led to the fact that the internal pressure does not restrain its collapse, there is a phase transition, which is, first of all, in the rapid reduction of the radius of the star. In this case, the law of conservation of energy is fulfilled: an increase in the absolute value of the potential energy of interaction between the particles of a star equals the increase of the kinetic energy of the particles of the star. However, for central-symmetrical objects there is a law (the viral theorem), according to which, in stationary state kinetic energy should equal half the potential energy with the opposite sign. Consequently, there is a large surplus of kinetic energy.

When there is compressing of a star, the density of matter in its central part continuously increases and is always higher than on the periphery. When the density in the center reaches the density of the nuclear material, it no longer increases, forming the nucleus of the future neutron star. In this case, the radius of the neutron nucleus will increase, and the region of matter with high kinetic energy will be displaced beyond the limits of the neutron core, while continuing to increase kinetic energy. At a certain stage of such an evolution, there is an explosion of the star, that is, excessive kinetic energy drops its upper layers from the star, leaving an almost intact central part that becomes a neutron star.

The second process worthy of attention in this section is the absorption of a black hole of an ordinary star. When a star meets a black hole, first of all its substance is extracted in the equatorial region of a black hole, covering it with a ring. Since we are dealing with a deep gravitational well, energy levels such as atomic are likely to exist. In this case, the reduction of the energy of the massive ring around the black hole must be accompanied by visible radiation and the release of gases simultaneously from the entire ring. The final step is to absorb the substance of the ring with a black hole. In such a process there is again an excess of kinetic energy of a substance absorbed by a black hole. So, you should expect the substance or energy to be ejected by a black hole. Since the substance is absorbed in the equatorial region, providing the cylindrical symmetry of the system, the separation of matter or energy must happen from the poles of the black hole or symmetrically from the equatorial region.

It can be argued that a substance can not leave a black hole. In this case, let us consider the possibility of illumination of excess energy from the poles of a black hole. Imagine that the illumination of electromagnetic waves with frequencies ν_o occurs from the gravitational surface of a black hole along its radius. In this case, you can write the equation:

$$\frac{GM_b m_p}{r^2} dr = \frac{GM_b h\nu}{c^2 r^2} dr = d(h\nu), \tag{15}$$

where M_b is the mass of the black hole, m_p is the mass of the photon.

Integration from r_g to ∞ gives

$$\int_{r_g}^{\infty} \frac{GM_b}{c^2 r^2} dr = \frac{1}{2} \int_{r_g}^{\infty} \frac{r_g}{r^2} dr = \int_{\nu_0}^{\nu} \frac{d\nu}{\nu} \tag{16}$$

We get it

$$2 = ln\left(\frac{\nu_0}{\nu}\right), \tag{17}$$

that is, the frequency of the electromagnetic wave decreases only in $e^2 = 7.39$ times.

However, in this case there is one non-matching thing: the symmetry of processes in time is disturbed. The matter is that the substance is absorbed, but an electromagnetic wave is radiated, which, in principle, can generate only a pair of antiparticle-particles that are again annihilated. Consequently, the energy of an electromagnetic wave will only dissipate, remaining electromagnetic wave.

In order to get out of the situation, which led to reflections on the processes, and to return the substance to space, one must assume that the wave that emitted is not actually the electromagnetic, but the Scalar Field [18]. Since the Scalar Field is capable of creating a substance, we will return to the initial state: the substance was absorbed and eventually radiated substance. Such a mechanism will

allow us to understand the process of radiation of hot matter and energy at a certain distance from the poles of a black hole, which is observed in astronomical studies (see article [19] and the references therein). This radiation feeds the Fermi bubbles [20].

Finally, we came to the consideration of the mechanism of the formation of Galactic Arms.

We are talking about the absorption by the central massive black hole of smaller black holes, resulting in shock waves [21] that create Galactic Arms.

We have already realized that the interaction of a star with a black hole will form a disk in the equatorial part of the black hole. Unlike this case, the contact interaction between two black holes will not be able to stretch a smaller black hole into the disk around a massive black hole. A symmetry axis appears that connects the centers of the masses of two black holes. Then there will be an absorption by a massive black hole of a light hole. As in the previous cases, when converging and combining black holes, there will be a large surplus of kinetic energy equal to half the change in potential energy. Let's evaluate the change in the magnitude of the potential energy:

$$\Delta E_p = \frac{GM_1M_2}{r_{g1}} = \frac{1}{2}M_2c^2 \qquad (18)$$

Here M_1 is the mass of a massive black hole; M_2 is the mass of a small black hole. At the same time it is believed that, when capturing a small black hole by the massive distance between their centers will be equal to the gravitational radius of a massive black hole. In addition, to determine the gravitational radius of a black hole, not a relativistic, but a classical formula is used.

From formula (18) it follows that the excess of kinetic energy when combined with black holes will be about a quarter of the mass of a light hole. This energy value should be distinguished by combining black holes. The result is **new and unexpected**, but it explains the process of creating Galactic Arms.

We drew attention to the existence of the axis of symmetry in the interaction of two black holes. In addition, it should be noted that the pulse of the system was close to zero, and the momentum that corresponded to the rotation of the small hole around the large at the time of their union could be large. As a result, the union of two black holes will cause the birth of two shock waves [21], that is, the ejection of two equal in magnitude flows of the Scalar Field, characterized by the components of motion: radial in the equatorial plane, and azimuthal. The ratio between the azimuthal and radial velocity of the flows will determine the tangent of the angle of the logarithmic spiral of Galactic Arms. Different forms of Galactic Arms are currently well-structured [17]. Looking at the Hubble Camerton, one can see that no black hole has been created in elliptical galaxies E0-E7, or only one light black hole has been created. In galaxies SBa and SBb there was an association of a light black hole with a central massive black hole. Moreover, in both cases, the azimuthal projection of the velocity of matter in the Galactic Arms far exceeds the radial projection. In the case of the SBc, the situation is the opposite, that is, the radial velocity projection significantly exceeds the azimuthal. At the same time, the central bar is collinear to the Galactic Arms. Therefore, it is not visible. In this example it is clearly seen that the gravitational field of the galaxy affects the form of Galactic Arms.

If the mass of a small black hole was 10^5 solar masses, then two generated shock waves will be carried on 12500 solar masses of matter. Such streams will really be visible as powerful Galactic Arms. They will be able to provide a fairly large magnetic field in Galactic Arms and cause active processes of evolution of matter within Galactic Arms. Similar properties of Galactic Arms can provide processes for absorption of a massive black hole of the lungs (10^4 or even 10^3 solar masses) of black holes. It is clear that in these cases the power of the Galactic Arms will be much lower. And such Galactic Arms are really observed. A strong pair of Galactic Arms are Scutum-Centaurus and Perseus's Arms, the Arms of the Norma and Sagittarius are significantly weaker, and two 3-kiloparsec Arms are very weak. At the same time, a central bar forms together with the spiral arms.

It is worth noting yet another feature of the creation of Galactic Arms. The fact is that from a massive black hole radiated only the Scalar Field, which carries with it a lot of energy. After some time, the Scalar Field generates a substance, starting with bineutrons or bineutron associates. Consequently, the substance of the Galactic Arms is not born immediately after the radiation of the Scalar Field, but at a distance from the central black hole. As a result, the central bar of our Galaxy, whose length (~ 27,000 light years = 2.55×10^{17} km [22, 23]), substantially exceeds the diameter of the massive black hole (25.46×10^6 km [13]) Judging by the classification of galaxies, the length of the central bar and the

number of galactic sleeves in different galaxies depend on the mass of the central black hole and the number of absorbed light black holes.

