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Mechanisms of Origin of Matter in the Model of the Universe with Minimum Initial Entropy

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Abstract: *A probable mechanism of the matter creation in the Universe starting from the Big Bang, when the initial entropy was minimal (cold Universe),was proposed in the paper, and the nuclear reactions which have led to the creation of all stable and unstable nuclei presently known are shown. In particular, it has been shown that heavy nuclei, and then the rest of the nuclei, were born and multiplied from a primary matter, which appeared at the Big Bang, due to the fact that in the vicinity of atomic nuclei the substance particles are born in the form of bineutrons or clusters of three bineutrons due to Field energy. Heavy nuclei birth and their multiplication processes in the central regions of the stars are responsible for the stellar radiation. Similar processes in the central regions of the planets cause their heating. The proposed mechanism explains the high amount of hydrogen and helium in matter of the Universe.*

Keywords: *origin and evolution of the Universe, the fiber space, the Laws of similarity and unity, the birth of heavy nuclei, bineutrons, Scalar Field.*

1. INTRODUCTION

A model of the emergence of our Universe with the minimum initial entropy was proposed by the author in the article [1], which is based on the Law of similarity and the Law of unity. At the same time our Universe is a part of the Super-Universe. In turn, the Super-Universe is the fiber space where the adjacent layers differ in dimension of space by one [2]. Our three-dimensional space (four-dimensional (3 + 1) Universe) is bordered by the two-dimensional space of quarks. In turn, the two-dimensional space is bordered by the one-dimensional space of diones that are found to be Planck particles. Finally, the one-dimensional space is bordered by the zero-dimensional space of the Scalar Field-time. There is information interaction between adjacent spaces through the single delocalized point. The zero-dimensional space of Field-time has a possibility to interact with other spaces and define a program of the Universe evolution.

Such approach to the problem of the origin and evolution of the Universe allows to avoid the many absurdities of the standard model, namely, to ensure that the evolution of the Universe is going on with its entropy growing, but at the same time to provide a possibility of galaxies, stars and planetary systems formation, and without the transformation of the Universe in a black hole during the Big Bang, etc.

Formation of the layered space takes place simultaneously in all layers with the appearance of energy of Fields-times in the zero-dimensional space (in the World-1). The Field produces the substance stepwise filling the one-dimensional World (World -2), the two-dimensional World (World-3) and our World-4. After the birth of the Super-Universe the characteristic size (radius) of each space increases with the speed of light. Filling our space with matter is starting from the time $T_{Uo} = 3 \cdot 10^{-5}$ s. Since that the creation of matter in the World-4 takes place with the constant speed. Before only vacuum states were filled in our space [3].

Scalar Field energy unlike electromagnetic field energy could directly produce particles of appropriate space. Herewith created particles or particles structures should be without charge or spins. In our space such particles are represented by neutron structures (bineutrons, bineutrons structures). Initial matter was similar to combination of small cold neutron stars. In World-3 we have structure of 6 quarks (that are bineutron). In World-2 there is a birth of diones structure, which cumulative electrical and magnetic charge is equal to zero.

Here the same laws will be applied to reveal the mechanisms of particles and atomic nuclei production in our four-dimensional (3 +1) Universe (in the World-4).

In modern cosmological theories, the production of heavy chemical elements referred to explosion of supernovas. If it is so in their depths a synthesis of heavy atomic nuclei has to take place due to thermonuclear reactions and in the result of a supernova explosion should cause an emission of heavy chemical elements into space. Further, on default it is considered that these heavy atoms group around the stars, and then they form small and large planets. But most of cosmogony theories state last stage of thermonuclear synthesis as Fe nucleus production. It is considered that endothermic reactions of heavy nuclei (Z> 50) production could take place only if temperature of star central area is higher than 10^9 K. If such a possibility exists, heavy nuclei should be localized in the middle of star. And in the case of large star bang on its place neutron star is created, all heavy nuclei should stay inside it, don't throw out into space. At the same time we explored huge quantities of Pl, Hg and U etc. in the Earth. And such theories of heavy nuclei birth inside thermonuclear stars don't give answer on where such huge quantities of heavy elements in the Earth are from?

It should be noted that the supernova explosions are quite rare phenomena within the galaxy (only 4 times in one thousand year in our galaxy [4]), and they are studied on all observable galaxies. In addition, as during the stars formation process the fusion of heavy nuclei (Z> 50) is energetically unfavorable, such explosions could not provide a sufficient amount of heavy chemical elements, to create even a cloud of cosmic dust, not to mention the extremely low probability of capturing such clouds by stars with the subsequent formation of planets. On the other hand, binary stars are quite common in the Universe. This suggests that both double stars and stars with planets have some common mechanism of the origin.

Thus, it is necessary to look for other mechanisms that would allow the production of heavy chemical elements, as well as small and large planets in the gravitational field of the stars.

