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Research Article

Physics of the Universe in a Model with Minimum Initial Entropy I the Universe Structure

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Abstract

Part I of this review presents a model of the creation of the Universe with minimal initial entropy (UMIE). The UMIE model is based on the Laws of Unity and Similarity in the Universe and is also created in such a way that it does not violate the laws of physics. In the UMIE model, our Universe is described as part of the Super-Universe, which consists of four separate layers with different spatial dimensions: zero-dimensional space (World-1), one-dimensional space (World-2), two-dimensional space (World-3) and our three-dimensional space (World-4). The time and information coordinates are common to all layers. The information coordinate sets the structure of the Super-Universe, that is, from the very beginning, the embryos of future stars were created and united into the embryos of future galaxies, which in turn were united into the embryos of galaxy clusters. Through World-1, the Scalar Field (SF) enters at a constant speed, filling all layers with particles and fields. World-1 sets a quantum of time, the value of which is determined by the Planck time. In World-2, Planck particles are born, and in World-3, quarks. In the Universe, the SF forms all known particles, atomic nuclei, atoms, and molecules, as well as massive bodies and their systems, increasing their mass at a constant speed. At the same time, radiation processes occur that cause the heating of matter. This mechanism ensures the presence of high temperatures in the central regions of stars and planets.

Keywords

UMIE Model, Super-Universe, Scalar Field, The Quantum of Time, The Birth of Matter, Increase in the Universe Mass

1. Introduction

The problem of the structure of the Universe has interested scientists of all ages. This led to the creation of models that would explain the facts known from observations of the starry sky. As science developed, the models were refined, and people's knowledge of the Universe grew. The 20th century brought a revolution in understanding the structure of the Universe.

In the 20th century, there were powerful achievements in the field of knowledge of the Universe from the microcosm to the Macrocosm. This was facilitated by the discovery of the wave properties of elementary particles, which contributed to the emergence of quantum mechanics. On the other hand, astrophysicists realized that the Solar System is a component of the Milky Way galaxy, and that the Universe contains a large number of galaxies, the distance between which increases with time according to Hubble's law. And, as always, this led to the emergence of many models of the creation, structure and development of the Universe.

The next period of the development of cosmology is associated with the works of G. A. Gamow, who created a model

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of the hot Universe. According to his model, the Universe was initially in conditions characterized by high temperature and pressure in a singularity, in which all matter was concentrated. Then, it gradually cooled as the Universe expanded.

Analyzing this model, it is easy to see that it contradicts the laws of physics. At the same time, it does not answer many important questions. In particular, if all matter was concentrated in a singularity, why did a black hole not arise? Do the laws of thermodynamics apply in the process of the evolution of the Universe? If the singularity had an extremely high temperature (~10^{28} K [1]) and high entropy ($S_0 = 10^{88}$ J/K [2]), why did planets, stars, and galaxies appear, the appearance of which requires a decrease in entropy? What determines the arrow of time? Does the Universe have any boundaries in space? If the Universe is infinite, then why is it dark at night? Can space exist without matter? What is the physical nature of annihilation? What is the nature of gravity? And many other, no less important and fundamental questions. Nevertheless, this model is accepted by most physicists and is called the Standard Model. Based on this model, the development of the Universe is predicted both in the future and in the past.

Of course, not all physicists share the Standard Model. In order to improve the properties of this model, there are many attempts to refine it.

The development of quantum physics has led to the emergence of a new round in the description of the development of the Universe. The first theories of quantum gravity have appeared: string theory and loop quantum gravity [3, 4]. One of the most significant features of loop quantum gravity is the cancellation of time. In [4] it is said that everything that characterizes the Universe (particles and interactions) consists of fundamental particles, but there is no understanding of what time can "consist of". In this regard, it is interesting whether the author of [4] knows what space consists of?

It is known that relativistic mechanics combines time and space. The result of such a combination is the invariant of relativistic kinematics:

$$\Delta S^2 = c^2\Delta t^2 - \Delta x^2 - \Delta y^2 - \Delta z^2 \qquad (1)$$

Since there is no boson particle responsible for space, there is no boson particle responsible for time. Because bosons are responsible for interactions that are not mentioned in the description of space. Therefore, the rejection of time from the Universe, declared in [4], contradicts the laws of physics. And this fact did not at all confuse the supporters of this theory.

In fact, the structure of time and space is given by the space-time "atom".

It is important to understand that it is impossible to follow the development of the Universe in retrospect, as is done in the Standard Model, since this development is accompanied by a mass of non-equilibrium processes. If this fact is not taken into account, then the corresponding calculations will lead to a hot start in the form of a singularity, which, in fact, did not happen. It is clear that the compression of the Metagalaxy will lead, first of all, to the creation of a black hole, which astrophysicists forgot to take into account when conducting theoretical studies of the Universe when approaching the singularity. This is my first. And secondly, within the framework of a separate Universe it is impossible to explain the property of gravitational waves.

Within the framework of a separate Universe, the value of the critical density of matter has been theoretically found, which determines the shape of space, that is, it allows us to determine whether the Universe is open (not enough matter), flat (enough matter) or closed (too much matter). Modern measurements using the WMAP and Planck telescopes have made it possible to show with great accuracy that the Universe is flat [5, 6]. Previously, the idea of a flat Universe was based on calculations of the average density of matter in the Universe based on data on the value of the Hubble constant, which gave rise to the anti-scientific theory of the inflation of the Universe.

In everyday life, we are used to perceiving the surface of the Earth as flat, although we know that it has a shape close to a sphere. It is not surprising that we see the Universe as flat since the radius of a four-dimensional sphere, the three-dimensional surface of which is our Universe, exceeds $13\cdot10^9$ light-years [7-10].

However, the authors of the article [11] showed that a flat Universe does not necessarily exclude the presence of complex shapes. They showed that a family of 3-toric shapes can preserve the impression of flat Euclidean geometry. And all this within the boundaries of a separate Universe! And taking into account all aspects of the physics of the Universe, we will come to the model of the UMIE, which the author of this article develops.

Noting the talent of theoretical physicists, it is worth saying that they work phenomenologically and not based on a certain self-consistent model of the creation of the Universe. And hence the incredible conclusion about the absence of time in the Universe, as well as about the eternity of the Universe. This type of conclusion, in theory, can only indicate one thing: it is necessary to change the model of the birth and evolution of the Universe.

2. Model of the Universe with Minimum Initial Entropy

In such a situation, the author decided to propose his own model, which would not contradict the named physical principles and could unambiguously answer the questions posed. This is the UMIE model [7]. The UMIE model was created on the basis of the Laws of Similarity and Unity in the Universe. The fulfillment of these laws is due to the fact that the Universe has a hierarchical structure [12]. Moreover, in [12] the principle of hierarchical similarity was considered as a new fundamental law of physics.

According to the theory of hierarchical systems, all processes in the Universe occur according to a single scenario, albeit at different levels and on different scales. Based on this to solve the problem posed, we will compare the stages of intrauterine development of a child and the stages of birth and evolution of the Universe.

First of all, for the beginning of intrauterine development of a child, fertilization of a female egg with a sperm is required. Thus, the first cell of the future organism appears. The entire program for creating a living organism is already laid in the first cell. The cell is accompanied by information about what the human organism should look like, which will be created in utero. The first cell receives the energy necessary for cell reproduction and development of the organism.

The process of building an organism proceeds in accordance with the hierarchical law, that is, first fibers (one-dimensional objects) are formed, then tissues (two-dimensional objects) and three-dimensional objects. Since three-dimensional objects are functional, before they are created, information must arrive about the creation of these objects and their future activity in accordance with the law of hierarchy. Thus, the created three-dimensional objects immediately begin functional activity depending on the purpose of the organ. In accordance with the hierarchy of the organism, the creation of three-dimensional objects occurs in the following sequence: the creation of a monofunctional organ (lobes), then the lobules are combined into a multifunctional organ (liver, kidneys, etc.). In turn, multifunctional organs are combined into systems (nutrition, metabolism, circulatory, nervous, protective, immune, etc.). All systems form the organism. And already during the intrauterine development of the child, its organs fully perform their functions.

At the birth of the child, additional information will ensure the transition of the organism to autonomous functioning. The period of intrauterine life is over.

Similarly, in the UMIE model, the beginning is marked by the creation of the germ of the Super-Universe, represented by a stratified space consisting of four layers [7, 8].

In the created Super-Universe, the first layer is depicted as World-1. The second layer is World-2, the third is World-3, and the fourth is World-4, our Universe. These spaces do not overlap but are united at the information level, thanks to the SF. This interaction occurs through one delocalized point in neighboring spaces.

It is important to understand the fundamental point: at the beginning of the creation of the Super-Universe, each layer is represented by a space with collapsed coordinates of fundamental dimensions. The first layer has 12 collapsed spatial coordinates, as well as time and information coordinates. The second layer has three collapsed spatial coordinates, one of which is revealed over time as a brane of two-dimensional space (a circle). The third layer has three collapsed spatial coordinates, two of which are revealed over time as a brane of three-dimensional space (a sphere). The fourth layer has 6 spatial coordinates, three of which are revealed as a brane of four-dimensional space. Time and information coordinates are inherent and common to all layers of the stratified space. The 12 collapsed spatial coordinates of zero-dimensional space encompass all spatial coordinates of the stratified space, which enables interaction between processes occurring in zero-dimensional space and processes occurring in other spaces.

Thus, individual layers of the stratified space are closed spaces. All spaces begin to expand simultaneously at the speed of light, that is, in all cases, the value of the brane radius increases at the speed of light ($R = cT_U$, where T_U is the time of the Super-Universe's existence from the beginning of filling the zero-dimensional space). Only the zero-dimensional space has unchanging dimensions and is a fundamental multidimensional sphere.

In the case of the intrauterine development of a child, energy and food constantly enter it. Similarly, in the case of the Super-Universe, the SF enters through World-1 at a constant speed. It carries with it the program (*universal code*) of creating the Super-Universe and the energy capable of creating material objects. This Field initially fills one-dimensional space with particles and fields until a constant density of matter is achieved in this space. The speed of introducing the SF should be 3 times higher than is required to maintain a constant density of matter in a one-dimensional space that is constantly expanding. This relationship is caused by the fact that the rate of filling one-dimensional, two-dimensional, and three-dimensional spaces with energy is the same and is $1 \cdot 10^{34}$ kg/s [7, 8]. The process of stabilizing the density of matter in one-dimensional space can last for a time T_1 of the Planck time order.