The surprise, at first glance, causes too much of the length of the central bar of our Galaxy. One of the explanations for this phenomenon is the removal of the onset of Galactic Arms from the center of the Galaxy. For billions of years of existence of Galactic Arms, such a distance (~ 13500 light years) is quite possible. However, in this case, the central bar should not be created.

Another version is related to the properties and dimensionality of the Scalar Field[3] [18]. Since the Scalar Field covers all layers of the layered Super-Universe space, it has the ability immediately to capture a light black hole with a heavy black hole to generate Galactic Arms at a distance of 13500 light years, with the preservation of information about the energy and momentum of a substance generated in the Galactic Arms. In addition, such a distance allows you to create Galactic Arms with a diameter much larger than the diameter of a massive black hole.

Thus, the onset of Galactic Arms appears outside the central spherical part of the Galaxy. Otherwise, the central part could be destroyed.

To explain the mechanisms of creating a central bar and transferring the beginning of Galactic Arms far beyond the spherical part of the Galaxy, we will consider simple examples. If we take the pebbles and cast them horizontally above the surface of the water, then we will see how it bounces many times from the water until it loses its speed. If the pebble throw over a viscous liquid or mud, then notice that the pebble will make a mark on the surface and stopped, drowning.

In the case of the Scalar Field, it has the ability to propagate in a two-dimensional space, each point of which is informally connected with a delocalized point of a three-dimensional space. In this way, the Scalar Field is instantly transferred to the point of birth of Galactic Arms, while forming the trace of its displacement in a three-dimensional space.

There is another idea that arises when considering the properties of Galactic Arms. The impression is that they have a constant configuration in time, like the knitting needles in the wheel, although their form and influence the gravitational field of the Galaxy. That is, the Galactic Arms has the same configuration, since the shock wave is not connected with the orbital motion of stars around the center of the Galaxy. In this case, it will be clear why the stars in the orbital motion around the center of the Galaxy, on the one hand, enter the Galactic Arms region, and on the other get out of it. Since the central bar is created at the same time as the Galactic Arms, its configuration must also remain constant. However, it is created as a matter of course moving the Scalar Field, and not as a result of a shock wave. As a result, the central bar actually stabilizes the position of the Galactic Arms.

There is a chaotic stream of matter to the central black hole, forming a ring of gas and dust in the equatorial plane of a black hole. At the same time there is a capture of matter with a black hole. As a result, part of the substance from the ring is thrown to all sides in the region of the galactic disk. If there are central bars, then the substance will be thrown mainly on the bars, like water from a crowded basin on the river. Such jets of matter will feed Galactic Arms. And since the flow of matter in a black hole is chaotic, then the stream of matter in the region of Galactic Arms will have an oscillating nonperiodic character. These oscillating jets will reach especially large amplitude when a black hole captures a star.

Somewhat different properties have the process of radiation of hot matter and energy from the poles of a black hole that feeds the Fermi bubbles. These fluxes of particles are too weak to influence the structure of the spherical part of the Galaxy, so they are created at relatively small distances from the poles of a massive black hole, but outside the critical region, which provides the possibility of returning the hot substance to a black hole. In addition, it is possible that along the central bar in both directions, there are immediate streams of hot matter that exist simultaneously with the fluxes fed by the Fermi bubbles.

[3] The fundamental space, through which the Scalar Field enters, has twelve rough spatial coordinates, one time and one informational. The scalar field carries with it the energy and program of creating the Super-Universe and matter in separate layers of the layered space. Therefore, after the radiation of the Scalar Field by a massive black hole, it has the ability to create Arms in a random place that corresponds to the program.

5. CONCLUSION

Based on the consideration of the processes of creation and evolution of the Galaxy in the model of the Universe with the initial minimal entropy, the following conclusions were made.

- At the birth of the Universe there is immediately created galaxy's germ in the form of a disk with a constant density of matter. The germ of the galaxy has a fractal structure, the elements of which are the embryos of the stars. The germs of the galaxy and stars have a rotational moment.
- The diameter of the galaxy increases over time solely by expanding the space.
- The increase in the mass and size of stars and galaxies causes a change in the dependence of the average density of matter from the distance to the center of the galaxy, including our Galaxy. In the center of the Galaxy, due to the development of chaos caused by the large density of stars, a spherical region with a constant density of matter is formed; resulting in a period of rotation around the center of the Galaxy in this part of the Galaxy is constant. Galactic disk is formed beyond the spherical region. The density of the substance in disk depends approximately in proportion to the distance to the Galaxy center. Such a distribution of stars in the Galaxy will cause a weak dependence of the stars velocity from the distance to the Galaxy center.
- The increase in the mass of stars over time and the gravitational interaction between them led to an increase in the thickness of the galactic disk. In this case, a projection of force appeared, directed perpendicular to the plane of the disk.
- Due to chaos in the movement of stars in the Galaxy center there was a collision of stars and the unification of their mass, resulting in the stars evolved to a black hole, which was formed primarily in the center of the Galaxy. The conditions for the formation of black holes appear after billions of years after the birth of the Universe and last a limited time. However, the weak process of capturing stars with a central black hole must exist continuously.
- Two processes are involved in the formation of the halo. The first one was manifested immediately after the birth of the galaxy due to the collapse of atomic nuclei in the nucleus of the stars. The second process involves the development of chaos in the central part of the Galaxy, in which the upper layers of the interacting stars were thrown outside the Galaxy. Both processes caused birth in halo of massive objects, in which there are no heavy chemical elements.
- The absorption of a substance by a central black hole causes the fluxes of fast particles, which feed on the Fermi bubbles, from the black hole poles.
- Galactic Arms of varying power flow in pairs, spreading the central black hole of light black holes. In this case, the superficial kinetic energy forms streams of the Scalar Field, which in turn forms the Galactic Arms. Simultaneously with Galactic Arms central bars also appeared.
- The configuration of Galactic Arms remains unchanged, since the shock waves are not related to the orbital motion of stars around the Galaxy center. Therefore, the stars on the one hand enter the region of the Galactic Arms, and on the other hand, they emerge from it.

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PHYSICS AND MATHEMATICS

THE INITIAL PERIOD IN THE UNIVERSE CREATION

Kondratenko Petro O.

Doctor of Science, professor, National Aviation University, Kyiv, Ukraine.

Abstract

The article analyzes the initial period of the Universe ctrition, proceeding from the Standard Model, as well as from the Model of creating the Universe with the minimum initial entropy. It is shown that the Standard Model and its development in the form of the theory of the Universe's inflation are based on ideas that contradict the laws of physics and do not explain the reasons for the rotation of matter at every hierarchical level of the Universe. As for the Model of the Universe's creation with the initial minimum entropy, this Model takes into account all the laws of physics, introducing a layered space consisting of four layers with different dimensions: zero-dimensional space, one-dimensional space, two-dimensional space, and three-dimensional space. All these spaces are combined into a single Super-Universe, where there is an information connection through a delocalized point between the individual spaces. In addition, all these spaces are united by common time. All these spaces are branes of spaces of higher dimension, the radius of which increases with time with the speed of light. Through the zero-dimensional space, which has 12 minimized spatial coordinates (fundamental space), the Scalar Field enters, carrying with itself a program (fundamental code) of the evolution of the Universe. This Field alternately fills all subsequent spaces of the Super-Universe, generating the corresponding particles in each of them: magnetic monopoles in one-dimensional space, quarks in two-dimensional space and particles in three-dimensional space. The Scalar Field is responsible for the rotation of matter at every hierarchical level of the Universe, for the annihilation processes, for the presence of mass of all created particles, and also for the visible radiation of stars.

