Formation of the Solar System

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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 $\upsilon_з$ must be greater than the double velocity of the Earth's embryo, that is, $\upsilon_з$ 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].

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	$3.3022\cdot10^{23}$	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

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

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

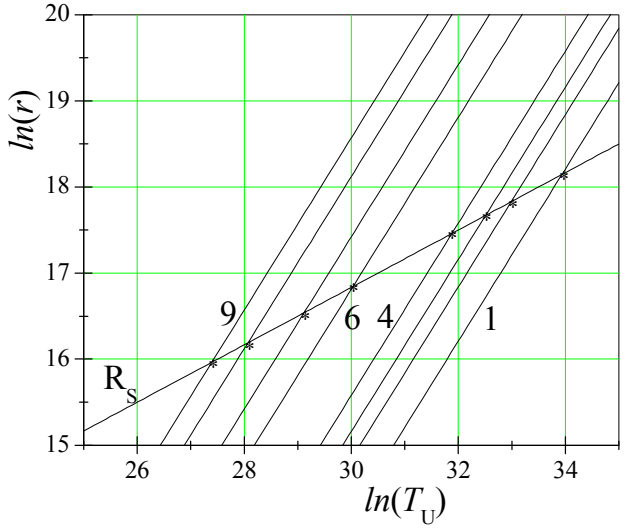

Fig. 1. Dependence of the radius of the Sun RS and the distance from the Sun to the planets from the time of existence of the Universe (the time of the creation of the planets is the intersection point of the straight lines 1-9 and R_S). Data for the belt of asteroids are absent.

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.

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	$1.958 \cdot 10^{20}$

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

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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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.

Аннотация

На основании рассмотрения возникновения Солнечной системы исходя из Стандартной модели в сравнении с моделью рождения Вселенной с минимальной начальной энтропией показано, что учет расширения Вселенной не допускает образования Солнечной системы в Стандартной модели, но допускает возможность адекватно описать образование Солнечной системы во Вселенной с начальной минимальной энтропией. В последней модели как масса космического тела, так и расстояние от планеты до Солнца увеличиваются

пропорционально времени. Этот факт обеспечивает постоянную во времени скорость движения планеты на своей орбите, которая постоянно удаляется от Солнца. Новая модель предполагает, что первой родилось облако Оорта, затем пояс Койпера и только после этого возникли условия резонанса для выделения из периферии солнечного диска зародыша будущей планеты Нептун. Затем, по тому же сценарию родились остальные планеты. Предложенная модель дает правильную оценку времени возникновения многоклеточных организма на Земле.

Ключевые слова. Модели рождения Вселенной, резонансное взаимодействие, рождение планет Солнечной системы, период существования жизни на Земле.