On the other hand, there is a general question about the origin of matter in the Universe emerges. Let us cite famous mathematician and astrophysicist S. Hawking [5]:

"Inflating Universe could explain why there are so many substances. The observable part of the Universe contains about 10^{80} particles. Where it is? The answer lies in the fact that in quantum theory particles can be created out of energy in the form of particle-antiparticle pairs. But, then, the question immediately rises: Where does the energy come from? There is the answer. The total energy of the Universe is exactly zero. In the Universe the substance is formed of positive energy. But the substance itself is attracted by gravity. Two closely spaced pieces of material have a lower energy than the same two pieces that are far from each other due to the diversity of the sides need to expend energy to overcome the gravitational force that seeks to connect them. Thus, the energy of the gravitational field is in some sense negative. It can be shown that in the case of the Universe, about the homogeneous space, this negative gravitational energy exactly cancels the positive energy associated with the substance. Therefore, the total energy of the Universe is zero." In this regard, we can say the following.

In this statement S. Hawking [5] after S.W. Carey [6] considers that the potential energy totally compensates the positive one (kinetic energy plus the rest energy of the substance), and the resulting energy is equal to zero. If it is true, there would be no reason for the formation of black holes, supernova explosions etc. If we compare this energy with the energy of the substance for instance in the solar system the value of Mc^2 for the Sun and planets exceeds the potential energy in 9 orders of magnitude. Similar calculation of gravitational interaction energy of arbitrary particle with mass of the Universe shows, that correlation between relativistic rest energy of particle and gravitational interaction energy is determined by correlation of the Universe radius R_u to its gravitational radius r_g[1]. Using R_u and r_g from [1] it could be shown that rest energy is 27 times bigger than gravitational energy. In other words, the contribution of the energy of motion and gravitational interactions can be neglected in comparison to the full energy of matter in the Universe, which is a large positive value and in any case is not equal to zero. So, it is impossible to get zero energy for the Universe.

[1] $E_G = -\int_0^{R_U} \gamma m\rho \cdot 4\pi r dr = \frac{3}{2} m \frac{\gamma M_U}{R_U} = \frac{3}{2} m \frac{\gamma M_U}{r_G} \cdot \frac{r_G}{R_U} = \frac{3}{2} mc^2 \cdot \frac{r_G}{R_U}$

At the same time the collapse does not significantly change the value of Mc^2. The collapse of stars leads to a dramatic reduction in their radius, a release of large amount of energy, which is equal to the half of the difference of the potential energies of a star in the original and the collapsed state. This will for sure lead to an explosion of the star, and it can be really observed in the Universe. So the collapse is a rapid (adiabatic) process. If the process of compressing of the star would be slow, then the excess of energy would come out in the form of emission of photons and particles without causing the explosion of the star (an open system, the process is non-adiabatic).

Since the Universe is assumed to be closed [7], its expansion is possible 1) due to the initial excess of the kinetic energy (the entire Universe was born in the Big Bang, the mass is constant), or 2) by constant infusion of energy and matter (weight increases).

In the first model the final stage of evolution of the Universe depends on the total energy (kinetic and potential), which can be both positive and zero or negative. And only negative energy makes the Universe closed, the expansion of which sometime will be replaced by the compression.

In the second model, the final stage of evolution of the Universe is totally depended on the program of the Scalar Field.

2. "BIRTH" OF MATTER

To explain the origin of a matter from the Fields energy, we are assuming that the **Scalar Field can directly produce the matter**. However, the Field is not bearer of charges. As a result our Universe is electrically neutral, i.e. the number of protons equals the number of electrons. Thus **only neutrons can be produced**. It can be single neutrons[2], or clusters which can contain many neutrons coupled by the strong interaction involving neutral pions. It is clear that the neutrons in such clusters will decay due to the weak interaction.

Thus, a pair of $p^+ + e^-$ and an electron antineutrino is formed from the neutron.

A cluster of two neutrons will produce a deuteron, an electron and an antineutrino. A cluster of three neutrons will give tritium, an electron and an antineutrino, with further decay into ${}_2^3He$. and so on.

From our estimations [1], first the four-dimensional world (World-4) substance was very dense (~ 10^{17} kg/m^3), but as a result of the expansion of the Universe, its density dropped, that led to the formation of clusters of different sizes (such initial clusters are micro neutron stars), which in particular according to the laws of physics were evolved in a complete set of nuclei, survived to the present days. The unstable nuclei decayed in the early stages of evolution.

It should be noted that the characteristic decay time of a free neutron is $\tau \approx 881$ s [8], for tritium it is $3{,}87\cdot10^8$ s, for ${}_2^6He$ is 0.797 s, for ${}_3^9Li$ is 0.176 s, for ${}_5^{13}B$ is 0.0186 s, etc.[9].

It is clear that fast enough processes of protons and electrons formation will take place in newly formed neutron matter. At the same time energy will be released and the matter will be heated. While the density of the substance will be high a reverse process of the integration of electrons and protons into a neutron will take place (the analogue of K-capture in heavy atoms). During this process neutrino will be produced.