Since all coordinates of World-1 are enclosed in circles of small radius, the SF wave must be circularly polarized. And this, in turn, will cause all created matters in the Universe to have a rotational moment. From atoms to galaxies, everything rotates. Moreover, astronomical observations confirm that galaxies rotate mainly in the same direction [13]. Since there is no visible reason for such rotation of galaxies, the author of the article [13] concludes that the rotation appeared at the birth of the Universe and was transmitted to the galaxies.

The SF begins to flow into two-dimensional space immediately after the stabilization of the density of matter in one-dimensional space. So, this space begins to fill with a delay during the time T_1.

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 proportional to time.

Our estimates have shown that the delay time for the beginning of filling three-dimensional space with energy is $3 \cdot 10^{-5}$ s [7, 8]. During this time, the radius of the brane will reach 9 km. The newborn three-dimensional space will initially be filled only with vacuum particles [14] and zero oscillations of physical fields. And the coordinates of all future stars, galaxies, and clusters of galaxies will already be arranged in it. The entry of a large flow of energy of the SF will lead to the excitation of vacuum particles in certain coordinates and the birth of material particles, which can only be bineutrons or complexes of bineutrons [15].

We will be interested in the properties of the SF, capable of fulfilling its grandiose mission. They must differ significantly from the properties of the electromagnetic field. We know that the electromagnetic field is capable of creating a particle-antiparticle pair under certain conditions. In contrast, the SF creates a material object in three-dimensional space, devoid of all quantum numbers except mass, for example, a bineutron or a complex of bineutrons. The SF is also responsible for the existence of mass in particles, and therefore there cannot be a period of existence of massless particles. There is no antimatter in our Universe either.

Since the SF 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 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 SF. Only the presence of the SF is responsible for the process of annihilation of a particle with an antiparticle. In this case, a vacuum particle is created [14], 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 the 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 at an arbitrary point in space only due to the SF.

The information connection between three-dimensional and two-dimensional spaces provides a tight connection between baryons in these spaces. The dimension of space determines the value of 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 dyons, that is, carriers of electric and magnetic charge. In other words, they turned out to be magnetic monopoles, the mass of which is equal to the mass of Planck particles. It is known that magnetic monopoles have a one-dimensional topological charge [16-19], which contributes to the existence of dyons in one-dimensional space. Interestingly, the average distance between dyons is determined by the Planck length.

The initial temperature of vacuum particles and then of bineutrons in three-dimensional space will be equal to 0 K. Therefore, the initial state of the Universe will be characterized by zero entropy. This fact led to the name of the model of the creation of the Universe - the UMIE model.

In the future, new particles will be born mainly in the vicinity of existing particles (nucleons), increasing the mass of newly formed nuclei. At the same time, the mass of newly formed nuclei will increase rapidly, reaching values that can significantly exceed the mass of uranium nuclei. Since such nuclei contain a large excess of neutrons, radiation processes will occur, in particular nuclear fission reactions, which will lead to the birth of protons and electrons and will also cause the heating of matter. From this it is clear 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 SF enters at a constant speed, and the volume of the Universe increases in proportion to T_U^3, then the average density of particles in World-4 will decrease inversely proportional to T_U^2. *The entire volume* of space will be filled with particles. Thus, Einstein's law of trinity is fulfilled, according to which space, matter, and time exist simultaneously at every point of the Universe.

2.1. Dimensions of Spaces

The revolutionary idea of the dimensionality of space is associated with the work of T. Kaluza, who combined the gravitational and electromagnetic fields on the basis of the hypothesis that our world is represented as a curved five-dimensional space-time [20, 21]. Having written down the components of these fields in the form of a matrix, T. Kaluza discovered the appearance of the G_{55} term. From the structure of the matrix, it follows that the gravitational field has a tensor character, the electromagnetic field is vector, and the G_{55} term is responsible for the SF. In addition, from the form of the matrix it follows that just as the gravitational and electromagnetic fields manifest themselves in the Microworld and the Macroworld, so too must the unknown SF manifest itself in the Microworld and the Macroworld. The dependence of energy on the distance to the field source may also be common to these fields.

After the publication of the theory of T. Kaluza, many works appeared in the literature devoted to the analytical description of five-dimensional space. It was shown that the fifth coordinate is spatial. Moreover, the fifth coordinate can vary only within small limits from 0 to L, that is, it turned out to be closed in a ring of small radius. To describe the fifth coordinate, A. Einstein proposed to consider it unlimited, such that it exists in the form of a periodic function twisted into a spiral with a period L. Thus, the world turned out to be closed with respect to the fifth coordinate. Such a theory was built later, but it contains coefficients that are multiples of the reciprocal of the period L: 1/L, 2/L, 3/L, etc. Thus, certain quantum values were obtained. At the same time, an expression was found to determine the period L:

$$\frac{ec}{2\sqrt{\gamma}\hbar} L = 2\pi n, \quad (2)$$

where n is an integer. The length of one cycle corresponds to n = 1.

The last formula can be rewritten as

$$T = 4\pi \sqrt{\frac{\hbar\gamma}{c^3}} / \sqrt{e^2/\hbar c} \approx 2.38 \cdot 10^{-31} \ cm. \quad (3)$$

In this formula, $\sqrt{\frac{\hbar\gamma}{c^3}} = l_0 \approx 1.616 \cdot 10^{-33} cm$ is the Planck length, and $e^2/\hbar c = \alpha \approx 1/137$ is the thin structure constant.

By introducing the fourth spatial dimension (the fifth coordinate of space-time), T. Kaluza was able to unify gravitational and electromagnetic interactions. However, strong and weak interactions are known in physics. To unify gravitational and electromagnetic interactions with strong and weak interactions, it turned out that it was necessary to introduce additional spatial coordinates. As a result, the gravity-electro-weak interaction, as well as the gravity-strong interaction, can be described by a seven-dimensional space-time, in which three spatial coordinates are collapsed into rings of small radius. Thus, our Universe has 7 coordinates: 6 spatial and one temporal.

From the UMIE model, it follows that in World-2 only one coordinate is manifested, and in World-3 – two spatial coordinates. A question arises concerning the sizes of particles of World-2 and World-3. The axiom is that these particles have finite dimensions in the manifested dimensions. It could turn out that in other dimensions the particles have zero dimensions, which would create difficulties for the description of such particles. However, since there are additional collapsed dimensions [8, 22] next to the manifested dimensions, the length of which is of the order of an elementary length, this allows us to assume that the dyons have at least a three-dimensional structure, but they can move only along one dimension. Other dimensions are provided for the appearance of certain physical properties of particles and not for movement. Therefore, the mechanical motion of a particle is possible only along the manifested dimension.

Similarly, it is possible to describe the structure of particles of World-3, where 2 dimensions are manifested, and at least one dimension is collapsed. Therefore, the motion of these particles is possible only in two manifested dimensions, and the third dimension is responsible for their physical properties.

As a result, the Super-Universe has a minimum of (3+3+7) space-time dimensions. Taking into account the information dimension, we get 14 dimensions. Most likely, these dimensions are enough to fully describe all the properties of the Super-Universe as a whole, and each World in particular.

2.2. Hierarchy of the Universe

Large systems in Nature should not exist since the probability of instability increases with increasing system complexity. It turned out that only those large systems that are organized according to a hierarchical principle can be stable. As a result, the result of the evolution of any large natural system is the formation of its hierarchical structure [12, 23].

It turned out that the hierarchical nature of the Universe is organized in such a way that each individual structure corresponds to a separate physical interaction. In addition, an arbitrary hierarchical system must have 7 levels [12, 23]. This is the hierarchical structure of our Universe (table 1).

Table 1. *Hierarchical structure of the Universe.*

HL	Substance	Interaction	Reaction
1	Elementary particles	Weak	Particle decay and lepton scattering on baryons
2	Atomic nuclei	Strong	Interaction between baryons
3	Atoms, molecules, molecular systems	Electromagnetic	Interaction between charged particles
4	Planetary systems	Gravitational I	Interaction between gravitating bodies within the planetary system
5	Star systems	Gravitational II	Interaction between stars within the galaxy
6	Cluster of galaxies	Gravitational III	Interaction between galaxies (cellular structure of the Universe)
7	Metagalaxy	Gravitational IV	Interaction between galaxy clusters
8	God of the system		

Today, four physical interactions are known. But from Table 1 it follows that in addition to the known interactions, there must be other interactions that manifest themselves on large scales [12, 24]. In addition, in [12, 24] 7 principles are described that describe hierarchical structures. And the first principle is the Law of Unity within the elements of a hierarchical level (HL).

Interaction within a separate HL element is responsible for temporal unity and for all other elements of the same HL – for the interaction between them. Temporal unity means that within the time $\Delta t = h/mc^2$ the unity signal will cover the characteristic (smallest) HL element, where m is the mass of this element. Since the mass of the smallest element at different hierarchical levels of massive objects is different, this causes different properties of gravitational fields at different hierarchical levels.

The hierarchy of the Universe, like any other system, requires that each higher level be composed of elements from the immediately lower level.

3. Scalar Field

In the scientific literature, there are many views on the nature and organization of the Universe. For example, not all scientists agree that the Universe had a beginning. Therefore, the question comes to the fore: did the Universe have a beginning in order to stop the multitude of views on this issue? In this regard, it is worth paying attention to the Bible. In this regard, atheistic propaganda has done a lot of harm to the process of knowing the Universe. A detailed study of the Bible shows that it does not contain myths, and its content is fully consistent with the latest achievements of science [25]. And the first thing to pay attention to is the verse "In the beginning God created the heavens and the earth" from Genesis 1:1. So, there was a beginning to the existence of the Universe! And from this, it is easy to conclude that at a certain point in time space and time appeared in it. That is, time and space are inseparable. Therefore, it is necessary to describe the mechanisms of creation and evolution of the Universe so that we get it in the form in which we see it today. As shown above, the author proposed a new model of the creation of the Universe (UMIE) to solve the problem. This model considers the information dimension and the SF, which controls the creation and development of the Universe as a component of the Super-Universe. In this case, the information dimension acts as a legislative body, the creator of the information code, and the SF - as an executive body.

