

The Problem of Dark Matter in Cosmology

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Abstract: A number of conclusions about impossibility of existence of dark matter and dark energy in the Universe is given in the paper, in view of the analysis of information about the dark matter in the Universe and the model of the Universe with Minimal Initial Entropy (UMIE model). Considering the Universe as an integral part of the stratified Super-Universe space, it is shown that particular layers do not intersect, but have an information link created by the multidimensional Scalar Field, which carries the fundamental code of the Super-Universe creation and evolution. The Scalar Field is responsible for masses of elementary particles, for information exchange with quarks of World-3, and for fundamental interactions in the Universe. It is also shown that the difference between electrostatic and gravitational interaction consists in the fact that electromagnetic interaction occurs within World-4, while gravitational interaction exists due to multidimensional wave transport; as a result, gravitational interaction is almost 40 orders of magnitude weaker than the electromagnetic one. This fact ensures the existence of the Universe, galaxies, stars, planets, the existence of life on the Earth. The effective speed of gravitational waves is different at different hierarchical levels, resulting in creation of planetary systems, star systems, galaxies, galaxy clusters. Actual massive objects enter into gravitational interaction at all hierarchical levels. Thus, all 100% of the matter in the Universe is revealed in gravitational interaction. At the same time, no more than 8% of energy and matter can be detected in the course of astronomical research. Therefore, there is no reason to consider unknown dark matter and dark energy. Instead, the model of the Universe formation must be replaced. The UMIE model permits to understand real processes that take place in the Universe. Moreover, the laws of physics are not violated.

Keywords: models of the Universe, hierarchical structure of the Universe, gravitational interaction, dark energy and dark matter.

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1. INTRODUCTION

Modern cosmology advances on the basis of Einstein's General Theory of Relativity, hence, it is called relativistic, in contrast to the former classical theory. A. Friedman's theoretical research and E. Hubble's astronomical observations proved a nonstationary behavior of the Universe. Therefore, the Universe expands, and the distance between galaxies increases, i.e., "scattering" of galaxies is observed. It follows that the beginning of the Universe existence had to take place in the past. This stage in the development of cosmology is associated with the work of G.A. Gamow, who proposed a model for the Universe creation, which was called the "Standard Model". According to this model, the Universe was born as a result of the Big Bang from a point of fundamental dimensions (singular point), with concentrated energy that gave rise to the whole mass of the Universe. The initial temperature equaled $\sim 10^{28}$ K [1]. The initial entropy of this Universe was also extremely large ($S_0 = 10^{88}$ J/K [2]). It is clear that very big initial entropy of the Universe shall disrupt the process of galaxies, stars and planetary systems creation. However, it is believed that this model is confirmed by the existence of relict radiation [3-7].

Based on the known value of the Hubble constant ($H = 73.8 \text{ km}/(\text{s}\cdot\text{Mpc}) = 0.755 \cdot 10^{-10} \text{ years}^{-1} = 2.392 \cdot 10^{-18} \text{ s}^{-1}$ [8]), we can calculate the critical density of the Universe,

$$\rho_{cr} = \frac{3H^2}{8\pi G} = 1 \cdot 10^{-26} \text{ kg}/\text{m}^3$$

However, no more than 5% of the mass found on the basis of critical density are detected by astronomical observations. Notwithstanding, recently it was shown that the density of matter in intergalactic space is 40% higher than it was previously thought [9], and, probably, the value of 5% of the critical mass shall slightly increase.

2. DIFFICULTIES OF THE STANDARD MODEL

The Standard Model of the Universe creation cannot explain the above-described paradox in terms of known physical laws. In addition, there are many other objections to the Standard Model. The Standard Model required answers to a number of important questions. In particular, if all matter was concentrated in a singularity, then why did not a black hole appear? What determines the arrow of time? Why are galaxies, stars and planets created? Does the Universe have any limit in space? Are the laws of thermodynamics fulfilled in the process of the Universe evolution? If the Universe is boundless, then why is it dark at night? Can space exist without matter?? And many other, no less important and fundamental issues.

It is clear that the Standard Model contradicts the laws of physics, it is unable to explain many physical effects. In order to correct the situation, scientists add a number of phenomenological assumptions to the model, in their opinion, it will improve the model. Worst of all, the new assumptions also contradict the laws of physics. These assumptions include the inflationary model of the Universe, according to which the Universe after its birth increased its radius many orders of magnitude faster than the speed of light. And this despite the fact that speeds exceeding the speed of light are impossible in our space, which has been proved. It is proved that particles (tachyons) with such speeds can be found only in another space [10] that does not intersect with ours. Otherwise, there would be a violation of the cause-and-effect laws. In addition, the inflation model does not provide a mechanism for ultra-rapid expansion of space due to its phenomenological nature.

Today, fundamental interactions are described purely phenomenologically using the exchange of bosons – particles of interaction. However, the mechanisms of such interactions are not fully understood. It is not clear how the exchange particles “know” what properties they must have and in what direction must move in order for the exchange interaction to arise. As a result, interaction potentials are introduced phenomenologically, and they are in no way associated with the exchange mechanism. In this situation, the physics of interactions remains unclear.

It should also be remembered that the Standard Model does not explain the particle-antiparticle annihilation mechanism, but accepts this process simply as a fact. Related to this is the understanding of the physical vacuum, which is considered empty of particles, but its properties are postulated in order to explain fine physical effects.