It was shown in [10][3]that there is a circulation of energy in the Universe, just like there is water circulation in the nature. The latter consists of four phases: 1) an evaporation of water from sea surfaces, 2) a condensation of water vapors in clouds and their motion, 3) water return to the ground as precipitates, 4) water transit to the seas by rivers. Analogous circulation of stellar radiation leads to a finite lifetime of light quantum. Ultimately, the star radiation energy returns to the center of the stars to complete the cycle of the energy circulation in the nature.

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[2]Neutron is a bearer of spin and the baryon number, and therefore it is unlikely that a field will create single neutrons. Rather, pairs or clusters of neutrons with fully compensated charges and spins will be produced.

[3] Circulation of energy in the Universe must be provided by electromagnetic field quanta (photons) because they do not affect on the electrical neutrality of the Universe. On the previous stage, it is the energy flux from the higher hierarchical level, which is transformed in massive objects into neutral particles and electromagnetic waves. Because electromagnetic radiation is 77% of the total solar radiation, the same part the energy is transformed inside the Sun in a circulation process. In this case, the lower limit of the antineutrino flux may be reduced to 23% of the presented value.

If the Sun gets $4 \cdot 10^9$ kg of neutrons every second due to the energy circulation process, and $4.25 \cdot 10^{12}$ kg/s during the process of the Universe mass increase [1], and the same number of neutrons decays into protons, electrons and antineutrinos, it is easy to calculate that of about $2.5 \cdot 10^{36} \div 2.5 \cdot 10^{39}$ neutrons/s turn (lower limit corresponds to the process of energy circulation, and the top one corresponds to the matter birth during the process of the Universe, if this matter is born inside some massive bodies –stars and planets). Hence, the same quantity of antineutrinos is formed and emitted into space. As a result $9 \cdot 10^{12} \div 9 \cdot 10^{15}$ antineutrinos per second fall on each square meter of the Earth's surface. If some parts of a new substance are born within the Sun, and the rest of it are born in the solar surrounding (within the Oort cloud), the antineutrino flux will come not only from the sun but also neighborhood areas. So the flux of antineutrinos from the sun to the earth is less than $9 \cdot 10^{15}$per second.

This value can change if the secondary substance conversion processes take place. Neutrinos can also appear.

It should be noted that all these processes can also take place in neutron stars (pulsars). In spite of great pressures keeping a neutron star in a compact form, a lot of electrons and protons should exist in its volume. Since this is a dynamic equilibrium process, a neutron star will emit a large flux of neutrinos and antineutrinos, as well as electromagnetic waves of a wide frequency range. Taking into account that the volume of a neutron star can serve as a resonator for the electrical oscillations generated by an electron gas, the nature of its pulsating electromagnetic oscillations registered by our receivers can be understood. It cannot be excluded that neutron decay in a neutron star is stimulated by these oscillations which is analogues to the stimulated emission of atoms in lasers.

The production of neutrons in stars will result in additional energy generation and appearance of hydrogen atoms (or electrons and protons) and antineutrinos. It is also possible an appearance of neutrinos due to the formation of neutrons from the electrons and protons.

There are two stages of the matter production. Let us consider the first one.

Let matter in the World-4 had a fractal structure and its density was of about 10^{17} kg/m^3. As a result the volume of one of a future stars increased during one second from $1{,}454 \cdot 10^{-9}$ m^3 = 1,454 mm^3 to $5.38 \cdot 10^4$ m^3. Note that this volume includes the volume of the star itself, and the volume of space between the stars. This space was formed because inside the future star nucleus the strong interaction forces acted first, then the forces of electromagnetic interaction appeared during process of structuring of substance and weak interaction reactions. The further increase of the star's mass and space expansion the gravitational interaction became dominant. These forces had slowed the expansion of the star and, as a consequence, led to the relative increase of the volume of vacuum between stars.

As there were gaps between the fractals in the initial structure of the Universe, nothing was prevented from rotation of some fractals (future stars) around their center of mass, as well as of groups of fractals (future galaxies) around a mutual center of mass.

The second important point, which immediately requires our attention, is the substantial difference between the conditions for the existence of an initial dense mass of the Universe and neutron stars which are currently known. This difference can be characterized by the relative change of size (deformation) of the Universe $\varepsilon = \Delta R_U / R_U = \Delta T_U / T_U$. For $\Delta T_U = 1$ s, the deformation of the Universe at present time is 18 orders of magnitude smaller than during the first seconds of the existence of the World-4. This stretching of matter at the beginning of the evolution of the Universe was so powerful that it was not slowed down by the forces of interaction between fractals. As a result, there are individual galaxies and stars inside them appearing.

Space expansion will lead to volume structuring of stars onto islands of dense matter, which caused an increase of the average distance between stars. However, the mass of the islands ***during the early stages of the Universe expansion may be much higher than the mass of the heaviest stable atomic nucleus*** and, in addition, it will increase rapidly.