We identify the SF from Kaluza's theory with the SF entering through World-1 [7].

In the UMIE model, the initial density of matter in the Universe has a limited (zero) value, which provides a zero-entropy value [8]. Moreover, the newborn matter has zero temperature.

The beginning of the creation of the Super-Universe is marked by the fact that a hierarchical matrix of stratified space is created through the information dimension. To create such a matrix, appropriate information is required. That is why we can conditionally speak of the existence of the information dimension. The start of the process of expanding time and space is set through the information dimension. Immediately in all layers of the stratified space, vacuum particles are created with which the SF can interact. In addition, after filling World-2 and World-3, the SF receives additional information when it begins to fill the three-dimensional space in which life is created. That is, the three-dimensional space is created so that life can exist in it.

So, the SF enters through the zero-dimensional space, and at the same time, certain spatial coordinates begin to expand in all layers. The SF ensures the creation and existence of a hierarchical structure of particles and fields in each layer of the Super-Universe. From this, it follows that the SF itself has a hierarchical structure.

Since the SF is multidimensional, it is able to provide information communication between arbitrary points of two-dimensional and three-dimensional spaces and two-dimensional and one-dimensional spaces. Thus, between neighboring layers of the Super-Universe there is information interaction through one delocalized point [26].

Since the time coordinate is common to all layers of the stratified space, the flow of time occurs equally in all layers.

It is clear that one-dimensional and two-dimensional spaces do not provide conditions for the development of intelligent life. Therefore, it did not appear there. And three-dimensional space is created precisely for life to take on all possible forms there (anthropic principle in the Universe [8]). Therefore, before the four-dimensional space-time is filled with energy and information of the SF, it is necessary for the information dimension to provide the SP with information about the next intelligent life. Only now are there all the grounds for creating a four-dimensional space-time.

The question immediately arises: Does life exist only on Earth or somewhere else in the Universe? Based on how the three-dimensional space of the Universe is created and taking into account the Law of Unity as the Supreme Law of the Universe, we must accept as a fact that information about life operates at all hierarchical levels of World-4, that is, we are dealing with an intelligent Universe. Otherwise, life could not exist on Earth! Therefore, planets inhabited by living organisms must exist in the Universe. Moreover, consciousness can be found even on planets, for example, the Earth.

To get rid of the inadequacies of the Standard Model, we will use the UMIE model proposed above and assume that at all stages of the evolution of the Universe its gravitational radius is significantly smaller than the radius of the Universe, that is, $r_G = \eta R_U$, and $\eta_{\leq}1$. Since the radius of the Universe increases at the speed of light, then $R_U = cT_U$. Here T_U is the lifetime of the Metagalaxy. For simplicity, we will perform the calculation not for a brane in four-dimensional space but for three-dimensional space.

Taking into account that

$$r_G = \frac{GM_U}{c^2} = \eta R_U = \eta c T_U, \text{ we find: } M_U = \frac{\eta c^3 T_U}{G}. \quad (4)$$

Consequently, the formation of matter in our world is carried out continuously at the same speed

$$v_m = \frac{dM_U}{dT_U} = \frac{\eta c^3}{G} = \frac{\frac{\eta \cdot 27 \cdot 10^{24}}{6.67 \cdot 10^{-11}} kg}{s} = \eta \cdot 4.05 \cdot \frac{10^{35} kg}{s}. \quad (5)$$

For the average density of matter in the Universe is

$$\rho = \frac{3M_U}{4\pi R_U^3} = \frac{3\eta c^3 T_U}{4\pi G c^3 T_U^3} = \frac{3\eta}{4\pi G T_U^2} = \frac{3\eta}{4\cdot 3.14\cdot 6.67\cdot 10^{-11} T_U^2} = \frac{3.58\cdot 10^9 \eta}{T_U^2} \tag{6}$$

Experimental facts show that in all interactions and transformations there is a law of conservation of baryon number. Therefore, scientists believe that this law is absolute for any model of the creation of the Universe. At the same time, they forget that in the process of the creation of the Universe according to the Standard Model, there were no baryons in the singular point. They appeared in the process of the evolution of the Universe. Therefore, the law of conservation of baryon number does not apply at the birth of the Universe.

In the UMIE model, the process of the birth of the Universe proceeds continuously. Therefore, in this process, the conservation of baryon numbers is impossible. At the same time, in the processes of strong or weak interaction, the baryon number is conserved.

To calculate the values of M_U, υ_m and ρ, we choose the value of T_U, found from the value of the Hubble constant H = 73.8 km/(s·Mpc) = $0.755\cdot 10^{-10}$ years^{-1} = $2.392\cdot 10^{-18}$ s^{-1} [27]. In this case, we will assume that the redshift is due to the expansion of space, and not the divergence of galaxies. Space is completely filled with matter. From formula (4) we find the parameter η = 0.025. The rate of matter formation will be υ_m = $1\cdot 10^{34}$ kg/s, that is, about 5000 solar masses per second. The current mass of the Universe ($4.2\cdot 10^{51}$ kg) turned out to be an order of magnitude smaller than expected. Therefore, the effective number of stars with a mass equal to the mass of the Sun ($M_\odot$= $1.99\cdot 10^{30}$ kg) is $2.1\cdot 10^{21}$.

In the Universe, the density of nuclear matter ($\rho_o \approx 10^{17}$ kg/m^3) is the maximum possible. Therefore, to estimate the time T_{Uo} of the beginning of filling World-4 with matter, we assume that the density of matter at this moment should not exceed the value ρ_o. In this case, the calculation gives T_{Uo} = $3\cdot 10^{-5}$ s. At this moment, the radius of the Universe was 9 km. From this moment, the volume begins to fill with matter at a constant rate. In this case, formula (4) for the first second of the expansion of the Universe will be

$$\rho = \frac{3\upsilon_m T_U}{4\pi R_U^3} = \frac{3\eta T_U}{4\pi G (T_U + T_{Uo})^3}, \tag{7}$$

In this formula, the time T_U is counted from the beginning of the filling of the Universe with matter. Already 1 second after the Big Bang, formulas (6) and (7) will not differ. According to formula (5), the density of matter initially increases, reaching a maximum ($1.48\cdot 10^{16}$ kg/m$_3$) at $T_U = T_{Uo}/2$. In this case, only about 15% of the volume will be occupied by matter. Therefore, separate nuclei of future stars and galaxies will be formed. After 1 second, the average density has dropped to $8.74\cdot 10^7$ kg/m^3.

If we assume that, on average, each star receives the same mass, then the Sun receives $4.7\cdot 10^{12}$ kg/s. In this case, the mass of the Sun will increase by $1.45\cdot 10^{20}$ kg per year, and by $1.38\cdot 10^{10}$ years – by $1.99\cdot 10^{30}$ kg, that is, the entire mass of the Sun. It is known that the Sun radiates energy equivalent to $4.26\cdot 10^9$ kg of matter every second. Therefore, the Sun loses 1100 times less matter per unit of time than it receives. Of course, this loss is imperceptible, so the mass of the Sun will continue to increase. And this will lead to a completely different scenario of the evolution of the Sun than follows from the Standard Model.

From the UMIE model, it follows that the creation of stars and galaxies is possible only if the matter in the World-4 is immediately structured. Thus, only the fractal structure of the nucleus of the Universe can provide a known ordering of matter. It is important that each fractal must have an angular momentum. In addition, the birth of matter in World-4 should introduce the minimum possible entropy, that is, the birth of matter should be cold. With the further entry of matter into the region of existing nucleons, its heating will occur. As a result, the entropy of the Universe should increase with time [7], which corresponds to the laws of thermodynamics and determines the thermodynamic arrow of time.

Based on the data on the average density of matter in the Universe, we can estimate the average effective value of the density of quark matter in World-3 and dyons matter in World-2. For the estimation, we will assume that the mass of matter in each layer is the same. We will use the formulas

$$\rho_3 = \frac{M_U}{V_U} = \frac{3M_U}{4\pi R_U^3}; \rho_2 = \frac{M_U}{S} = \frac{M_U}{\pi R_U^2} = \frac{4}{3}\rho_3 R_U; \rho_1 = \frac{M_U}{2R_U} = \frac{2}{3}\rho_3 \pi R_U^2. \tag{8}$$

From here, we find that quark matter has an effective density $\rho_2 = 8.33\cdot 10^{-2}$ kg/m^2. At the same time, for dyons matter we obtain $\rho_1 = 1.64\cdot 10^{25}$ kg/m. Thus, matter in World-3 is still rarefied, and in World-2 it is very compressed from the point of view of World-4.

Let us compare the density of nuclear matter arranged in a chain with the density of dyons matter. For nuclear matter, we obtain a linear density $\rho_1 = 1.267\cdot 10^{12}$ kg/m. If we create a flat structure from nuclear matter, we obtain $\rho_2 = 1.11\cdot 10^3$ kg/m^2. From here, it follows that the effective density of quark matter is 4 orders of magnitude lower than that of nuclear matter, and that of dyons matter is 13 orders of magnitude higher.

Now let us compare the possible density of dyons matter with the Planck parameters. It is known that the Planck mass $M_p = 2.176761\cdot 10^{-8}$ kg, and the Planck length $l_p = 1.616\cdot 10^{-35}$ m. If particles with Planck mass are arranged in a linear chain with a distance l_p, then we obtain a linear density ρ_l = $1.347 \cdot 10^{27}$ kg/m. Therefore, in this case, the linear density parameters for Planck particles exceed our estimates for the effective linear density of dyons matter by 2 orders of magnitude. Applying the rarefaction parameter η = 0.025 to the Planck matter density, we obtain $\eta\rho_l = 3.29 \cdot 10^{25}$ kg/m, which is only 2 times the effective value of the density of dyons matter. Such closeness of the obtained parameters indicates that the Planck parameters (mass, length, time) are realized precisely in the one-dimensional space of World-2.