Keywords: Models of the Universe creation; layered space; Scalar Field; mass of particles; rotation of matter; radiation of stars.

The discovery of galaxy recession made by E. Hubble in 1929, as well as the theoretical studies of A. Friedman, which showed that the Universe filled with gravity of

matter cannot be stationary, led to the understanding that in the distant past our Universe was very small, that is, there was a moment of birth of the Universe. In this regard, studies of the expansion of the Universe and determination of age by the duration of this expansion come to the fore. Many theories of the birth of the Universe arose. The modern theories of the emergence and evolution of the Universe are based on the works of G. Gamov, in which the physical processes that occur at various stages of the expansion of the Universe are studied.

Based on the model of G. Gamow, scientists believe that at first the Universe was in conditions characterized by the presence of high temperature and pressure in the singularity, that is, at the point at which all matter was concentrated. This model is called Standard. It is believed that this model is confirmed by the presence of relict radiation [1-5].

The expansion of matter from a singularity is called the Big Bang.

Of course, there are alternative theories of the birth and evolution of the Universe. In this article we will consider for comparison only the model of the birth of the Universe with a minimum initial entropy [6,7].

Standard Model of the Birth of the Universe

So, the Standard Model for the Creation of the Universe declares that the beginning of the creation of the Universe was a singularity in which the energy equivalent to the modern mass of the Universe was placed. Moreover, the temperature of the Universe at this point was very large. If the diameter of the singularity point is zero, then the temperature will be equal to infinity. If, nevertheless, it is recognized that the initial diameter must be finite (use the Planck length in this case), then the initial temperature will have a finite value (~ 10^{28} K [8]). The initial entropy of such a Universe will also be extremely large.

The Planck length is a fundamental quantity at which the gravitational radius of the Planck particle is equal to the Compton length. For elementary particles, the Compton length is significantly greater than the Planck length, and the value of the gravitational

radius is much less than the Planck length. If we calculate the Compton length for the Universe, which is singularly similar to a small particle with a complex internal structure, then we get the value $\lambda_c \sim 5 \cdot 10^{-93}$ m, which is 58 orders less than the Planck length. At the same time, the magnitude of the gravitational radius of the Universe is $r_g \sim 7 \cdot 10^9$ Light years. Consequently, the Universe at birth appears inside a black hole [6,7]. Supporters of the Standard Model do not take this fact into account. Despite this fact, theoretical studies were conducted [9], which showed that at the birth of the Universe as a result of fluctuations in the distribution of matter small black holes should have been created. So, according to the accepted model, a large black hole is not created, but small ones can be created! Paradox. And there could be so many (millions) of such small black holes in every galaxy. To detect such small black holes, special astronomical studies were conducted [10], which showed that such holes are absent in the Universe. This fact is a serious blow to the theory of the hot start of the Universe.

On the other hand, the unlimited or very large initial entropy of the Universe ($S_0 = 10^{88}$ [11]) will stand in the way of creating galaxies, stars and planetary systems.

Regarding the fundamental nature of the Planck length, there is a point of view [12-15], according to which additional spatial measurements should appear at small distances, as a result of which the Planck length will not have a clear fundamental physical meaning.

Despite such comments, it is believed that after such a start, the size of the Universe is rapidly increasing, that is, the Big Bang is taking place.

Since the space in which it occurs is also being born at the same time as the Big Bang, it is important to answer the question: why do we see this space flat and why is matter and energy in this space evenly distributed? To answer these questions, an inflationary model of the Universe was created. According to this model, the Universe was originally created in an unstable state (false vacuum), which in search of the true vacuum state caused its rapid expansion. As a result, the Universe turned out to be much larger than its part filled with matter.

The beginning of the theory of inflation was laid by Alan H. Guth in 1980 [16]. However, it followed from his model that the distribution of matter in the Universe can be heterogeneous. Immediately after this, Andrei Linde, as well as Andreas Albrecht and Paul Steinhardt supplemented the theory of A. Gut, so that it ensured uniformity in the distribution of matter in the Universe [17]. The model developed by A. Gut claims that the size of the Universe due to the Scalar Field doubled every 10^{-35} s and so lasted at least 10^{-32} s (sometimes called 10^{-34} s). So, doubling the size of the Universe was at least 10^3 times! If the expansion rate of the Universe in the first 10^{-35} s was equal to the speed of light, then at the moment $t = 10^{-32}$ s it reached $2^{1000} = 10^{301}$ speeds of light. In the second case, the expansion rate of the Universe reached $2^{10} = 1024$ light speeds. Even if at the birth of the Universe there was some curvature in it, then with such a powerful expansion, the curvature will disappear.

The size of the Universe will be much larger than the diameter of the Metagalaxy. With an increase in the volume of space, the magnitude of the Scalar Field should decrease, as a result of which the ultrafast expansion of space will cease. So, nothing will interfere with the expansion of the Metagalaxy after the Big Bang.

In this case, the distance between the galaxies will increase due to the expansion of galaxies as a result of the explosion, and due to the expansion of space. In this case, the effect due to the expansion of galaxies should decrease with time due to the gravitational interaction between galaxies, and the effect due to the expansion of space should increase exponentially within the limits of inflation.

As a physical reason for such a rapid expansion of space, the concept of an inflate field and its carrier particle, inflate, are introduced. So, this particle must move faster than the speed of light, that is, be a tachyon. However, it has been proved that the space of tachyons cannot be combined with the space of tardions, that is, particles that move slower than the speed of light. Otherwise, the causality principle will be violated [18].

In addition, it is believed that the inflation field should be scalar. Therefore, it is worth stopping at this moment. On the one hand, it is assumed that this field is identical to the Higgs field. On the other hand, it is indicated that the Scalar Field should be the

same throughout the Universe, since it ensures the presence of mass for elementary particles. Astronomical observations confirm that the masses of atoms and their components are really the same in the Universe. If a Scalar Field has caused inflation of space, then it should fill the entire space. Therefore, the question arises: why do we need a field where there is no substance?

In addition, the presence of a carrier particle of the field indicates that this field is responsible for the interaction. In this case, let us consider a Scalar Field, as it was introduced in the works of T.F.E. Kaluza. Moreover, as for four-dimensional space-time, it was believed that one coordinate is temporary, and four are spatial [19,20].

For the five-dimensional interval, we write:

$$dI^2 = G_{AB} dx^A dx^B,$$

where the indices A and B are 0, 1, 2, 3, 5 (the four are purposely omitted). We write the components of the tensor G in the form of a matrix

$$G = \left(\begin{array}{ccccc} G_{00} & G_{01} & G_{02} & G_{03} & G_{05} \\ G_{10} & G_{11} & G_{12} & G_{13} & G_{15} \\ G_{20} & G_{21} & G_{22} & G_{23} & G_{25} \\ G_{30} & G_{31} & G_{32} & G_{33} & G_{35} \\ \hdashline G_{50} & G_{51} & G_{52} & G_{53} & G_{55} \end{array}\right)$$

The tensor G is symmetric, so there are only 15 different components in it. Moreover, 10 components correspond to the Einstein general theory of relativity tensor, four components correspond to the components of the electromagnetic vector potential A_α ($G_{5\alpha} = \frac{2\sqrt{\gamma}}{c^2} A_\alpha$, where γ is the gravitational constant in Newton's formula, α = 0, 1, 2, 3), and the additional component G_{55} is unknown. It follows from the structure of the matrix G that the component G_{55} corresponds to an unknown Scalar Field.