Simultaneously with the described structuring processes a matter transmutation will take place: protons and electrons will appear as a result of weak interaction reactions. The islands become super heavy nuclei. In addition, a large excess of neutrons will lead to some neutrons penetration through the surface of the islands. Neutrons can cause a fission reaction for nuclei on to fragments, which quantity will decrease and as a result this leads to the creation of nuclei, having from 1 to ≥92 protons. Due to this a lot of thermal energy will be released, and the substance will be heated up.

As you can see, such mechanism of the Universe evolution, in particular, will lead to the production of heavy atomic nuclei just after the Big Bang. Therefore, we should expect that the **bowels of the Sun and stars consist of heavy nuclei, the increase of their mass and fusion will provide the energy release and the temperature regime in stars**.

3. The "Birth" of Light Nuclei and Atoms

In the second part, let us consider the birth of light nuclei in the process of the evolution of the Universe. As a result of fission of heavy nuclei, the number of light nuclei will exceed the number of heavy nuclei; such course of the evolution will prevail.

We shall assume that the creation of matter is fulfilled by pairs of neutrons, which do not carry charge and spin. This creation takes place continuously and does not require temperature for nuclear reactions (cold fusion). In its turn, the thermonuclear fusion reactions can take place only at high temperatures which allow over coming the Coulomb barrier. Such temperatures exist only in thermonuclear stars providing the reactions:

$p + p \rightarrow d + e^{+} + \nu + 0.5$ MeV,

$d + p \rightarrow {}^{3}He + \gamma + 5.5$ MeV,

${}^{3}He + {}^{3}He \rightarrow \alpha + 2p + 12.9$ MeV.

This cycle allows four protons turn into α-particle with the energy release of about 19 MeV.

This simple mechanism of nuclear synthesis stops after the creation of α-particles because nuclei with mass number 5 cannot exist. In the literature, the problem was solved assuming α-particles triple fusion reactions at $T \sim 10^{8}$K [11]:

$3\alpha \rightarrow {}^{12}C + 7{,}7$ MeV.

Triple fusion of the helium nuclei is possible due to the resonance between three α-particles and excited ${}^{12}_{6}C^{*}$ nucleus. Indeed it was shown in the experiment that ^{12}C nucleus has appropriate excited state, for triple fusion of α- particles[4]. If this nucleus will have time to emit γ- quantum its breaking onto 3 α- particles, which is unlikely, ${}^{12}_{6}C$ nucleus will be created.

However, the fusion nuclear synthesis becomes ineffective if nucleus mass approaches to 50.

In our case (cold nuclear synthesis) the substances creation takes place in nucleus and in the nucleus field, where free or bounded bineutrons (*Bn*) are produced with certain probability. Unlike biprotons, which could not exist as the result of prevailing electrostatic repulsion between protons, inside bineutrons such energy is quite huge (~ 0.5 MeV [12,13]). The only reason of bineutron unstableness is weak interaction energy, which transforms bineutron to deuteron. Life time of bineutron is 1-4 orders lower than neutron life time. It is very long time in comparison with life time of charged pions.

If *Bn* are free particles, then the possible reactions are:

$$Bn \rightarrow 2\,{}^{1}_{0}n \rightarrow 2\,{}^{1}_{1}p + 2e^{-} + 2\tilde{\nu}$$

$$Bn \rightarrow {}^{2}_{1}d + e^{-} + \tilde{\nu}$$

Now let us consider nucleus processes during *Bn* production.

$${}^{1}_{1}p + Bn \rightarrow {}^{3}_{1}T \rightarrow {}^{3}_{2}He + e^{-} + \tilde{\nu}$$

$${}^{1}_{1}p + Bn \rightarrow {}^{2}_{1}d + {}^{1}_{0}n \rightarrow {}^{2}_{1}d + {}^{1}_{1}p + e^{-} + \tilde{\nu}$$

[4] In such reactions, the Coulomb repulsion between α-particles, which creates a barrier for the reaction, is not taken into account.Therefore, the reactionis possible only if the density of matter is comparable with the nuclear one, when other charges surrounding eliminates Coulomb repulsion.

$${}_{1}^{2}d + Bn \rightarrow {}_{1}^{4}H \rightarrow {}_{2}^{4}He + e^{-} + \tilde{\nu}$$

$${}_{1}^{2}d + Bn \rightarrow {}_{1}^{4}H \rightarrow {}_{1}^{3}T + {}_{0}^{1}n \rightarrow {}_{1}^{3}T + {}_{1}^{1}p + e^{-} + \tilde{\nu} \rightarrow {}_{2}^{3}He + {}_{1}^{1}p + 2e^{-} + 2\tilde{\nu}$$

$${}_{1}^{3}T + Bn \rightarrow {}_{1}^{5}H^{*} \rightarrow {}_{2}^{4}He + {}_{0}^{1}n + e^{-} + \tilde{\nu} \rightarrow {}_{2}^{4}He + {}_{1}^{1}p + 2e^{-} + 2\tilde{\nu}$$