3.1. Time Quantum

We have come to the need to solve the problem of time in physics. The twentieth century was devoted to the development of quantum mechanics. At the same time, time was perceived as something existing which flows continuously in one direction - from the past to the future. At the same time, the problem of time was never solved. The reason can be seen in the fact that the minimum time interval with which science had to deal is equal to nuclear time, that is, the value of $\sim 10^{-23}$ s. It is clear that in the case of the existence of a time quantum, its value should be several orders of magnitude smaller than the value of nuclear time. From this, it follows that in quantum mechanics, it can be assumed that time flows continuously at a constant speed.

The range of distances and times in the Universe has a much wider scale than in quantum mechanics. Therefore, it was hoped that the development of the theory of quantum gravity would allow explaining the physics of time and finding the value of a time quantum. Indeed, quantum gravity operates with the concept of a time quantum. However, for the general case, the problem remains unsolved.

The Standard Model did not introduce the concept of a time quantum since it was developed based on the general theory of relativity, taking into account information about the divergence of galaxies.

Scientists who disagree with the Standard Model create their own models. In particular, Eric J. Lerner, author of the book "The Big Bang Never Happened: Startling Refutation of the Dominant Theory of Origin of the Universe" (1991), at the 235th meeting of the American Astronomical Society argued in his report [28] that the Big Bang did not happen. He compared the ratio of the number of chemical elements in the Universe, obtained using the Big Bang, with the data of astronomical observations, Lerner saw that, in reality, the number of light chemical elements is significantly less than the Big Bang model gives [29]. He also compared 18 other predictions of the Big Bang theory with observational data and found that they were also very different. As a result, Lerner concluded that there were no light elements at all from the beginning of star formation. At the same time, he believed that light elements appeared inside stars.

A group of astrophysicists from the University of Liverpool, UK, led by Bruno Bento, who study the nature of time, have applied a new theory of quantum gravity. In it, space and time are broken down into fundamental units of space-time, that is, space-time "atoms" [30]. They have shown that general relativity cannot explain two singularities, one of which arises at the creation of the Universe and the other at the center of a black hole. To describe these singularities, a quantum theory of gravity is needed, within the framework of which singularities cannot exist. Matter cannot be compressed to infinitely tiny points smaller than the size of a space-time "atom".

What does the UMIE model say?

In such a situation, the author decided to shed light on the problem of the creation of the Universe using his own UMIE model, which does not contradict the aforementioned physical principles and can unambiguously answer the questions posed [7].

At the initial moment, the four spaces of the stratified space of the Super-Universe were represented by collapsed spatial coordinates of fundamental dimensions.

At the moment of the birth of the Super-Universe, all spaces simultaneously began to expand. It is important to understand that all spatial coordinates remain closed during expansion. Therefore, the corresponding spaces turn out to be branes of spaces that have a unit larger dimension; therefore, they turn out to be closed, that is, they have finite "volumes": $2\pi R_2, 4\pi R_3^2, 2\pi^2 R_4^3$ for the one-dimensional, two-dimensional, and three-dimensional "volume" of the brane, respectively.

One of the properties of the SF is its ability to directly create matter particles in all spaces of the stratified Super-Universe according to the formula $E = mc^2$. In World-4, the SF creates bineutrons in the singlet state in the vicinity of nucleons with a constant speed $\upsilon_m = 10^{34}$ kg/s.

This information will allow us to determine the value of the time quantum τ. During the time τ, $\upsilon_m\tau$ kilograms of matter will enter through World-1. Based on the uncertainty relation, we find:

$$mc^2\tau = \upsilon_m \tau c^2 \tau = \hbar = 1{,}0546 \cdot 10^{-34} \ J \cdot s, \quad (9)$$

$$\tau^2 = 1{,}17 \cdot 10^{-85} \ s^2, \qquad \tau = 3{,}42 \cdot 10^{-43} \text{ s}. \quad (10)$$

To continue consideration of the issue of the time quantum, let's pay attention to the Planck units [31, 32].

$$m_P = \sqrt{\frac{\hbar c}{G}} \approx 2.176 \cdot 10^{-8} \ kg. \quad (11)$$

$$l_P = \frac{\hbar}{m_P c} = \sqrt{\frac{\hbar G}{c^3}} \approx 1.616 \cdot 10^{-35} \ m. \quad (12)$$

$$t_P = \frac{l_P}{c} = \sqrt{\frac{\hbar G}{c^5}} \approx 5.391 \cdot 10^{-44} \ s. \quad (13)$$

Comparison of the quantities τ and t_P showed that there is a relation between them: $\tau = 2\pi t_p$. Therefore, the time coordinate in World-1 is also twisted into a spiral with the length of the circle τ and the radius t_p. This result explains the physical meaning of Planck time. In the article [7], it is shown that the Planck length and mass are realized in World-2 as fundamental physical quantities. Planck particles, as dyons, are realized precisely in the one-dimensional space of World-2. The concentration of these particles is constant in time. The average distance between them is determined precisely by the quantity proportional to the Planck length l_P. In addition, the Planck length determines the radius of the collapsed spatial coordinates in World-1. Therefore, World-1 is a multidimensional fundamental sphere characterized by 12 collapsed spatial coordinates and one time coordinate. Thus, the mass, length and Planck time, as well as the constant h, are fundamental quantities on which all properties of the Universe depend. Together, they represent a space-time "atom".

Another property of the SF is its ability to move the flow of time when entering through World-1 along a time spiral. Therefore, the flow of time is carried out discretely. The SF enters World-1 at a constant speed. Therefore, time moves in the Super-Universe at a constant speed. Since the size of a time quantum is 20 orders of magnitude smaller than nuclear time, the discreteness of time is not felt in our world.

3.2. Mass of Particles and Vacuum Particles

The formation of the most important concept of modern physics - physical vacuum (PV) is very difficult. Until the beginning of the 20th century, it was believed that empty space is filled with an all-pervading ether. In the 20th century, the ether was replaced by absolute emptiness. Currently, according to the Standard Model of the creation of the Universe, the concept of physical vacuum is introduced as a physical system without particles and field quanta. This is the lowest state of a quantum system, in which its energy is minimal. Therefore, it is assumed that the vacuum is filled with zero oscillations of electromagnetic fields. Despite this assumption, concepts such as "vacuum corrections" were introduced to explain various phenomena. PVs continue to be endowed with an increasing number of unexplained but rigidly postulated properties. There is no clear understanding of how real or virtual particles can be obtained from an empty PV. There is no hint of the mechanism of these processes. And this is understandable because the four known types of physical interactions are unable to explain the processes associated with the nature of the physical vacuum.

To get out of this impasse, the following hypothesis about the nature and structure of the physical vacuum was first put forward in the monograph [26]: during the annihilation of a particle-antiparticle pair, they are not eliminated but are combined into a system called an elementary particle of the vacuum (EVP).

It is worth briefly dwelling on the properties of EVPs. Their main property is the equality of all quantum numbers (mass, charge, spin) to zero. They are created exclusively due to the action of the SF, the consequence of which is the complete superposition of the particle on the corresponding antiparticle, that is, the process of annihilation occurs. All other types of interaction cannot ensure the annihilation of a particle with an antiparticle. In turn, the SF provides both annihilation and the reverse process - the creation of a real or virtual particle with an antiparticle by exciting a vacuum particle.

In the monograph [26], it is shown that there can be 9 types of vacuum particles, but the basis is the proton-antiproton vacuum. The concentration of such EVPs is $1.54541 \cdot 10^{39}$ cm^{-3}, while the concentration of electron-positron EVPs is only $1.73009 \cdot 10^{29}$ cm^{-3}, i.e. 10 orders of magnitude lower.

It was shown above that at the birth of the Super-Universe, our space was immediately filled with EVPs. The SF enters the Universe with a delay of $3 \cdot 10^{-5}$ s. At the birth of the Super-Universe, when the SF energy begins to enter the Universe, it excites proton-antiproton vacuum particles and then creates a bineutron in the vicinity of the proton. And further, near each nucleon, the SF can create a bineutron. Antiparticles are not created in this case. At the same time, antimatters are not created in our Universe. In the vicinity of each massive particle, there is an SF, which determines the presence of particle mass [22]. The annihilation of a particle with an antiparticle is accompanied by the release of energy according to the formula $\Delta E = 2mc^2$. Therefore, vacuum particles are not endowed with an SF in the part that is responsible for their mass. Therefore, their mass is zero. The SF has the ability to excite these particles to the state of virtual or real particles using the information available to the SF, which is stored in the EVP.

In the Standard Model, there are no EVPs since none of the known interactions is capable of creating them.

Thus, the SF consistently fills all layers of stratified space with particles. In all cases, the SF creates complexes of massive particles, which are characterized by the absence of charges and other (except mass) quantum numbers.

Such a structure of the Super-Universe causes the appearance of hadrons in the Universe (World-4) as a result of the interaction between quarks in World-3 and the transfer of information about this interaction to World-4. At the same time, there is a strong interaction between quarks and hadrons.

3.3. The Birth of Particles in Stratified Space: Hyhelithes, Quarks, Magnetic Monopoles

The SF brings energy, which in turn fills one-dimensional space until a stationary particle concentration is established, then the energy enters two-dimensional space and, finally, three-dimensional space. In the future, the energy will enter all spaces at the same speed.

As a result, there will be no singularity in the Universe. Matter (the complete set of fermions and bosons at once) will appear only when its initial density does not exceed the density of nuclear matter.

When the SF energy enters World-2, Planck particles are born. At the same time, conditions arise for the existence of the corresponding bosons. These bosons simultaneously belong to both World-2 and World-3 through information transfer and spatial metamorphosis [26].

The existence of an electromagnetic field (EMF) in three-dimensional space is familiar to us. They correspond to electromagnetic waves that can have linear or circular polarization and move at the speed of light. They, being virtual, are responsible for the electromagnetic interaction between particles. Probably, in two-dimensional space, EMF can also exist in a slightly modified form. And it is quite problematic to imagine it in one-dimensional space. Therefore, in one-dimensional space, one-dimensional particles must exist that carry both electric and magnetic charges. This requirement is due to the fact that for the existence of EMF and spins in elementary particles in two-dimensional and three-dimensional spaces, a manifestation of metamorphosis from one-dimensional space is necessary. Hence, particles in one-dimensional space must necessarily be dyons, that is, simultaneously carriers of electric and magnetic charges. In this case, we can conclude that the dyons have united in such a way that magnetic charges do not pass to the Worlds of higher dimensions but only generate spin in elementary particles.