We draw attention to the fact that the electrostatic field is characterized by a scalar potential. But this field causes a force interaction, which is determined by the gradient of this field. Consequently, the field turns out to be vector, which is a component of the electromagnetic interaction vector, which is reflected in the Kaluza matrix. At the same time, the Scalar Field is characterized by a single component G_{55}. This is not a force

field! It has completely different properties [21]. And he does not need to have a particle carrier field. For an unknown reason, physicists do not pay attention to this fact.

The Scalar Field was introduced phenomenologically without justification and description of its properties. In theory, it can have different value in different areas of the Universe. An increase in the magnitude of the Scalar Field in individual parts of the Universe should lead to the creation of the Multiverse, that is, Universes with narrow corridors between them. You need to have great imagination to think of such a structure of the Universe. There are no physical mechanisms that would cause the formation of such a structure and support it.

All three types of fields are involved in our Universe. It is only necessary to understand where the Scalar Field manifests itself.

Thus, it can be argued that the expansion of space with the speed, higher than the speed of light, in our Universe is impossible. The Scalar Field, which is responsible for the ultrafast expansion of space, does not have this property.

Another surprise is the hypothesis of the expansion of space, leaving it flat. Such a hypothesis can only be understood as a convenient moment for conducting theoretical research.

For unknown reasons, in the presence of a very large entropy of the Universe, it is structured into galaxies, star clusters, planetary systems. All these processes occur with a decrease in entropy. The standard model does not answer the question: where does the excess entropy go? It is only believed that the grouping of matter into galaxies, stars and planets occurs due to quantum fluctuations, the scales of which are infinitely smaller than the sizes of galaxies.

So, according to the theory of inflation, space can exist without matter and time. Of course, such a result contradicts the Einstein's triunity law[1], according to which space, time and energy (matter) must coexist inseparably.

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[1] The triunitylaw, discovered by A. Einstein, is formulated as a formula $R_{ik} - \frac{1}{2} g_{ik}(R - 2\Lambda) = \frac{8\pi G}{c^4} T_{ik}$.

In such a space, light quanta that separated from matter after the Big Bang have the ability to propagate beyond the Metagalaxy. The expansion of space, as well as the adiabatic expansion of the region of existence of this light should lead to its cooling and manifest itself as relic radiation. Experimental confirmation of the existence of microwave radiation, which is characterized by a temperature of -270.425 °C = 2.725 K, is considered confirmation of the Standard Model for the Birth and Evolution of the Universe.

Paying attention to the development of the theory of T.F.E. Kaluza, we can conclude that all coordinates must be folded onto themselves, which to some extent contradicts the theory of inflation.

In the Standard Model, a substance is not born immediately after the Big Bang, but only after some time, in the era of nucleosynthesis. In the theory of inflation, the birth of matter also occurs at the end of the inflationary stage of the expansion of space over a period of 10^{-10} s, until the temperature drops to 10^{16} GeV. This period is called the period of the Great Unification. In this case, all known elementary particles are created, but without mass (?). This point is also surprising, because according to the inflation model, the Scalar Field causes both inflation and the presence of mass in the particles.

A further decrease in temperature to 10^{15} GeV leads to the replacement of the era of the Great Unification with the era of electroweak unification. At the moment when the temperature drops to 100 GeV, the era of electroweak unification ends, and quarks, leptons, and intermediate bosons are created. The hadron era begins when quarks merge into hadrons. Confinement of quarks arises. Moreover, the time from the birth of the Universe is 10^{-6} s.

Here again misunderstanding arises. The fact is that both the Kaluza theory and the Dirac theory prove that the charge of elementary particles is quantized, and the minimum charge is the charge of a proton and an electron. At the same time, the charge of quarks is 3 times less!

In the singularity there was only energy, which, according to the authors, could create only a particle-antiparticle pair. And from here an unresolved problem arises: why are only particles observed in the Universe?

As follows from the above information, there was a period after the Big Bang, when there were no baryons. And in our time, based on a consideration of nuclear reactions, experts argue that there is a law of conservation of the number of baryons, forgetting about the existence of a nucleosynthesis period. It would be necessary to clarify this point in the scientific and educational literature.

Various theories of the Great Unification allow the birth of a large number of magnetic monopoles in the early Universe. However, so far they have not been found.

And finally, existing theories do not explain why everything in the Universe rotates.

Model of the birth of the Universe with minimum initial entropy

The model of the birth of the Universe with minimum initial entropy is created on the basis of the Laws of similarity and unity in the Universe.

It is known that the Universe has a hierarchical structure, which determines the fulfillment of the Law of Similarity [22]. Moreover, in [22] the principle of hierarchical similarity was considered as a new fundamental law of physics. In addition, the Law of similarity is uniquely described using the Tree of Life, which allowed the author of the monograph [22] to create a theory of hierarchical systems and to create numerous schemes of free electron lasers. We use this information in modeling the processes of birth and evolution of the Universe.

In this model, the beginning is marked by the creation of the embryo of the Super-Universe, represented by a layered space that consists of four layers [6,7].

In the created Super-Universe, the first layer is depicted as a zero-dimensional space (World-1). The second layer is one-dimensional space, the third is two-dimensional and the fourth is our three-dimensional space.

There is information interaction between adjacent layers through one delocalized point.

At the beginning of the creation of the Super-Universe, each layer is represented by a space with folded coordinates of fundamental dimensions.

The first layer has 12 minimized spatial coordinates, as well as temporal and informational coordinates. The second layer has three folded spatial coordinates, one of which with time reveals itself as a brane of two-dimensional space (a circle whose radius increases with the speed of light). The third layer has three convoluted spatial coordinates, two of which eventually open up as branes of three-dimensional space (a sphere whose radius increases with the speed of light). The fourth layer has 6 spatial coordinates, three of which are revealed as branes of four-dimensional space. In this case, the radius of the four-dimensional sphere increases with the speed of light. The time and information coordinates are characteristic for all layers of the layered space.

12 coiled spatial coordinates of zero-dimensional space cover all spatial coordinates of the stratified space, which makes it possible to interact between processes occurring in zero-dimensional space with processes that occur in other spaces.

Thus, the individual layers of the stratified space are closed spaces. The length of the shown coordinate of one-dimensional space is $V_1 = 2\pi R$, the area of two-dimensional space is $V_2 = 4\pi R^2$, and the volume of three-dimensional space is $V_3 = 2\pi^2 R^3$ [18]. In all cases, the value of R increases with the speed of light ($R = cT_U$, where T_U is the time of existence of the Super-Universe from the beginning of filling of zero-dimensional space). Only zero-dimensional space has constant dimensions and represents a fundamental multidimensional sphere.

The Scalar Field enters through the zero-dimensional space at a constant speed. The Scalar Field carries with it a program (universal code) for creating the Super-Universe. This Field first fills the one-dimensional space until a constant density of matter in this space is reached. The application rate of the Scalar Field should be 3 times higher than that required to maintain a constant density of matter in a one-dimensional space, which is constantly expanding. This ratio is due to the fact that the rate of filling

with energy of one-dimensional, two-dimensional and three-dimensional spaces is the same and amounts to $1 \cdot 10^{34}$ kg / s [6,7]. The process of stabilizing the density of a substance in one-dimensional space can last for a time T_1, which is much shorter than Planck's time. Most likely, the value of T_1 will be equal to the period of oscillation of the Scalar Field generating the Super-Universe. As follows from the article [21], the value of the oscillation period of the Scalar Field is $T_1 = 2.45 \cdot 10^{-85}$ s. Based on the structure of World-1, it is clear that the Scalar Field can be in World-1 only during the time T_1. So, the energy of the Scalar Field, which is in a multidimensional sphere, is equivalent to a mass of $7.35 \cdot 10^{-51}$ kg, which is much less than the mass of a Planck particle. And from this it follows that our Universe can not be inside a black hole.