$${}_{2}^{3}He + Bn \rightarrow {}_{2}^{5}He^{*} \rightarrow {}_{2}^{4}He + {}_{0}^{1}n \rightarrow {}_{2}^{4}He + {}_{1}^{1}p + e^{-} + \tilde{\nu}$$

$${}_{2}^{4}He + Bn \rightarrow {}_{2}^{6}He \rightarrow {}_{2}^{4}He + 2{}_{0}^{1}n \rightarrow {}_{2}^{4}He + 2{}_{1}^{1}p + 2e^{-} + 2\tilde{\nu}$$

$${}_{2}^{4}He + Bn \rightarrow {}_{2}^{6}He \rightarrow {}_{3}^{6}Li + e^{-} + \tilde{\nu}$$

Since the nuclei ${}_{2}^{5}He$ and ${}_{3}^{5}Li$ don’t exist, the ejection of a neutron from the nucleus ${}_{2}^{6}He$ cannot be expected. During the initial stage of the Universe expansion the following reactions are possible:

$${}_{2}^{6}He + Bn \rightarrow {}_{2}^{8}He \rightarrow {}_{3}^{8}Li + e^{-} + \tilde{\nu} \rightarrow {}_{4}^{8}Be + 2e^{-} + 2\tilde{\nu} \rightarrow 2{}_{2}^{4}He + 2e^{-} + 2\tilde{\nu}$$

$${}_{2}^{6}He + Bn \rightarrow {}_{2}^{8}He \rightarrow {}_{3}^{8}Li + e^{-} + \tilde{\nu} \rightarrow {}_{4}^{7}Be + {}_{0}^{1}n + 2e^{-} + 2\tilde{\nu} \rightarrow {}_{4}^{7}Be + {}_{1}^{1}p + 3e^{-} + 3\tilde{\nu}$$

$${}_{2}^{6}He + Bn \rightarrow {}_{2}^{8}He \rightarrow {}_{3}^{8}Li + e^{-} + \tilde{\nu} \rightarrow {}_{3}^{7}Li + {}_{0}^{1}n + e^{-} + \tilde{\nu} \rightarrow {}_{3}^{7}Li + {}_{1}^{1}p + 2e^{-} + 2\tilde{\nu}$$

In this case, there is no ${}_{4}^{8}Be$ nucleus which is just the sum of unbounded α- particles. Therefore, hopping that ${}_{3}^{8}Li$ will be enough active, it was prescribed for it to throw a neutron and an electron or a neutron only. The reaction of ${}_{4}^{7}Be$ formation is hypothetical in this case. Given reactions are actually quite rare (the ratio of a probability of bineutrons creation to probability of the birth of a matter is $2 \cdot 10^{-18}$, which is equal to the ratio of the Universe mass increase rate to the mass of the Universe [1]). Thus, the probability of appearance of bineutrons in nucleus is 10^{-18} per second per nucleon, and therefore it is hard to assume that unstable nuclei will be involved in such reactions. So, below we shall consider only stable nuclei (or more precisely, quasi-stable ones), whose the half-life is years. Next

$${}_{3}^{6}Li + Bn \rightarrow {}_{3}^{8}Li$$

This reaction is similar to the previous one, however, it is going on with a stable particle ${}_{3}^{6}Li$. In this case, we can not exclude the appearance of activated nucleus ${}_{3}^{8}Li$ which can emit a neutron, a proton or an electron. In the first case ${}_{3}^{7}Li$ will be formed, in the second one a non-existent isotope ${}_{2}^{7}He$ will be produced which will immediately loose a neutron. If the electron will be emitted, non-existent particle ${}_{4}^{8}Be$ will be formed which will immediately decay into two α- particles.

At the first stage of hyhelith formation, when there are a lot of neutrons, it is probable that a neutron capture reaction by the bottom row of hyhelith[5] will be effective. Then ${}_{3}^{6}Li$ and ${}_{2}^{3}He$ will "erode". Many deuterons will be also born.

$${}_{1}^{1}p + {}_{0}^{1}n \rightarrow {}_{1}^{2}d$$

But eventually the continuous channel of the protons formation will overpower their transformation into deuterons.

$${}_{2}^{3}He + {}_{0}^{1}n \rightarrow {}_{2}^{4}He$$

$${}_{3}^{6}Li + {}_{0}^{1}n \rightarrow {}_{3}^{7}Li$$

[5]Here the author has introduced the term "hyhelith" (hydrogen, helium, lithium) to denote six stable isotopes: ${}_{1}^{1}H$, ${}_{1}^{2}D$, ${}_{2}^{3}He$, ${}_{2}^{4}He$, ${}_{3}^{6}Li$, ${}_{3}^{7}Li$.