The corresponding metamorphosis requires that the properties of particles in World-3 correlate with the corresponding properties of particles in World-4. In this case, the behavior of World-3 bosons is strictly correlated with the properties of World-4 bosons [26].

From the information presented above, it follows that the number of basic elementary particles of space corresponds to the dimension of space: in one-dimensional space, these are only Planck particles with charges of one type, in two-dimensional space, these are quarks with charges of two types (±⅓ and ±⅔). Therefore, it is logical to assume that when the SF energy enters World-4, particles with charges of three types (±1, ±2, ±3) are born. Let us call these particles of four-dimensional space-time hyhelithes (from hydrogen, helium, lithium): protons, deuterons, two types of helium nuclei, and two types of lithium nuclei. All these particles have a positive electric charge. To neutralize the charge in our space, electrons are used. The corresponding antiparticles have the opposite electric charge. At the same time, with an increase in the charge of positively charged particles, their number noticeably decreases. This rule is even more pronounced when moving to quarks and leptons: with increasing mass, the lifetime decreases.

The brane of the four-dimensional World is the *final stage* of the evolution of the Super-Universe. This conclusion also follows from a comparison of a child's intrauterine development and the Super-Universe's development.

The appearance of neutrons in the four-dimensional world is accompanied by the appearance of $W(Z^o)$-bosons, responsible for the weak interaction [33]. A neutron is an unstable particle that spontaneously splits into a proton, an electron, and an electron antineutrino. Since the weak interaction is accompanied by a change in both neutrons and quarks, such bosons are simultaneously in World-3 and World-4.

The above consideration has shown that the formation of particles of the four-dimensional world is completed by the birth of electrons and nuclei ${}^1_1H$, ${}^2_1D$, ${}^3_2He$, ${}^4_2He$, ${}^6_3Li$, ${}^7_3Li$. All other nuclei (Z > 3) in World-4 must consist of these three types of nuclei as the elementary charges of the Universe. Therefore, the nuclei of heavy atoms must consist of light nuclei, as a molecule consists of atoms. In other words, the nuclei of heavy atoms have a molecular structure according to the Law of Similarity.

3.4. Molecular Model of the Atomic Nucleus

The molecular structure of heavy atoms has been discussed in the literature as one of the models of the structure of the atomic nucleus. The model, which is included in all textbooks on nuclear physics, represents the nucleus as a set of protons and neutrons with a configuration that provides a minimum of nuclear energy. Such a model does not contain α-particles as isolated clusters in the nucleus, which contradicts the α-activity of heavy nuclei.

Among the models of the atomic nucleus there is also a cluster (molecular) model [34-36]. This model treats the structure of some nuclei as a kind of molecule consisting of α-particles, deuterons (D), tritons (T), etc. For example, ${}^{12}C=3\alpha$, ${}^{16}O=4\alpha$, ${}^6Li=\alpha+D$, ${}^7Li=\alpha+T$, etc.

It has been experimentally shown that among the exciting states of these nuclei there are states with anomalously large widths of α-transitions, i.e., α-particles *exist* on the surface of the nucleus. According to this model, the wave function of the nucleus is written as an antisymmetrized product of the wave functions ψ_α, which describe the internal motion of nucleons in a separate α-cluster, and the wave function χ, which describes the motion of clusters relative to each other. It was important to confirm that such a record of the wave function adequately describes the properties of the nucleus. It turned out that such a wave function satisfactorily describes the behavior of only ^{8}Be and ^{12}C, but is not suitable for describing ^{16}O, ^{20}Ne, etc.

As a result, we have real confirmation of the molecular structure of the nuclei of ^{8}Be and ^{12}C. The only thing that distinguishes the cluster models used in experimental and theoretical studies from our model [37] is that they are empirical, not substantiated by anything. Our idea naturally follows from the new methodological basis of knowledge of the World.

3.4.1. Fundamentals Particles of Four-dimensional UNIVERSE

Two groups of quarks have electric charges -(⅓)e and +(⅔)e. For the corresponding antiquarks, the charges are opposite. This result can be understood, taking into account that the birth of the Universe is depicted as a vortex (and hence the twisting in gravity [33] and time [38]). At the same time, as stationary states, 3 charge projections are realized in

World-3, as shown in Figure 1.

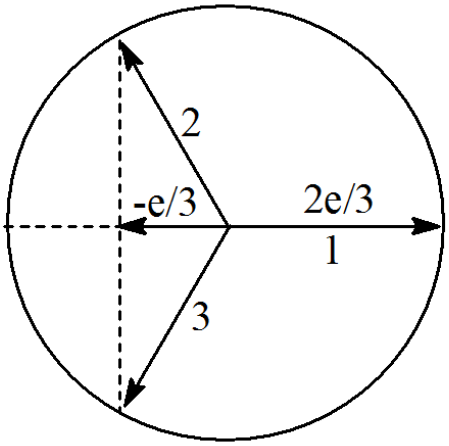

Figure 1. Three charge projections in World-3. The two types of charges -(⅓)e must differ in additional quantum numbers (helicity). Reflection at the inversion point will give antiparticle charges.

Similarly, we can determine the charges in World-4. To do this, we need to use the rotation of the sphere (Figure 2).

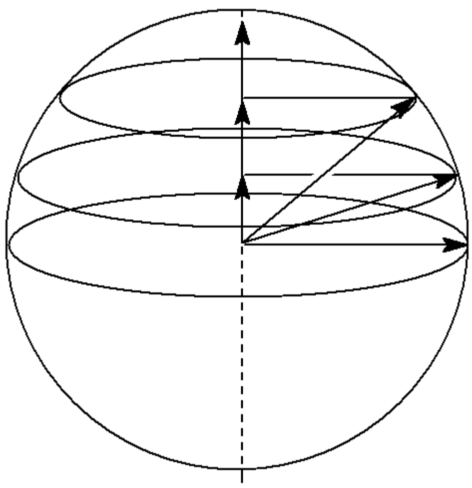

Figure 2. Four charge projections in World-4. Reflection at the inversion point will give the charges of the antiparticles.

It is worth emphasizing another important detail: all particles of World-4 are formed due to the transfer of information from a cluster of quarks, while heavy nuclei are formed from particles of World-4.

From Figure 2, it follows that in our space, there must be stable charges e, ±2e, ±3e, and also 0.

Of course, there must exist particles and antiparticles of the corresponding particles with opposite charges. However, electrons with a charge of -e are used to build atoms and ensure the electroneutrality of the Universe. They will also act as such for heavy nuclei, that is, for particles of World-4 (Z≥4).

Since particles of World-4 act as indivisible, it is better to depict them using the quark structure:

$$\begin{cases} {}^1_1H = 2\text{u} + \text{d} \equiv u^2d \\ {}^2_1D = 3\text{u} + 3\text{d} \equiv u^3d^3 \\ {}^3_2He = 5\text{u} + 4\text{d} \equiv u^5d^4 \\ {}^4_2He = 6\text{u} + 6\text{d} \equiv u^6d^6 \\ {}^6_3Li = 9\text{u} + 9\text{d} \equiv u^9d^9 \\ {}^7_3Li = 10\text{u} + 11\text{d} \equiv u^{10}d^{11} \end{cases} \quad (14)$$

From the list (14), it follows that there are no structures containing 15 quarks (${}^5_2He$ or ${}^5_3Li$), since, in these cases, the binding energy of a neutron or proton is negative [39].

The spatial metamorphosis between World-3 and World-4 is organized in such a way that some quantum numbers of quarks, in particular color, are lost when particles of World-4 are born. It is logical to assume that in the two-dimensional World some characteristics were lost when passing to World-3, in particular magnetic charges. Therefore, particles of World-2 carry with them a large set of quantum numbers, which are gradually lost when passing to higher-dimensional Worlds.

3.4.2. Particles of World-4(Z≥4), the Hierarchy of Bosons

From the above, we have concluded that in World-4(Z≥4), all nuclei (Z≥4) are combined from "elementary" particles of World-4, and, therefore, can be decomposed into these "elementary" particles. To confirm this idea, we will consider the structures of atomic nuclei as combinations of neutrons and "elementary" particles of World-4. In this case, we will assume that the contribution of a certain combination of "elementary" particles of World-4 to the composition of a heavy nucleus depends on the concentration of these particles in the Universe. Then, we will expand the list of "elementary" particles of World-4 by introducing heavy isotopes: ${}^3_1$T, ${}^6_2He$, ${}^9_3Li$.

Let's create combinations of "elementary" particles:

${}^3_1T \to {}^2_1D + {}^1_0n$, nucleus is β⁻- active due to the contribution of a neutron.

${}^8_3Li \to {}^7_3Li + {}^1_0n$, - nucleus is β^- - active.

${}^9_4Be \to {}^7_3Li + {}^2_1D$, - nucleus is stable but quite rare because there is not enough lithium and deuterium.

${}^{10}_4Be \to {}^7_3Li + {}^2_1D + {}^1_0n \leftrightarrow {}^7_3Li + {}^3_1T$, - nucleus is β^- - active.

${}^{10}_5B \to {}^4_2\alpha + {}^6_3Li$, - nucleus is stable; but less than ${}^{11}_5B$, because $[{}^6_3Li] < [{}^7_3Li]$.

${}^{11}_5B \to {}^4_2\alpha + {}^7_3Li$, - nucleus is stable but quite rare because there is not enough lithium.

${}^{12}_5B \to {}^4_2\alpha + {}^7_3Li + {}^1_0n$, - nucleus is β^- - active, ${}^{12}_6C$ is formed in an excited state, which decays into three α-particles. ${}^{11}_{6}C \rightarrow 2\,{}^{4}_{2}\alpha + {}^{2}_{1}D + {}^{1}_{1}H$, or ${}^{11}_{6}C \rightarrow 2\,{}^{4}_{2}\alpha + {}^{3}_{2}He$, the second contribution is small, the first is β^+ - active.

${}^{12}_{6}C \rightarrow 3\,{}^{4}_{2}\alpha$, - reaction in the excited state.

${}^{12}_{6}C \rightarrow {}^{9}_{3}Li + 3{}^{1}_{1}H \leftrightarrow {}^{7}_{3}Li + 2{}^{1}_{1}H + {}^{3}_{1}T$; ${}^{12}_{6}C \rightarrow 2{}^{6}_{3}Li$, - nucleus is stable.