On the other hand, we can conclude that the Scalar field can be in World-1 for a time $\tau \gg T_1$, forming all the properties necessary to create a Super-Universe. In addition, since all the coordinates of World-1 are folded into circles of small radius, the Scalar Field wave must be circularly polarized. And this, in turn, will lead to the fact that in the Universe all the created substance must have a torque. From an atom to a galaxy, everything revolves. Moreover, astronomical observations confirm that galaxies rotate mainly in the same direction [23]. Since there is no apparent reason for such a rotation of galaxies, the author of [23] concludes that the rotation appeared at the birth of the Universe and was transmitted to galaxies.

After stabilization of the density of the substance in one-dimensional space is completed, the energy of the Scalar Field is poured into two-dimensional space. Therefore, this space begins to fill up with a delay over time τ.

Since the "volume" of two-dimensional space ($V_2 = 4\pi c^2 T_U^2$) is proportional to the square of the time of existence of the Super-Universe, and the amount of energy supplied is proportional to time, the density of matter in two-dimensional space will decrease inversely with time.

As calculations showed, the delay time of the start of filling with energy of three-dimensional space is $3 \cdot 10^{-5}$ s [6,7]. During this time, the radius of the brane will reach 9 km. A newborn three-dimensional space will initially be filled only with vacuum

particles [18] and zero oscillations of physical fields. The entry of a large energy flux of the Scalar Field will lead to the excitation of vacuum particles and the creation of material particles, which can only be bineutrons or complexes of bineutrons [24].

It was indicated above that the properties of the Scalar Field are significantly different from the properties of the electromagnetic field. While the electromagnetic field is capable of creating a particle-antiparticle pair under certain conditions, the Scalar Field creates a material object devoid of all quantum numbers except the mass, for example, a bineutron or a complex of bineutrons. Such particles are born in three-dimensional space. The Scalar Field is also responsible for the existence of mass of particles, and therefore there cannot be a period of existence of massless particles. There is no antimatter in the Universe. Since the Scalar Field is not a charge carrier, the matter generated by it must be electrically neutral. Therefore, in all spaces there is a law of conservation of the total charge.

The mass of elementary particles is formed due to the fact that in the vicinity of each particle of the corresponding substance there is a Scalar Field. Only the presence of a Scalar Field is responsible for the processes of annihilation of a particle with an antiparticle. In this case, a vacuum particle is created [18], the main characteristic of which is the absence of mass and the equality of all quantum numbers to zero. The polarization of such a particle in the field of an atomic nucleus allows the excitation of this particle by an electromagnetic wave with the formation of a particle-antiparticle pair. Excitation of a vacuum particle to a virtual state is possible due to the Scalar Field.

The informational connection between three-dimensional and two-dimensional spaces leads to the fact that particles appear in a two-dimensional space that are rigidly connected with the baryons of three-dimensional space. The dimension of space determines the minimum electric charge of a particle. Therefore, quarks, being localized in two-dimensional space, have a charge $q_2 = \pm e/3$ and $\pm 2e/3$, and particles of one-dimensional space have a charge $q_1 = \pm q_2/2 = \pm e/6$. Moreover, it turned out that particles of one-dimensional space are diones, that is, carriers of electric and magnetic charges. In other words, they turned out to be magnetic monopoles, the mass of which is equal to

the mass of Planck particles. The existence of diones in one-dimensional space is facilitated by the fact that magnetic monopoles have a one-dimensional topological charge [25–28].

The initial temperature of vacuum particles, and then of bineutrons in three-dimensional space will be equal to 0 K. In the future, new particles will be born mainly in the vicinity of existing particles (nucleons), increasing the mass of newly created nuclei. In this case, the mass of newly created nuclei will increase with acceleration, reaching values that can significantly exceed the mass of uranium nuclei. There will be reactions of fission of nuclei, causing the birth of protons and electrons, which will entail heating of the substance. This explains why heavy chemical elements are present on Earth, including uranium and plutonium, and also why the central regions of all planets and stars have a high temperature.

Since the Scalar Field enters at a constant speed, the average particle density in three-dimensional space will decrease inversely with the square of the lifetime of the Super-Universe. The entire volume of space will be filled with particles. Consequently, the Einstein's triunity law holds.

In everyday life, we are used to perceiving the Earth's surface as flat, although we know that it has a shape close to a ball. Therefore, it is not surprising that we see the Universe flat, since the radius of the four-dimensional sphere, the three-dimensional surface of which is our Universe, exceeds $13 \cdot 10^9$ light years [6,7,29,30].

Conclusion

Based on the analysis of the initial period of the creation of the Universe in the Standard Model and in the model with the initial minimum entropy, the following conclusions are drawn:

1. The standard model of the birth of the Universe and its development in the form of a theory of inflation of the Universe are based on ideas that contradict the laws of physics. In particular, it follows from the Standard Model that the Universe at birth should be inside a black hole. And the theory of inflation of the Universe requires the

intervention of the tachyon field, the existence of which is possible only in parallel worlds. In addition, the considered models unconvincingly explain the structuring of matter in the Universe in the form of galaxies, stars and planets, and also do not explain the reasons for the rotation of matter at all hierarchical levels of the Universe. An important drawback of the Standard Model for the Creation of the Universe is its image in the form of a single three-dimensional sphere, partially filled with matter and fields.

2. To explain all the properties of the Universe, the model of its birth and evolution with minimum initial entropy uses a layered space consisting of four worlds with different spatial dimensions: zero-dimensional space, one-dimensional space, two-dimensional space and three-dimensional space. All these spaces are combined into a single Super Universe, in which between the individual spaces there is an information connection through a delocalized point. In addition, all these spaces are united by a single time.

3. The beginning of the creation of the Universe is the simultaneous creation of layers of layered space. Moreover, in each separate layer of the stratified space, the beginning is a multidimensional space of fundamental dimensions. All spaces simultaneously begin their expansion as branes of spaces of higher dimensions. In one-dimensional space, only one of the three collapsed coordinates is revealed. In two-dimensional space, two of the three collapsed coordinates are revealed. In three-dimensional space, three of the six collapsed coordinates are revealed. Zero-dimensional Space remains unchanged and forms the properties of the Scalar Field, which enters through it into the Super-Universe.

4. The Scalar Field has the ability to create particles or ensembles of particles in each space, all of whose total quantum numbers are equal to zero. In one-dimensional space, these are ensembles of dyons, which are Planck particles, magnetic monopoles. In two-dimensional space, these are ensembles of famous quarks. In three-dimensional space, these are bineutrons or complexes of bineutrons, the grouping and decay of which causes the creation of all known particles, atoms and massive bodies in the Universe.

5. The energy filling of the Scalar Field of the Super-Universe begins with a zero-dimensional space having 12 minimized spatial coordinates, as well as time and information coordinates. Then, with a certain delay, the Scalar Field fills the one-dimensional space, creating diones in it. After reaching a stationary concentration of particles in this space, the Scalar Field begins filling two-dimensional space, and then three-dimensional space. In the latter case, the delay with filling reaches $3 \cdot 10^{-5}$ s.

6. Scalar Field has the ability to cause rotation of matter at all hierarchical levels of the Universe.

7. The mass of all massive objects in the Universe increases in proportion to time due to the Scalar Field, which gives rise to bineutrons in the vicinity of existing atomic nuclei. As a result, the mass of atomic nuclei increases, nuclear reactions of decay and heating of the inner regions of stars and planets arise. These reactions cause the visible emission of stars.