It should be noted that the inelastic collisions of nuclei with neutrons are possible in the presence of resonance and fast channel for the excitation relaxation of new nucleus. Resonance can be provided by an appropriate kinetic energy of interacting particles in daughter nucleus coordinate system. In other words, the probability to capture a neutron by nucleus for most nuclei may be negligible. Than

$${}^{7}_{3}Li + Bn \to {}^{9}_{3}Li \to {}^{9}_{4}Be + e^{-} + \tilde{\nu}$$

$${}^{7}_{4}Be + e^{-} \to {}^{7}_{3}Li$$ *K*-capture of an electron in an atom

$${}^{9}_{4}Be + Bn \to {}^{11}_{4}Be \to {}^{11}_{5}B + e^{-} + \tilde{\nu}$$ - known β^{-}-activity of ${}^{11}_{4}Be$.

$${}^{9}_{4}Be + {}^{1}_{0}n \to {}^{10}_{4}Be$$

$${}^{10}_{4}Be + Bn \to {}^{12}_{4}Be \to {}^{11}_{4}Be + {}^{1}_{0}n \to {}^{11}_{5}B + {}^{1}_{1}p + 2e^{-} + 2\tilde{\nu}$$

$${}^{10}_{5}B + Bn \to {}^{12}_{5}B \to {}^{12}_{6}C + e^{-} + \tilde{\nu} \qquad (100\%)$$

$${}^{10}_{5}B + Bn \to {}^{12}_{5}B \to {}^{12}_{6}C^{*} + e^{-} + \tilde{\nu} \to 3\alpha + e^{-} + \tilde{\nu} \qquad (1{,}5\%)$$

$${}^{11}_{5}B + Bn \to {}^{13}_{5}B \to {}^{13}_{6}C + e^{-} + \tilde{\nu}$$

$${}^{12}_{6}C + Bn \to {}^{14}_{6}C \to {}^{14}_{7}N + e^{-} + \tilde{\nu}$$

$${}^{13}_{6}C + Bn \to {}^{15}_{6}C \to {}^{15}_{7}N + e^{-} + \tilde{\nu}$$

$${}^{14}_{6}C + Bn \to {}^{16}_{6}C \to {}^{16}_{7}N + e^{-} + \tilde{\nu} \to {}^{16}_{8}O + 2e^{-} + 2\tilde{\nu}$$

$${}^{14}_{7}N + Bn \to {}^{16}_{7}N \to {}^{16}_{8}O + e^{-} + \tilde{\nu}$$

$${}^{15}_{7}N + Bn \to {}^{17}_{7}N \to {}^{17}_{8}O + e^{-} + \tilde{\nu}$$

$${}^{15}_{7}N + Bn \to {}^{17}_{7}N \to {}^{16}_{8}O + {}^{1}_{0}n + e^{-} + \tilde{\nu} \to {}^{16}_{8}O + {}^{1}_{1}p + 2e^{-} + 2\tilde{\nu}$$

$${}^{16}_{8}O + Bn \to {}^{18}_{8}O$$

$${}^{17}_{8}O + Bn \to {}^{19}_{8}O \to {}^{19}_{9}F + e^{-} + \tilde{\nu}$$

$${}^{18}_{8}O + Bn \to {}^{20}_{8}O \to {}^{20}_{9}F + e^{-} + \tilde{\nu} \to {}^{20}_{10}Ne + 2e^{-} + 2\tilde{\nu}$$

$${}^{19}_{9}F + Bn \to {}^{21}_{9}F \to {}^{21}_{10}Ne + e^{-} + \tilde{\nu}$$

$${}^{20}_{10}Ne + Bn \to {}^{22}_{10}Ne$$ stable atomic nucleus.

$${}^{21}_{10}Ne + Bn \to {}^{23}_{10}Ne \to {}^{23}_{11}Na + e^{-} + \tilde{\nu}$$

$${}^{22}_{10}Ne + Bn \to {}^{24}_{10}Ne \to {}^{24}_{11}Na \to {}^{24}_{12}Mg + e^{-} + \tilde{\nu}$$

$${}^{23}_{11}Na + Bn \to {}^{25}_{11}Na \to {}^{25}_{12}Mg + e^{-} + \tilde{\nu}$$

$${}^{24}_{12}Mg + Bn \to {}^{26}_{12}Mg$$ stable atomic nucleus.

$${}^{25}_{12}Mg + Bn \to {}^{27}_{12}Mg \to {}^{27}_{13}Al + e^{-} + \tilde{\nu}$$

$${}^{26}_{12}Mg + Bn \to {}^{28}_{12}Mg \to {}^{28}_{13}Al + e^{-} + \tilde{\nu} \to {}^{28}_{14}Si + 2e^{-} + 2\tilde{\nu}$$

$${}^{27}_{13}Al + Bn \to {}^{29}_{13}Al \to {}^{29}_{14}Si + e^{-} + \tilde{\nu}$$

$${}^{28}_{14}Si + Bn \to {}^{30}_{14}Si$$ stable atomic nucleus.

$${}^{29}_{14}Si + Bn \to {}^{31}_{14}Si \to {}^{31}_{15}P + e^{-} + \tilde{\nu}$$

$${}^{30}_{14}Si + Bn \to {}^{32}_{14}Si \to {}^{32}_{15}P + e^{-} + \tilde{\nu} \to {}^{32}_{16}S + 2e^{-} + 2\tilde{\nu}$$

$^{31}_{15}P + Bn \rightarrow {}^{33}_{15}P \rightarrow {}^{33}_{16}S + e^- + \tilde{\nu}$

$^{32}_{16}S + Bn \rightarrow {}^{34}_{16}S$ stable atomic nucleus.