${}^{13}_{6}C \rightarrow {}^{6}_{3}Li + {}^{7}_{3}Li$, - the nucleus is stable.

${}^{14}_{6}C \rightarrow 2{}^{7}_{3}Li$, or ${}^{14}_{6}C \rightarrow {}^{7}_{3}Li + {}^{4}_{2}\alpha + {}^{2}_{1}D + {}^{1}_{0}n$, or ${}^{14}_{6}C \rightarrow 3{}^{4}_{2}\alpha + 2{}^{1}_{0}n$, - nucleus is β^-active.

${}^{55}_{25}Mn \rightarrow 5{}^{4}_{2}\alpha + 5{}^{7}_{3}Li$,

${}^{54}_{26}Fe \rightarrow 10{}^{4}_{2}\alpha + 2{}^{7}_{3}Li,\ 7{}^{4}_{2}\alpha + 2{}^{7}_{3}Li + 2{}^{6}_{3}Li$, - nucleus is stable (5.84%).

Considering the molecular structure of heavier nuclei, it can be seen that the ratio of the number of protons and neutrons to nucleus No. 50 can be described by the content ${}^{7}_{3}Li$ ${}^{4}_{2}He$, etc. But in the case of subsequent nuclei, the contribution of neutrons increases. Moreover, when going from ${}^{208}_{82}Pb$ to ${}^{238}_{92}U$ 10 protons and 20 neutrons were added [40]. So, ${}^{3}_{1}T$, ${}^{6}_{2}He$, ${}^{9}_{3}Li$ should be included into the consideration. Such nuclei really exist, but they are β^- - active with the lifetime 3.87 ·10^8 s = 12.262 years, 0.797 s and 0.176 s respectively.

Neutrons in the free state are also β^-- active, however, all nuclei contain them. The strong interaction transforms a neutron into a proton much faster than it could carry out the act of fission, therefore, neutrons are stable in the composition of nuclei. Therefore, it is logical to assume that the indicated three β^-- active nuclei in the composition of atomic nuclei will quickly transform and, as a result, remain stable.

Bosons are always responsible for the interaction between particles. Gluons create a strong interaction between quarks; the $W^{(\pm)}$ and Z^o bosons, which are partly in World-3 and partly in World-4, are responsible for the weak interaction [23]. The $\pi^{(\pm)}$ and π^o bosons are carriers of the strong interaction in World-4 between nucleons in the three groups of particles of the four-dimensional World.

The interaction between neutrons and protons is possible only due to the transfer of the π^o boson. Since there is an electrostatic repulsion between protons (≈ 1 MeV), the resulting binding energy in a biproton is -0.5 MeV. From this, we conclude that the strong interaction energy caused by the transfer of a neutral pion between neutrons is ≈ 0.5 MeV [41, 42]. However, a neutron decays due to the weak interaction processes in a time of ≈881 s [43]. And how does the environment of a neutron in a nucleus affect its decay period? Let us compare the half-lives of even β^-- active nuclei: $T_{½}(^{16}N)$ = 7.14 s i $T_{½}(^{18}N)$ = 0.63 s; $T_{½}(^{20}F)$ = 11.56 s and $T_{½}(^{22}F)$ = 4.0 s [40]. Therefore, we can conclude that with an increase in the number of neutrons in the cluster, the neutron half-life can decrease by 1-4 orders of magnitude. It is clear that this period is much longer than the half-life of the strong interaction bosons.

Between the particles of World-4(Z≥4), the interaction must also be carried out by the World -4(Z≥4) bosons. Such a boson can consist of two bound neutrons Y(2n). For example, in the structure of nuclei:

$$\begin{cases} {}^{10}_{4}Be \rightarrow {}^{9}_{3}Li + {}^{1}_{1}H \leftrightarrow {}^{7}_{3}Li + Y(2n) + {}^{1}_{1}H \leftrightarrow {}^{7}_{3}Li + {}^{3}_{1}T \\ {}^{13}_{5}B \rightarrow {}^{9}_{3}Li + {}^{4}_{2}He \leftrightarrow {}^{7}_{3}Li + Y(2n) + {}^{4}_{2}He \leftrightarrow {}^{7}_{3}Li + {}^{6}_{2}He \end{cases} \quad (15)$$

It is clear that the nucleus ${}^{8}_{4}Be \rightarrow 2{}^{4}_{2}\alpha$ cannot exist and immediately decays into two α-particles. Here, it is impossible to organize the transfer of two neutrons.

In the case of the oxygen-16 nucleus, the reaction ${}^{16}_{8}O \rightarrow 4{}^{4}_{2}\alpha$ occurs only in the highly excited state. The presence of four α-particles will provide more opportunities for the organization of the ground and lower excited states, and the lower excited state emits only one α-particle, turning into a carbon-12 nucleus.

$$\begin{aligned} &{}^{16}_{8}O \rightarrow {}^{9}_{3}Li + {}^{4}_{2}\alpha + 3{}^{1}_{1}H, \\ &{}^{16}_{8}O \rightarrow {}^{9}_{3}Li + {}^{3}_{1}T + 4{}^{1}_{1}H, \\ &{}^{16}_{8}O \rightarrow {}^{7}_{3}Li + 2{}^{3}_{1}T + 3{}^{1}_{1}H, \\ &{}^{16}_{8}O \rightarrow {}^{6}_{2}He + {}^{7}_{3}Li + 3{}^{1}_{1}H, \\ &{}^{16}_{8}O \rightarrow {}^{6}_{2}He + {}^{4}_{2}\alpha + {}^{3}_{1}T + 3{}^{1}_{1}H \end{aligned} \quad (16)$$

Let us consider the interaction in atoms and molecules to describe, using the *similarity principle*, the interaction in nuclei built from three pairs of World-4 particles on the molecular structure model. The boson that determines the interaction between the electron and the nucleus in an atom is the virtual photon [33]. *The boson that determines the interaction of atoms in a molecule is a pair of electrons in a singlet state, surrounded by a coat of virtual photons*. This pair of electrons is in constant motion around the interacting atoms.

Similarly, the boson responsible for the interaction between World-4 particles in atomic nuclei (Z≥4) is a *bineutron* (two neutrons) *in a coat of neutral pions*. Therefore, it is logical to assume that complex nuclei have a certain geometric structure, like molecules from atoms. In this case, in the state ${}^{16}_{8}O \rightarrow {}^{9}_{3}Li + {}^{4}_{2}\alpha + 3{}^{1}_{1}H$ the nucleus ${}^{9}_{3}Li$ is surrounded on three sides by protons and in this structure, the interaction manifests itself due to Y(2n)-bosons. The interaction of this structure with the boson ${}^{4}_{2}\alpha$ will be weakened, leading to the emission of an α-particle, which is observed when the nucleus is excited.

The state with the structure ${}^{16}_{8}O \rightarrow {}^{6}_{2}He + {}^{7}_{3}Li + 3{}^{1}_{1}H$ will resonate with the previous state if they have the same geometric structure. This resonance will lower the corresponding energy level and stabilize the nucleus.

The structure ${}^{16}_{8}O \rightarrow {}^{6}_{2}He + {}^{4}_{2}\alpha + {}^{3}_{1}T + 3{}^{1}_{1}H$ should have a noticeably lower energy level, where two transfers of Y(2n)-bosons occur at once. The states corresponding to the structures ${}^{16}_{8}O \rightarrow {}^{9}_{3}Li + {}^{3}_{1}T + 4{}^{1}_{1}H$ and ${}^{16}_{8}O \rightarrow {}^{7}_{3}Li + 2{}^{3}_{1}T + 3{}^{1}_{1}H$, where two Y(2n)-bosons are transferred at once, will be resonant to it. These resonant states will form a triplet of energy levels.

4. Creation of Stars and Planetary Systems, Galaxies and Galaxy Clusters

According to the requirements of the UMIE model, matter born in three-dimensional space has a fractal structure from the very beginning. Each element of this structure (a future star) rotates quickly. Stars are immediately combined into future galaxies and galaxies into clusters of galaxies. The galaxies also rotate, compensating for the total angular momentum of the stars. With the expansion of space, the masses of stars and galaxies, as well as the diameters of galaxies, increase at a constant rate. However, the radius of a star increases with time proportional to the cube root of time, and the distance between stars is proportional to time. Therefore, the stars move away from each other.

The distance between galaxies in galaxy clusters was small at the time of the creation of the Universe. Therefore, neighboring galaxy nuclei could fluctuate and merge into one galaxy. As a result, this contributed to the early formation of black holes in the centers of individual galaxies.

To calculate the expansion rate of the Milky Way Galaxy, we will take as a basis the age of the Universe of 13.8 billion years (4.2 10^{17} s) [7], and the current radius of the Galaxy is 50 thousand light-years (4.73 10^{20} m) [44-46]. From here, we find the rate of increase in the radius of the Galaxy of 1130 m/s, which exactly corresponds to the rate of expansion of space within the Galaxy. There is also confirmation of the found value of the rate of increase in the radius of the Galaxy, made in the article [44], where an estimate of the speed of the order of 500 m/s is given, which is only 2 times different from the estimate made within the framework of the UMIE model.

The rapid rotation of the Galaxy's nucleus during its creation caused the Galaxy to have a disk shape. Over time, this shape has evolved, increasing in mass and density closer to the center due to gravitational interactions between stars within the Galaxy. In addition, gravitational interactions cause the disk to thicken [46].

4.1. The Motion of Stars in a Discoid Galaxy

Thus, the UMIE model requires that the Galaxy initially had a disk-like shape. Since all star embryos have large angular momentum, it is logical to assume that the corresponding angular momentum in the opposite direction is possessed by a group of stars that make up the mass of the Galaxy.

The gravitational interaction between stars, the masses of which are constantly increasing, leads to the evolution of the shape of the Galactic disk and an increase in the average density of stars as they approach the center of the Galaxy. In addition, the thickness of the disk will increase [46].

Astronomical observations of distant galaxies show that initially, the Galaxy had a disk shape, and over time, a thickening was created in the center of the Galaxy, and a bulge was formed [45, 46]. Nothing is said about the mechanisms of the new star birth. Note that the results of astronomical observations are described in [47, 48]. correspond to the UMIE model.