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RELICT RADIATION IN THE MODEL OF THE UNIVERSE WITH INITIAL MINIMUM ENTROPY

Petro O. Kondratenko
National Aviation University, Kyiv, Ukraine
(pkondrat@nau.edu.ua, pkondrat@ukr.net)

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Abstract

The paper analyzes the results of the observation of the relict radiation using the Standard Universe Birth Model and the Universe Birth Model with minimal initial entropy. It has been shown that the Standard Model cannot adequately describe the relic radiation, since the realization of such a fashionable model of Universe would be inside a black hole. In order to describe the relict radiation using this model, scientists had to phenomenologically introduce two assumptions, namely, the existence of a period of inflation of the Universe and the existence of dark matter and dark energy. Both the original model and the assumptions made are contrary to the laws of physics. It is shown that using the model of the Universe with initial minimal entropy, it is possible to describe the properties of relict radiation without violating the laws of physics, since this model is based on the laws of unity and similarity, which act as fundamental laws of the Universe. The model is based on the idea of the stratified space and the Scalar Field, which brings into the Universe substance, fundamental laws and the program of development of the Universe. The new model requires that all layers of the stratified space be branches of spaces that are larger in size and continuously inflated. The finite volume of the Universe causes the radiation of all stars to remain in space and, due to the action of the Scalar Field, can return to the inner regions of stars and planets. Due to such energy circulation, we have equilibrium radiation, which is perceived as a relic, and stars retain activity for billions of years.

Keywords: relict radiation, models of the birth of the Universe, laws of unity and similarity, stratified space, dams of spaces of higher dimensions.

Radiation filling the outer space, which is described by the laws of absolutely black body radiation with a maximum at $\lambda m \approx 1.1$ mm [1], was discovered in 1965 by radio astronomers Arno Penzias and Robert Wilson (Bell Telephone Laboratories). Since theoretical models of relict radiation, developed by George Gamow [2,3], Ralph Alfer and Robert Herman based on the first theory of the hot Universe they had created, already existed at that moment, the experimentally found radiation was immediately interpreted as relict one [4]. On the other hand, the relict discoveries were seen as evidence of a model of the Universe's creation from a singularity point in which energy density and temperature are extremely high.

After the relic radiation was discovered, perfect spacecraft (COBE, WMAP, Planck) were created to investigate the exact value of its temperature and possible deviations from the Planck distribution in separate regions of the spectrum across the sky. It has been proved that the spectral distribution is indeed equals to Planck's one with a temperature of 2.725 ± 0.0002 K [5], that is, the average relict radiation temperature is 2.725 K, in regions of galaxy clusters the temperature is higher by 0.0002 K, and in void regions between galactic filaments (in voids) - lower by 0.0002 K.

This result is believed to confirm the non-stationary model of the Universe. In addition, high isotropy and homogeneity of relict radiation are thought to indicate the existence of inflation in the Universe.

Important for the study of the Universe was the study of the anisotropy of relict radiation, that is, the dependence of temperature and polarization of radiation on the direction in space. If the relic radiation was strictly isotropic, it would mean that the solar system was not moving about it. The presence of such motion causes the Doppler effect and, as a consequence, the dependence of the relict radiation temperature on the direction of observation. Thus it was possible to show that the solar

system together with the Galaxy are moving in the direction of the constellation of the Lion at a speed of ~ 600 km/s.

Of course, the theory of relict radiation was developed based on the Standard Model of the Universe. To align the theory with the results of observation, additional models of the evolution of the Universe were created. One such model is the inflation of the Universe the other is dark matter and dark energy. According to these models, the computer system of the spacecraft was programmed, which as a result allowed to determine the content of the specified parameters: baryonic substance - 5%, dark matter - 23%, dark energy - 72%.

Unfortunately, from the point of view of the author of these lines, all (!) these models are contrary to the laws of physics. Therefore, models need to be corrected so that they are consistent with the laws of physics, then create appropriate calculation programs and list reliable experimental data. Therefore, the author has undertaken to consider known experimental observations of the Universe that he trusts completely, from the point of view of the model of creation of the Universe with minimal initial entropy. An important point is the compulsory compliance with the laws of physics described within the new model of the Universe's structure and processes.

The relict radiation in the Standard model

According to the Standard Model of the Universe creation, it arose through the Big Bang from a singular point characterized by large values of energy (mass) and temperature [3]. If the diameter of the singular point is zero, then the temperature will be infinite. However, if it is acknowledged that the initial diameter had finite dimensions (in this case the Planck length is used), then the initial temperature will have a finite value (~ 10^{28} K [6]). The initial entropy of such a Universe will be extremely large ($S_0 = 10^{88}$ [7]).

This also resulted in a flat space that expanded for some time with the speed of light, and exponentially in a separate period of time ($10^{-35} \div 10^{-32}$ s), doubling the expansion rate every 10^{-35}s (the so-called inflation theory [8,9]) . After the explosion of the substance, elementary particles (protons, electrons, etc.), which were in a state of hot thick plasma, were sequentially created after the explosion.

To represent the state of this plasma, it is possible to compare it with the plasma from which all the mass of the Sun and stars consist. In this dense plasma, multiple scattering of photons occurs on the particles, which ensures a temperature-equilibrium state and the presence of equilibrium radiation from the star surface. Therefore, the spectrum of radiation of the star is close to the spectrum of a completely black body. This allows to determine the surface temperature of the star by registering the radiation spectrum.

That's the kind of equilibrium radiation formed in the thick plasma of the Universe. The expansion of the substance of the Universe, caused by the Big Bang, led to a decrease in the plasma density, so that at some time the radiation was able to go beyond the substance and freely expand in space, the radius of which at that time significantly exceeded the radius of the substance of the Universe. And since, after a period of inflation, space expansion occurred at the speed of light, radiation could never fill the entire volume of space when radially propagated. In other words, the radiation from equilibrium turned into nonequilibrium, and escaped from the plasma that gave rise to it. However, the experimental confirmation of the existence of microwave radiation, which is characterized by a temperature of -270.425 ° C = 2.725 K, is considered to be a confirmation of the Standard Model of the Birth and Evolution of the Universe. Using the Wien bias law, one can find the wavelength at the maximum of the relict emission spectrum $\lambda_m = 1.063$ mm.

For comparison, consider the supernova explosion. Before the explosion, it formed equilibrium electromagnetic radiation. During the explosion, it was released from the plasma and immediately radiated into the space that we register as the appearance of a supernova. Soon enough, this radiation moves away from the supernova. After that, instead of a star, we will see clouds of cosmic dust radiating away from the star, and (under certain conditions) a neutron star in place of a former massive star.

As we can see, in this case the radiation ceased to be equilibrium and non-equilibrium propagated in a conditionally boundless space. Back that radiation will not return and we will not see it as relic radiation.

Therefore, the theory of the cosmic relict radiation of the Universe as a cool primary radiation because of the adiabatic expansion looks strange. Radiation will really cool down due to the expansion of the space, but in order to fit the model of relict radiation, it is necessary that it does not leave the plasma, and then atoms, molecules, planets, stars, cosmic dust. And in the described scenario of the Big Bang and the presence of a period of inflation, the exchange of energy with the substance was excluded.

Let us mention what is equilibrium radiation.

Equilibrium radiation occurs in a closed volume, the inner walls of which are able to reflect electromagnetic waves. In this case, the number of photons emitted by the heated body contained in this volume will be equal to the number of photons that will return from the space around the body to the body itself. There is an equilibrium in which radiation is characterized by the laws of W. Wien and Stefan-Boltzmann. The spectrum of such radiation is described by Kirchhoff's function. The explicit appearance of such a function was established by M. Plank in 1900.