$^{33}_{16}S + Bn \rightarrow {}^{35}_{16}S \rightarrow {}^{35}_{17}Cl + e^- + \tilde{\nu}$

$^{34}_{16}S + Bn \rightarrow {}^{36}_{16}S$ stable atomic nucleus.

$^{36}_{16}S + Bn \rightarrow {}^{38}_{16}S \rightarrow {}^{38}_{17}Cl + e^- + \tilde{\nu} \rightarrow {}^{38}_{18}Ar + 2e^- + 2\tilde{\nu}$

$^{35}_{17}Cl + Bn \rightarrow {}^{37}_{17}Cl$ stable atomic nucleus.

$^{37}_{17}Cl + Bn \rightarrow {}^{39}_{17}Cl \rightarrow {}^{39}_{18}Ar + e^- + \tilde{\nu} \rightarrow {}^{39}_{19}K$ stable atomic nucleus.

$^{36}_{17}Cl + Bn \rightarrow {}^{38}_{17}Cl \rightarrow {}^{38}_{18}Ar + e^- + \tilde{\nu}$

$^{38}_{18}Ar + Bn \rightarrow {}^{40}_{18}Ar$ stable atomic nucleus.

To form a stable nucleus $^{36}_{18}Ar$ is necessary to assume stable in the normal situation isotope $^{36}_{16}S$ at meeting $^{34}_{16}S$ with bineutrons will be activated with the reaction

$^{36}_{16}S \rightarrow {}^{36}_{17}Cl + e^- + \tilde{\nu} \rightarrow {}^{36}_{18}Ar + 2e^- + 2\tilde{\nu}$ stable atomic nucleus.

As a result the concentration $_{16}S^{36}$ in nature is 0.014% only.

This assumption can be considered as justified, because in a similar situation for $^{12}_{5}B$ the activated nucleus $^{12}_{6}C$ is formed with probability 1.5%, instantly into 3 α-particles.

Continue to write down nuclei formation reactions, can reach the heaviest stable nuclei, which composition is near the islands of atomic nuclei stability. Therefore, if there is a deposit of uranium-238, we should expect the formation of plutonium in it. And this is really the case: in uranium ores ^{239}Pu with a half life 24100 years and ^{244}Pu with a half life ($T_{1/2} = \tau \cdot \ln 2$) of 80 million years was found. It was found that ^{239}Pu is formed in accordance with the following nuclear reaction:

$$^{238}_{92}U + {}^{1}_{0}n \rightarrow {}^{239}_{92}U \xrightarrow{\beta^-} {}^{239}_{93}Np \xrightarrow{\beta^-} {}^{239}_{94}Pu$$

Intermediate products have a short lifetime: 23.5 min for ^{239}U and 2.3565 days for ^{239}Np.

Surprise scientists did not find are action that could lead to the formation of ^{244}Pu. It was decided that it was formed before the creation of the solar system (4.5 billion years ago), and as a result its concentration now is approximately $6.5 \cdot 10^{-18}$ from the initial one.

Please note that this plutonium isotope is the most stable, and it is necessary to add two protons and four neutrons to $^{238}_{92}U$ nucleus to create it (this ratio is typical for heavy nuclei[6]).

Concentration of ^{244}Pu atoms could be defined using value of life cycle of these atoms, birth velocity of clusters formed from bineutrons and concentration of $^{238}_{92}U$ atoms.

$$\left[{}^{238}_{92}U\right] \cdot \frac{d\left[\left({}^{1}_{0}n\right)_6\right]}{\left[{}^{238}_{92}U\right] \cdot dt} \cdot \tau = \left[{}^{244}_{94}Pu\right]$$

$$\text{or} \cdot \frac{d\left[\left({}^{1}_{0}n\right)_6\right]}{\left[{}^{238}_{92}U\right] \cdot dt} = \frac{\left[{}^{244}_{94}Pu\right]}{\left[{}^{238}_{92}U\right] \cdot \tau} = \frac{6.5 \cdot 10^{-18}}{2.5 \cdot 10^{15}} = 2.6 \cdot 10^{-33}\ s^{-1}.$$

Resulted value is 15 orders lower than current relative birth velocity of bineutrons in the Universe [1]. Seems, it should be so.

[6]For example, in the nucleus $^{238}_{92}U$ the number of neutrons increased by20 in comparison with $^{208}_{82}Pb$, and the number of protons– by10.