When modeling the dependence of the density of stars and their velocity on the distance from the center of the Galaxy, it was found that in the case when the gravitational field strength in the Galaxy decreases inversely proportional to the distance from the center, the magnitude of the velocity of stars will not depend on the distance, which qualitatively corresponds to the results of observations [49, 50].

4.2. The Concentration of Stars in the Galaxy

In [45], the average mass of a galaxy was estimated. For this case, we estimate the effective number of stars in it:

$$N_G = M_G/M_\odot = \int_0^{R_G} n(r)\cdot 2\pi r\cdot dr = \frac{R_G A}{M_\odot} = 6.82\cdot 10^{11}, \quad (17)$$

where

$$n(r) = \frac{\rho(r)}{M_\odot} = \frac{A}{2\pi r M_\odot} = \frac{N_G}{2\pi r R_G} = \frac{6.82\cdot 10^{11}}{6.28\cdot 50000\cdot r} = \frac{2.17\cdot 10^6}{r} \quad (18)$$

concentration of stars (per square light year).

Hence

$$A = \frac{N_G M_\odot}{R_G} = 6.82\cdot 10^{11}\cdot 1.99\cdot \frac{10^{30}}{50000} = 2.714\cdot 10^{37}\ \text{kg/(light year)}. \quad (19)$$

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

Since the disk thickness is about 1000 light-years [46], we obtain a volume density of stars of 0.0434 stars/(light-year)^3. Therefore, the average volume per star is 1/0.0434 = 23 (light-years)^3, and the average distance between stars is 2.85 light-years. It is known that in the region of the Solar System, the distance between stars is several times greater. This fact 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-year we obtain n(0.5) = $4.34 \cdot 10^6$ stars/(light-year)^2. In this case, the bulk density will be $4.34 \cdot 10^3$ stars/(light-year)^3, and the average distance between stars will be 0.061 light-years, which is only 2 orders of magnitude greater than the distance from the Sun to Neptune. If we consider the early Universe, that is, take the period (0.1 ÷ 0.3)$\cdot T_U$, then a critical approach between stars and the development of chaos in the central part of the Galaxy was common. This was a period of rapid evolution in the formation of the central part of the Galaxy, that is, there was a period of chaos. Chaos caused a change in the orbit of stars and the removal of some of them beyond the boundaries of the galactic disk, as well as the transformation of the central part of the Galaxy into a sphere.

4.3. Spherical Shape of the Galaxy Center

The turbulent evolution in the formation of the central part of the Galaxy resembles complete chaos in the motion of stars, which can result in the movement of a star towards the center of the Galaxy. This will cause collisions and coalescence of stars. In this case, the resulting mass of the star grows much faster than from the birth of new matter [1]. As a result, stars evolve into the state of a black hole. When using the virial theorem before the coalescence of stars, it becomes clear that in this case, large masses of matter are thrown out of the star, and large clouds of cosmic gas and dust are formed. It is clear that with the approach to the center of the Galaxy, the probability of the formation of a black hole increase. Therefore, it is formed primarily in the center of the Galaxy. With distance from the center of the Galaxy, the probability of the creation of black holes decreases. It is possible that there are cases when only one black hole is formed in the Galaxy.

The article [51] describes the chaos that should exist in the period from 3.6 to 8 billion years from the birth of the Universe. This chaos resulted in the creation of spiral galactic arms, such as in the Milky Way or Andromeda galaxies.

Let us assume that in this region, the condition is realized under which the average volume density of matter $\rho_3(R)$ is a constant value. Then, the speed of motion of the star around the center of mass will be determined by the conditions:

$$(M_\odot v^2)/r = \frac{GM(r)M_\odot}{r^2} = \frac{4\pi\rho_3 GM_\odot}{3r^2}\cdot r^3 = \frac{4\pi\rho_3 GM_\odot}{3}\cdot r. \quad (20)$$

From here

$$v = r\sqrt{\frac{4\pi\rho_3 G}{3}}. \quad (21)$$

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

$$T = \frac{2\pi r}{v} = \sqrt{\frac{3\pi}{\rho_3 G}} = \text{const}. \quad (22)$$

This result resembles the rotation of a star around its axis, provided that all its parts have approximately the same rotation period. The difference is that in the case of a spherical shape of the galaxy center, there is no such axis, and the stars move almost independently in their orbits. Therefore, the trajectories of the stars will intersect with each other. In this case, the interaction between the stars will change their motion trajectory.

Comparison of the theoretically obtained results with the observational data [49, 50] shows that the speed of the stars increases with distance, i.e., it corresponds to the considered model.

From the above, it is clear that in a spherical region of the galaxy, the speed of the stars decreases with decreasing distance to the center of the Galaxy. As a result, stars whose orbits are at a critical distance from the center of the Galaxy will be absorbed by the central star or black hole. Therefore, the central black hole will have the largest mass among black holes [45].

Astronomical observations indicate that the mass of the central black hole in the Galaxy is $4.31 \cdot 10^6$ solar masses [52].

4.4. Halo

A halo is a spherical part of a galaxy, the radius of which is several times greater than the radius of the galaxy itself [53, 54]. The halo consists of rarefied gas, massive bodies, and stars that contain only light atoms. To observe halos, you need to use modern, powerful telescopes otherwise they cannot be seen.

A study of the halo of the Andromeda Nebula using the Hubble spacecraft [53, 54] led to the conclusion that the halo contains only old stars with an age of 11–13.5 billion years and 6–8 billion years. Any manifestations of stellar activity in the halo are extremely rare.

In order to understand the processes of halo creation, we need to pay attention to the model of the solar system's creation [42] in the UMIE and use the Law of Similarity in the Universe. According to this model, the active decay of superheavy atomic nuclei in the star's nucleus leads to the ejection of electrons, protons, helium, and lithium nuclei beyond the nucleus. And since a magnetic field has 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 the ejected particles, which effectively occurs at the initial moments of the evolution of stars, increases the radius of the trajectory, as a result of which satellites of light particles appear around the star's nucleus, the mass of which grows over time. At the same time, these particles cannot contain heavy atomic nuclei. This is how the Oort cloud is formed. The orbit of this cloud is close to the equatorial plane of the star's nucleus.

A similar process will occur in the case of the galaxy's nucleus. Clouds of light atoms and atomic nuclei will form in the initial galactic magnetic field. Radiation processes in the galaxy's nucleus eject atomic nuclei that create the halo at high speed, so the halo's radius must be several times larger than the radius of the galactic disk.

In the second stage, when chaos processes dominate in the galaxy's center, large masses of matter from the upper layers of stars are ejected into outer space. Light atoms and fairly massive objects consisting of light atoms were ejected. So, we will have two generations of matter ejected beyond the galaxy. This matter will move in an elliptical orbit, occasionally approaching the center of the galaxy, where chaos processes continue. The latter caused a change in the orbit of these particles, as a result of which a spherical halo was formed.

4.5. Galactic Arms

Immediately after the discovery of galaxies, galactic arms were also noticed as the most noticeable spiral formations. Thanks to the study of nearby galaxies' structure, our Galaxy's structure also became clear. Further studies of the structure of galaxies showed that the youngest stars are mainly concentrated along the arms, as well as many scattered star clusters and associations. In addition, there are chains of dense clouds of interstellar gas in which stars continue to form. An important element of galactic arms is the galactic magnetic field. Of course, the magnetic field permeates the entire galactic disk, but it is concentrated mainly in the arms.

Let's consider galactic arms in detail. First of all, we notice the symmetry of the arms. So, you can rotate the picture by 180º and get the same structure of the arms. In the Galaxy, we see three pairs of arms: the Perseus arm corresponds to the Scutum-Centaurus arm, and the Cygnus arm corresponds to the Sagittarius arm. In addition, there are two 3-kiloparsec arms. In all galaxies, the arms never extend beyond the galaxy's boundaries.

Let us consider some simplified models of the evolution of objects in the galaxy, which allow us to understand the processes that cause the emergence of galactic arms.

As the mass of a star increases, according to the UMIE model, its evolution will lead to the fact that the internal pressure will not counteract its collapse. A phase transition occurs, which consists of a rapid decrease in the radius of the star. In this case, the law of energy conservation is fulfilled: an increase in the absolute value of the potential energy of the interaction between the particles of the star is equal to an increase in the kinetic energy of the particles of the star. On the other hand, we know that for centrally symmetric objects, there is a virial theorem, according to which, in a stationary state, the kinetic energy must be equal to half the potential energy with the opposite sign. Therefore, a large excess of kinetic energy arises, equal to half the change in potential energy.

The density of matter in the central part of a star always significantly exceeds the density on the surface. Therefore, when a star contracts, the density of matter in its central part can reach the density of nuclear matter. It will not contract further. Thus, the core of a future neutron star is formed. This fact will cause the surrounding matter to move towards the center, increasing the radius of the neutron core. On the other hand, the region of matter with increased kinetic energy will move beyond the neutron core from the center. As a result, the kinetic energy increases rapidly. When the magnitude of the kinetic energy reaches the magnitude of the potential energy of the near-surface layer of the star, the star explodes. In this case, the excess kinetic energy throws off the star's upper layers, heating them and leaving the central part almost intact, which becomes a neutron star.

Next, we will consider the absorption of an ordinary star by a black hole. When an ordinary star approaches a black hole in its trajectory, there may come a point when the attraction of the nearby part of the star by the black hole exceeds the attraction of this part to the center of the star. As a result, the opposite part of the star will receive an increase in kinetic energy. The shape of the star will first acquire an ellipsoidal shape, and then the star will break into pieces. The distant part of the star will be thrown into space. On the other hand, the part closest to the black hole will be stretched into the equatorial region of the black hole, enveloping it with a ring.

Since we are dealing with a deep gravitational well, energy levels should likely be similar to atomic ones. In this case, the massive ring's energy decrease around the black hole should be accompanied by visible radiation and the simultaneous emission of gases from the entire ring. The last stage will be the absorption of the ring matter by the black hole. In this process, an excess of the kinetic energy of the matter absorbed by the black hole again arises. Therefore, one should expect the black hole's ejection of matter or energy. Since matter is absorbed in the equatorial region, which ensures the cylindrical symmetry of the system, the release of matter or energy should occur from the poles of the black hole or symmetrically from the equatorial region. The latter option should be considered unlikely.