According to the law of similarity, which is implemented in the Universe, a similar process can be observed when the water is heated in a closed vessel. In this case, the equilibrium is established between the number of molecules of water vapor that returns to the surface of the water and the number of molecules that evaporate from the surface of the water. The closed volume will set the equilibrium in which the water vapor is saturated. As the temperature rises, the saturated water vapor pressure increases much more than the ideal gas pressure with the same temperature rise in the isochoric process. If we now open the vessel with water, the water vapor will move beyond the vessel where the water vapor pressure is lower than the saturated vapor pressure. Consequently, the vapor beyond the vessel stops to be equilibrium.

In similar way the light, that left the inner volume of the star, goes out into the open forever, stops being equilibrium. And it does not return to previous state.

Another question arises: could the substance after the Big Bang be evenly distributed in space? An example with a supernova shows that it could not. One can imagine an arbitrary explosion. In this matter, the substance flies into space and nothing remains at the site of the explosion. Much information on this topic was in the nuclear and fusion tests. During the bomb blast, the air pressure increased significantly, which as a result flew at high speed, creating significantly reduced pressure at the explosion site. Then the air returned and the atmosphere equalized steady state.

How then to imagine the Big Bang? First of all, according to molecular kinetic theory, the particles created during the explosion had a certain velocity distribution. Therefore, a small part of the substance flew at a speed close to the speed of light. There were almost no particles with zero velocity. The bulk of the particles had an intermediate velocity. Thus, the substance was moving away from the half-wave explosion site, the shape of which resembles Maxwell's velocity distribution. Over time, the fast particles were inhibited by gravitational interaction, and the spatial distribution blurred, reducing the pressure in the plasma. The process was completely unsteady and there was virtually no way to equalize the pressure and fill the site of the explosion with a substance. This is the picture observed after the supernova explosion. The expansion of the occupied matter region was lagging behind the radial propagation of light. However, the width of the area occupied by radiation did not exceed the diameter of the area occupied by the substance at the time of separation of light from the plasma. Thus nowadays the substance of the Metagalaxy must have a radial density distribution.

The result of the process described is the removal of the relic radiation far beyond the substance. We will no longer be able to register it. Therefore, the relict radiation we observe in space cannot be related to radiation that separated from hot plasma shortly (perhaps 1 billion years) after the Big Bang. Another point concerns the period of inflation in the Universe. The corresponding theory appeared only because of a mistake that violates the law according to which velocities are prohibited in our space beyond the speed of light. Such velocities are possible in parallel space where tachyons are possible.

This prohibition is related to a possible breach of the principle of causality. The existence of the ban is proved by the fundamental field theory developed by I. Gerlovin [10].

The relict radiation in a model of the Universe with a minimum initial entropy

Unlike the Standard Model, which declares that the substance in the initial state had a very high temperature, in the model of the Universe with a minimum initial entropy (UMIE) the initial temperature was zero. The second important difference between these models is that in the Standard Model, at birth, the Universe has a single flat space, while in the UMIE model the space must be stratified, one of which is our Universe, and all layers create a single Super-Universe.

Such a model of the Universe came about because of the understanding that the Law of Similarity is being implemented in it. For example, one can compare the stages of pre-natal development of a child and the creation of the Super-Universe [11,12]. In the case of pre-natal development of the baby, the fertilization of the egg first occurs and a fetal development program begins, then the processes of cell division begin, resulting in fibers (one-dimensional objects), tissues (two-dimensional objects) and three-dimensional objects (embryos), organs and systems). This sequence of processes is implemented fairly quickly. Over time, full-fledged organs and systems emerge, and a baby is formed that is able to perceive information during intrauterine development.

And so in the case of the creation of the Super-Universe [11,12]. In this case, the stratified space contains a zero-dimensional space through which the Scalar Field enters, a one-dimensional space in which Planck particles are created that have electric and magnetic charges (i.e., diones), a two-dimensional space in which quarks are created, and a three-dimensional space, in which our Universe is realized. The Scalar Field carries with it not only energy but also a program (universal code) for the creation of the Super-Universe [11-13]. One of the properties of the Scalar Field is the creation of a substance (bineutron) in the vicinity of nucleons, which provides a continuous increase in the mass of the Universe [14].

Since all the coordinates of the World-1 are closed in circles of small radius, the Scalar Field wave must be circularly polarized. And this in turn will cause that in the Universe all created matter must have a torque. From the atom to the galaxy, everything rotates. Moreover, astronomical observations confirm that galaxies rotate mainly in the same direction [15]. Since there is no apparent reason for this rotation of galaxies, the author of article [15] concludes that rotation appeared at the birth of the Universe and was transmitted to galaxies.

The scalar field is also a carrier of time.

The energy of the Scalar Field enters the Super-Universe at a constant speed, gradually filling the named spaces [11, 12]. In this case, all spaces are branches of spaces that have a unit of higher dimension. Therefore, one-dimensional space is represented by a circle, two-dimensional - the surface of a three-dimensional sphere, three-dimensional - a three-dimensional surface of a four-dimensional sphere. In the embryo of the Super-Universe, all coordinates are locked by themselves into circles of small radius [16, 17]. When creating Super Space layers, one or more coordinates, while closed on their own, increase their length. Consequently, at once these layers of the stratified space appear to be branches of spaces per unit of larger dimension. In a zero-dimensional space, all coordinates remain undiscovered. Because the Scalar Field has the ability to generate particles in all spaces, its dimension must cover the dimensions of all layers of the stratified Super-space, as well as the time and information coordinates. Therefore, 14 coordinates must correspond to the Scalar Field and the zero-dimensional space [11,12].

In all cases, the radii of the spaces whose branches are the above spaces expand at the speed of light [18, 19]. Branch volumes always remain limited and the corresponding branes are closed [11,12].

The stagnant filling of the dams, that is, layers of the stratified Super-Universe, causes the layers to begin to fill with substance with some delay. It is important that the delay of the process of filling the three-dimensional space is $3 \cdot 10^{-5}$ s [11,12]. The radius of the four-dimensional space will reach 9 km.

With further expansion of all layers, the energy of the Scalar Field is distributed equally between them. The filling of matter with spaces is such that the radius of the spaces is always greater than its gravitational radius [11,12]. By the way, this requirement is not met in the Standard Model. If the Standard Model were correct, then the Universe would be inside the black hole.

All layers of the stratified Super-space are immediately filled with vacuum particles [10,18,19]. It should be recalled that the Standard Universe Creation Model rejects the existence of vacuum particles, though it gives the vacuum a large number of properties to explain particle physics and fundamental interactions. However, the Standard Model does not explain the physics of annihilation of particles with antiparticles, the presence of virtual particles, etc. It simply declares the existence of such facts.

The UMIE model explains all the processes in the microcosm observed in the experiments by introducing the Scalar Field and vacuum particles [10, 11, 12, 20]. Only the Scalar Field provides the particle annihilation process, in which all quantum characteristics (mass, charge, spin, etc.) disappear. An electromagnetic wave, unlike a Scalar Field, cannot excite a free vacuum particle. To excite a vacuum particle, it must first be polarized in the field of an atomic nucleus, after which it is able to absorb an electromagnetic wave.

By interacting with the vacuum particles first and then with the nucleons of the substance, the Scalar Field consistently creates heavy atomic nuclei that, in accordance with the laws of physics, are capable of detecting radioactivity. In this case, charged particles are born and great energy is released, which heats the substance. This creates stars and planets with high temperatures in the inner regions. Therefore, the source of energy in the center of the Sun and planets is the usual nuclear decay of heavy atoms.