We should also pay attention to the value $6.5\cdot10^{-18}$, which corresponds toa relative increase of the Universe mass at present moment [1]. Thus, we can conclude that ^{244}Pu in uranium ores is formed due to reaction:

$$^{238}_{92}U + \left(^{1}_{0}n\right)_6 \rightarrow ^{244}_{92}U \xrightarrow{\beta^-} ^{244}_{93}Np \xrightarrow{\beta^-} ^{244}_{94}Pu\ .$$

So, near heavy nuclei Field forms clusters of three bineutrons. A large excess of neutrons in the $^{244}_{92}U$ nucleus will lead to the increase of β^--activity, so we can not observe intermediate nuclei.

Now let us consider what would happen if the Universe was filled with a substance through the creation of individual neutrons?

Unlike bineutrons that carry only baryon charge (as there is no interaction between the baryon charge, they renamed to the baryon number), neutrons also have a spin which is the real characteristic of the particles, leading to the appearance of the magnetic moment of the particle and the some kinds of interactions.

Therefore, if neutrons were born in the nucleus or in the nucleus field only, all known and unknown isotopes should be born during the first minute after the Big Bang, because the rate of the nuclei creation should exceed their decay rate. But later nucleus living less than a second could be excluded from the process of creation. In 3.5 days all nuclei that live less than 10^3 s would be excluded. If we take a look on the table of isotopes we note that there are very few unstable nuclei that are still able to take part in the creation of new nuclei. Today only stable isotopes, as well as $^{238}_{92}U$ the half-life of which is $4.5\cdot10^9$ years = $1.42\cdot10^{17}$ s are involved in this process.

Now let us take a look on the table of isotopes and let us establish what isotopes cannot exist today which amount was so small that they can be ignored in the isotopic composition of the Universe.

If the creation of isotopes was due to the production of neutrons in nuclei or in the field of nuclei[7], it would be impossible to get $^{6}_{3}Li$ nucleus from $^{4}_{2}He$, we could not get $^{9}_{4}Be$ from $^{7}_{4}Be$, and all other nuclei could not be created after it. Moreover the creation of isotopes through the generation of neutrons in nucleus does not allow describing the difference in concentrations of stable isotopes of the same chemical element. A large amount of $^{4}_{2}He$ could be explained due to the decay of unstable $^{12}_{5}B$ nucleus. Nuclei $^{8}_{5}B$, $^{12}_{7}N$, $^{20}_{11}Na$, which should also decay with the $^{4}_{2}He$ release are absent in nature. It is looking suprising the ratio of the neon nuclei abundance [$^{20}_{10}Ne$]:[$^{21}_{10}Ne$]:[$^{22}_{10}Ne$] = 90.92: 0.257: 8.82. The same situation is for the nuclei of magnesium, silicon and others. This excludes the possibility of single neutron production in the nucleus and supports the idea of bineutrons creation.

So, we can definitely say that the creation of isotopes is exclusively due to the creation of bineutrons and their clusters in nuclei.

4. CONCLUSIONS

The analysis of the birth and the evolution of the Universe with minimum initial entropy have allowed proposing the mechanisms of substance (light and heavy nuclei) creation, namely:

1. Most likely, the birth of matter in the Universe created with a minimum of initial entropy takes place in nuclei or in the nuclei fields in the form of bineutrons or clusters of three bineutrons due to the energy of Field. This mechanism supposes that in the first moments after the birth of the Universe mainly heavy nuclei are produced, their mass exceeds the mass of known atomic nuclei.
2. The chain reactions of nuclear fission cause heating of substance and leads to emission of stars and high temperature in the cores of planets up to the present time.
3. In the process of the Universe evolution, when the number of protons (hydrogen atoms) significantly exceed the number of heavy nuclei the mechanism of light nuclei formation will dominate, which is typical for stars in our time. Moreover, in the ground the light atoms formation processes should also take place, resulting in appearance of the Earth's atmosphere and water on the Earth surface.

[7]In such situation there is the effect of a heavy atom for the spin-orbit interaction, the value of which does not depend on ether a heavy atomis in its ownnucleus, orin the nearby one. Therefore, the processes of bineutrons creation can be assumed equally probable in the nucleus andin the nuclear field.

4. The probability of a birth of bineutrons now is10^{-18} bineutrons per nucleon per second. Since the rate of production of the substanceis constant in time, and the Universe mass grows, the probability of particles birth in the nucleus decreases and is inversely proportional to the Universe lifetime.
5. At the moment of the Big Bang the probability of bineutrons creation in the World-4 per nucleon was more than10^5 s^{-1}. At the end of the first second the probability of a birth of bineutrons per nucleon becomes less than the unit.
6. The Universe birth through the creation of single neutrons in the nucleus seems to be impossible.
7. The proposed mechanism explains the large abundance of hydrogen and helium in the Universe and reveals the stars radiation source.

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