It is known that matter cannot leave a black hole. What way out does Nature give us?

Such a way out really exists. It is known that when a star's matter collapses into a black hole, its gravitational field does not disappear. So, the gravitational field is multidimensional, unlike the electromagnetic field. But how will matter or energy be released from the poles of a black hole? In [22], it is shown that it is not matter or an electromagnetic wave that is actually emitted but a SF. Such a mechanism will allow us to understand the radiation process of hot matter and energy at a certain distance from the poles of a black hole, which is observed in astronomical studies [55]. This radiation feeds the Fermi bubbles [56].

Now, consider the mechanisms of the formation of galactic arms.

Let us consider the absorption of smaller black holes by the central massive black hole, which leads to the appearance of shock waves [57], which create galactic arms.

Unlike the absorption of stars by a massive black hole, the contact interaction between two black holes will not be able to stretch the smaller black hole into a disk around the massive black hole. At the moment of the collision of the black holes, an axis of symmetry will appear, connecting their centers of mass. Then, the absorption of the light hole by the massive black hole will occur. The large excess of kinetic energy that will arise in this case will equal half the change in potential energy. Let's estimate the change in potential energy:

$$\Delta E_p = \frac{GM_1M_2}{r_{g1}} = \frac{1}{2}M_2c^2 \tag{23}$$

Here, M_1 is the mass of the massive black hole, M_2 is the mass of the small black hole. Formula (23) is valid for the case when, at the moment of capture of a small black hole by a massive hole, the distance between their centers will be equal to the gravitational radius of the massive black hole. In addition, to determine the gravitational radius of a black hole, not a relativistic but a classical formula was used.

Since the excess kinetic energy during the merger of black holes is equal to half the change in potential energy, it will be approximately a quarter of the mass of the light hole, as follows from formula (23). Thus, we have estimated the energy that should be released during the merger of black holes. The result is new and unexpected, but it explains the process of creating galactic arms.

We drew attention to the existence of an axis of symmetry during the interaction of two black holes. At the moment of the interaction of the black holes, the momentum of the system was small, and the angular momentum, which corresponded to the rotation of the small hole around its axis, as well as around the large black hole at the moment of their merger, could be large. The presence of an axis at the moment of the merger of two black holes will cause the birth of two shock waves [57], that is, the ejection of two equal-in-magnitude flows of the SF. These flows are characterized by motion components: radial in the equatorial plane and azimuthal. The ratio between the azimuthal and radial velocities of the flows will determine the tangent of the angle of the logarithmic spiral of the galactic arms.

Let us give examples of the real absorption of a small black hole by a large hole. Let us assume that the mass of the small black hole was 10^5 solar masses. In this case, the two shock waves formed will carry 12500 solar masses of matter each. The SF at a certain distance from the black hole will create matter in three-dimensional space, creating visible galactic arms. Since the created flows will be high-energy, and therefore, they will be represented by a plasma with the same kinetic energy of all charged particles, the electrons will gain a much higher speed than the protons. The flows of charged particles will be able to provide a sufficiently large magnetic field in the galactic arms and cause active processes of matter evolution within the galactic arms.

Galactic arms with similar properties will be created in the case of absorption by a massive black hole of light (10^4 or even 10^3 solar masses) black holes. In this case, the power of the galactic arms will be much lower. And such galactic arms are observed. In particular, a strong pair of galactic arms are the Scutellarin-Centaurus and Perseus arms, the Cygnus and Sagittarius arms are significantly weaker, and the two 3-kiloparsec arms are completely weak.

Simultaneously with the spiral arms, a central bridge is formed. The reason for the creation of the central bridge is as follows. Only the SF is emitted from the massive black hole, which moves only in other layers of the stratified space of the Super-Universe and carries with it a lot of energy. Using the interaction properties between neighboring layers, the SF will leave a trace in three-dimensional space and completely pass into three-dimensional space at a great distance, from where the beginning of the galactic arms will arise. The SF will generate matter in the form of bineutrons, which quickly dissociate into two electrons and two protons. With the same kinetic energy of electron and proton bunches, electrons will move within the galactic arms much faster than protons. Therefore, the movement of electrons will create a magnetic field counterclockwise, and the movement of protons will be clockwise. In this case, a region will be between these two streams of charged particles where the magnetic field is absent. Of course, this is an idealized model since, during the orbital motion of stars in the Galaxy, they cross the galactic arms and interact with them. As a result, large molecular clouds and dust clouds appear, which, under extreme conditions, are capable of generating new stars, planets, and smaller objects. So, the proposed model of the creation of galactic arms can be tested by measuring the magnetic field along the arm.

Thus, the matter of the galactic arms will be born after the emission of the SF not close but at some distance from the central black hole. Otherwise, the matter could be absorbed by the black hole.

Let us compare the above simulation with the structure of galactic arms in the Milky Way Galaxy. It turned out that in the Galaxy between the beginnings of the Scutellar-in-Centaurus and Perseus galactic arms, there appeared a central bridge with a length of ~27000 light-years = 2.55 10^{17} km [58, 59], which significantly exceeds the diameter of a massive black hole (25.46 10^6 km [52]). Using its properties, the SF will generate a bridge and the beginning of galactic arms *immediately* after the absorption of a small black hole by a large hole [22] at a distance of 13500 light years while preserving information about the energy and angular momentum of the matter generated in the galactic arms.

Let me remind you that the SF has the ability to propagate in a two-dimensional space, each point of which is informationally connected with a delocalized point in a three-dimensional space. Thus, the SF will instantly move to the point of birth of the galactic arms, simultaneously forming a trace of its movement in three-dimensional space.

There is a chaotic flow of matter from the surrounding space to the central black hole, forming a ring of gas and dust in the equatorial plane of the black hole. Further capture of matter by the black hole causes part of the matter from the ring to be thrown out in all directions into the region of the galactic disk. If there are central bridges, the matter will be thrown out mainly along the bridges, like water from an overflowing pool along rivers. Such jets of matter will feed the galactic arms. And since the flow of matter into the black hole is chaotic in nature, the jets of matter into the region of the galactic arms will have an oscillating non-periodic character. These oscillating jets will reach a particularly large amplitude when the black hole captures a star. In particular, when a black hole captures a star, only the part closest to the black hole will be captured by it, while the part further away will be thrown out of the way of its interaction with the black hole. In this case, the ejected remnant of the star will most likely break up into many small objects.

The radiation of hot matter and energy from the poles of the black hole, which feeds the Fermi bubbles, has somewhat different properties. These streams of particles are too weak to affect the structure of the spherical part of the Galaxy, so they are created at a relatively small distance from the poles of a massive black hole but outside the critical region that ensures the return of hot matter to the black hole.

5. Conclusions

This part of the review is devoted to describing some of the achievements the author managed to obtain through the use of the UMIE model. Based on these achievements, the following conclusions are formed.

The model is built based on the Laws of Similarity and Unity in the Universe. In this case, all the laws of physics are taken into account, particularly the law of the hierarchical structure of large systems. As a result, the UMIE model fulfilled the requirements of all the laws, using the view of the Universe as a component of the Super-Universe. In turn, the Super-Universe is represented by a layered space, which consists of four elements: World-1, World-2, World-3, and our World-4.

To ensure that all the laws of physics are fulfilled, World-1 is represented by 12 collapsed spatial dimensions, as well as time and information dimensions; World-2 is represented by 3 spatial dimensions, two of which remain collapsed; World-3 is represented by 3 spatial dimensions, one of which remains collapsed; World-4 is represented by 6 spatial dimensions, three of which remain collapsed. The spatial dimensions of World-1 encompass all the spatial dimensions of the other worlds.

Time and information dimensions are common to all layers of stratified space. World-1 defines a quantum of time, the value of which corresponds to Planck time. This is the basis on which the development of all layers of stratified space is ensured. Its use contributed to describing the development of all processes occurring in the Super-Universe.

It is shown that the information dimension provides the initial structure of all layers of the stratified space and sets the program for the development of all processes in the Super-Universe, in particular, the simultaneous expansion at the speed of light of the collapsed dimensions in all layers of the stratified space. Therefore, all spaces turned out to be branes of spaces with one more dimension. Therefore, all spaces are closed.

Through zero-dimensional space, the SF enters at a constant speed, endowed with energy and a program for the creation and control of all processes in the Super-Universe. In particular, the SF creates particles of World-2, dyons, and Planck particles. In World-3, it creates quarks, and in World-4 it forms all known particles, atomic nuclei, atoms, and molecules, as well as massive bodies and their systems. The SF ensures interaction between particles of different spaces at the information level.

The SF creates bosons for the implementation of fundamental interactions. It also ensures the presence of mass in all particles at all hierarchical levels. Therefore, the SF is constantly present near each particle. It also ensures the processes of annihilation in the particle-antiparticle system and the excitation of vacuum particles to a virtual state.

In accordance with the laws of hierarchy, the SF creates 7 types of fundamental interactions: strong, weak, and electromagnetic interactions, as well as 4 types of gravitational interactions at different hierarchical levels of the Universe. The SF is also responsible for the creation of life in the Universe.

Four types of gravitational interactions ensure planetary systems, star systems, galaxy clusters, and Metagalaxies are stable. The structure of the Super-Universe ensures the multidimensional nature of gravitational interaction, which does not disappear when stars collapse to the state of black holes. The multidimensionality of gravitational interaction is responsible for the rapid interaction between large masses. Still, due to multidimensionality, the magnitude of the constant of this interaction turned out to be very small. In particular, the gravitational interaction between an electron and a proton is weaker by almost 40 orders of magnitude than the electromagnetic interaction.

Abbreviations

The UMIE Model	The Model of Creation of the Universe with Minimum Initial Entropy

World-1	Zero-dimensional Space
World-2	One-dimensional Space
World-3	Two-dimensional Space
World-4	Three-dimensional Space
SF	Scalar Field
HL	Hierarchical Level
PV	Physical Vacuum
EVP	Elementary Particle of the Vacuum
EMF	Electromagnetic Field
Hyhelithes	Hydrogen, Helium, Lithium

Author Contributions

Petro Olexiyovych Kondratenko is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

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