In accordance with Einstein's triunity law[1], the Scalar Field immediately fills all created stratified space in the Super-Universe. In one-dimensional space, the concentration of diones remains constant over time, in two-dimensional space the concentration of quarks decreases inversely in proportion to the Super-Universe existence time, and in three-dimensional space, inversely proportional to the square of time. In this case, the density of matter in all layers of the stratified space will be the same throughout. Only with the passage of time does the gravitational interaction between galaxies lead to a cluster of galaxies and voids. That is, there is a non-stationarity in the distribution of matter in the Metagalaxy according to Friedman's theory.

The beginning of matter creation in three-dimensional space is the embryos of stars and groups of stars that make up future galaxies. With the expansion of the Universe, the distance between the stars increases in proportion to time, while the radius of the stars increases in proportion to the cubic root of time. Between the stars there is a space filled with vacuum particles and fields. The galaxy's radius increases in proportion to time with the rate of expansion of the Universe within the galaxy [21].

Since three-dimensional space has finite volume, the energy of electromagnetic waves emitted by all stars remains in space. In [22], the author showed that in the case of the Standard Model of the Universe creation (all mass of matter is born at once) under the condition of a limited space of the Universe the equilibrium temperature of the Universe would reach 22 K, and in calculations using the UMIE model in which the mass of the substance increases in proportion to the lifetime of the Universe, this temperature will be 15.6 K. Therefore, the temperature exceeds the experimentally found value of the temperature of the relict radiation by 5.725 times. This ratio corresponds to the excess of radiation energy in the Universe 1074 times. Where does excess energy go? In addition, a source of energy is required to provide the stars with constant radiation ability.

It is clear that the burning of the mass of stars is not able to provide a condition for the stability of their radiation. In particular, the sun could live only a few tens of millions of years under such a mechanism of radiation, which contradicts the geological structure of the Earth, which requires that the sun's radiative power is maintained for billions of years.

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[1] The law of triunity, discovered by A. Einstein, is formulated as a formula $R_{ik} - \frac{1}{2} g_{ik}(R - 2\Lambda) = \frac{8\pi G}{c^4} T_{ik}$

The conclusion about the absence of special energy sources in the stars was substantiated in detail in the work of Kozyrev [23], devoted to the consideration of the internal structure of stars. From other work by Kozyrev [24] it follows that the problem of star glow is a separate case of a general problem: why there are no equilibrium states in the Universe. If the principle, stating that equilibrium states are never achieved, is valid in the Universe, then this means that there is always and under any circumstances a difference between the future and the past[2].

In the UMIE model, it is also concluded that stars only play the role of energy conversion machines. However, the energy source is the Scalar Field, which generates the flow of time.

Scalar Field, by increasing the mass of heavy atomic nuclei, causes their radioactivity and the generation of a large amount of heat. This heat is spent on radiation from the surface of the star by electromagnetic waves and fast particles.

In order to explain the excess energy of electromagnetic waves in the Universe, it is necessary to take into account the laws of similarity that are realized in the Universe. In this case, we pay attention to the cyclic processes that take place on Earth. For example, consider the cycle of water on Earth. Rivers carry water into seas and oceans. Under the influence of solar radiation, water from the surface of reservoirs (oceans, seas, lakes, rivers) evaporates, condenses into clouds, which are carried by wind to dry land. There, rain replenishes river sources with water. The cycle has ended.

A similar cycle must exist in the Universe. We already know that the Universe has a zero energy level (i.e., a vacuum particle level) and a basic level that corresponds to the functioning of matter from elementary particles to Metagalaxy. In order to realize the cyclic process of energy transformation in the Universe, it must be assumed that there is a higher level that the Scalar Field uses for cyclic processes.

Thus, the stream of electromagnetic radiation of the stars is a world ocean, from which, under the action of the Scalar Field, the quanta of electromagnetic waves "evaporate". In this case, the bulk of energy is localized at the upper level. It can return to the basic level only as a result of the perturbation of massive objects, ie stars and planets. The high level of excess energy is caused by the fact that stars make up a very small volume relative to the volume of the Universe. Under the action of perturbation, energy from higher levels causes rain to enter the central part of the massive bodies, which causes maximum perturbation. The result of such a cyclical process is the equilibrium radiation in the Universe, which we perceive as relict radiation. Noteworthy is the fact that the radiation comes from the stars, the totality of which constitutes the galaxy. Therefore, it is not surprising that the temperature of the relict radiation is higher in the regions of localization of galaxies and lower in the regions of localization of large voids. And since each star emits energy in all directions, isotropically, so the resulting relic radiation must be isotropic.

The return of energy to the central regions of the stars can be experimentally verified. Since the photon has a limited lifetime τ, the light intensity from a distant galaxy will be described by the formula:

$$I = \frac{J}{r^2} \cdot exp\left(-\frac{r}{c\tau}\right),$$

where J is the light force of the galaxy.

If it is possible to record the intensity of the central part of the galaxy visible at a body angle Ω (area of the plot $S = \Omega \cdot r^2$), then the intensity of light from the central parts of different galaxies will be described by the formula:

$$I = J \cdot \Omega \cdot exp\left(-\frac{r}{c\tau}\right),$$

that is, a formula that will allow you to find the characteristic lifetime of a photon in the Universe.

Finally, let us note that, using the Standard Universe Creation Model, spacecraft have found that baryon matter is close to 5% of the mass of the Universe. In the VMPE model, the masses of stars increase in proportion to time. Therefore, in the past epochs of the star had a small mass and much less energy was emitted. As shown in [18], based on astronomical observations and calculating the density

[2] Here we have one reason for the appearance of the arrow of time.

of the Universe on the intensity of galaxies, we can see no more than 8% of the mass actually available in the observable area of the Universe. In reality, this can be 5%.

Conclusions

On the basis of the analysis of the experimentally obtained results on the relict radiation of the Universe and the theoretical studies carried out using the Universe model with minimal initial entropy, the following is shown:

1. The standard model cannot describe the processes of birth and evolution of the Universe, because as a result of the laws of physics, such a Universe will immediately find itself in a black hole. The inflation model cannot be realized in our Universe, since it requires the expansion of the Universe at a rate in the inflationary period that far exceeds the speed of light, which is prohibited by the laws of physics. Relativistic radiation cannot be a remnant of equilibrium radiation that broke away from thick plasma $4 \cdot 10^5$ light years after the birth of the Universe, since that radiation has long since left the volume of matter. Dark matter and dark energy have emerged in theory as parameters that help to describe the properties of relict radiation. The standard model cannot describe the physics of annihilation of an antiparticle particle and the birth of virtual particles.

2. Using the model of the Universe with initial minimum entropy, it is possible to describe the properties of relict radiation without violating the laws of physics.

3. The new model of creation and evolution of the Universe is based on the Laws of Unity and Similarity, which act as the fundamental laws of the Universe. The model is based on the idea of the stratified space and the Scalar Field, which brings into the Universe the substance, fundamental laws and the program of development of the Universe. The substance is created at once throughout the space in accordance with the law of Einstein's triune.

4. The new model requires all layers of the stratified space to be branches of spaces that are larger in size and continuously inflate. Scalar Field is able to interact with all layers of the stratified space, having a dimension that integrates the dimensions of all layers: 12 spatial closed coordinates, one temporal and one information coordinates.

5. When creating a substance, the Scalar Field immediately introduces great torque, which is preserved to this day in the form of rotation of galaxies, stars, planets, and so on.

6. The finite volume of the Universe causes the radiation of all stars to remain in space and, due to the action of the Scalar Field, can return to the inner regions of stars and planets. Due to such energy circulation, we have equilibrium radiation, which is perceived as relict. Thanks to such energy circulation, as well as the birth of matter, the Scalar Field, the stars retain activity for billions of years.

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