3. MODEL OF THE UNIVERSE WITH MINIMAL INITIAL ENTROPY

Based on this state of the Standard Model development, the author of this paper proposed a new model for the creation and evolution of the Universe on the basis of the Law of Similarity and the Law of Unity, where the laws of physics would be fulfilled [11, 12]. It is the model of the Universe with minimal initial entropy (UMIE model). According to this model, our Universe is an integral part of the Super-Universe. On the other hand, the Super-Universe is represented by stratified space [10], and the neighboring layers differ in the dimension of space by one. Our three-dimensional space (four-dimensional $(3 + 1)$ Universe, World-4) borders on two-dimensional space (World-3). And two-dimensional space borders on one-dimensional space (World-2). Then, one-dimensional space borders on zero-dimensional space (World-1). Information link exists between adjacent spaces through one delocalized point. The Super-Universe is born as an organic whole, but its filling with energy and matter proceeds gradually.

The stratified space is filled with energy, starting from World-1. The Scalar Field continuously enters through the zero-dimensional space [13], it carries energy and the fundamental code, i.e., the program of the Super-Universe creation and evolution. Firstly, the Scalar Field fills World-2 with particles and energy. Then the spaces of higher dimensions are filled, each in turn. Energy that enters World-2 is able to create particles of World-2 (diones, which turned out to be Planck particles). Similarly, the energy coming to World-3 and World-4 is **able to create groups of quarks and bineutrons, respectively**, in the vicinity of atomic nuclei. An important characteristic of these groups of particles is the absence of (color, electric, magnetic) charges and magnetic moments. The Super-Universe possesses time from the moment of its creation. Thus, World-1 is the Field-Time space. The Scalar Field is able to interact with other spaces and set the program of evolution in them.

Unlike the Standard Model of the Universe creation [3, 14-16] from singularity with extraordinarily high density of matter and extremely high temperature, thus, with extraordinarily high entropy, the

UMIE model provides the minimum possible entropy value, cool initial state, and limited substance density.

This approach to the problem of the Universe origin and evolution eliminates many inconsistencies that exist in the Standard Model, it arranges the evolution of the Universe in such a way that its entropy increases while galaxies, stars and planetary systems are forming, and the Universe did not become a black hole at the moment of the Big Bang.

At the time of the Super-Universe creation, all its layers had a fundamental size, that is, all spatial dimensions were folded into a ring of the fundamental size. Then, over time, the characteristic size of the corresponding dimensions (radius of the respective ring) of each space increases, as the Scalar Field sets it. Therefore, each of these spaces is a brane of space with the dimension that increases by one. And the radius of this brane increases with the speed of light.

The process of filling of our space with matter begins from the moment $T_{U_0} = 3 \cdot 10^{-5}$ s with a constant inflow of matter in time, which is 5000 solar masses per second, i.e., $1 \cdot 10^{34}$ kg/s [11,12]. World-2 and World-3 spaces are filled similarly. Only vacuum states were filled in our space prior to T_{U_0} [10].

It should be noted that vacuum states are filled with vacuum particles [10]. Nowadays, such particles can be formed as a result of particle-antiparticle annihilation, when these two particles are combined into one vacuum particle devoid of all quantum numbers, including mass. The vacuum particles formation and their excitation to the virtual state is possible exclusively due to the Scalar Field [13]. If such a particle is polarized by a strong Coulomb field in the vicinity of atomic nuclei, then it can be excited by an electromagnetic wave, and free particles shall be formed. Therefore, these are vacuum particles that are responsible for the known vacuum corrections in the physics of elementary particles (corrections to the magnetic moment of an electron, displacement of the fine structure level in a hydrogen atom, etc.).

The existence of the Scalar Field became known from the works of T. Kaluza [17, 18]. Based on this theory, one can conclude that an unknown Scalar Field shall reveal in the Microworld and the Macroworld in the same way as the gravitational and electromagnetic fields appear in the Microworld and the Macroworld. The electromagnetic field is much stronger than the gravitational field; it is maximally revealing itself in the structure of atoms and molecules, interaction between charges. **It is the Scalar Field, which is permanently present in the Universe, that is responsible for existence of masses of elementary particles** (mass is a scalar quantity)¹. Thus, the Scalar Field is able to localize in the vicinity of every elementary particle. This localization ensures information exchange between particles in World-4 and quarks in World-3, resulting in a known quark structure of baryons. As the masses of elementary particles are independent of coordinates in the Metagalaxy, the action of the Scalar Field is the same throughout the Universe. Moreover, it can be stated that **the Scalar Field forms the Universe**. Thus, we identify the Scalar Field from the Kaluza's theory with the Field in World-1 [11, 12]. It is interesting that the Scalar Field gave rise to our Universe, and matter and other fields in the Universe as well; it created conditions for intelligent life and life itself, but we have not yet paid attention to it and have not studied its properties.

From Kaluza's theory it can be concluded that the Scalar Field generates other fields, which ensures the creation of matter, existence of life, evolution of the Universe. The common feature of these fields generated by an elementary particle is the dependence of their magnitude on distance.

Naturally, a question arises about real dimension of all Worlds. It is clear that all possible coordinate axes in World-1 are not revealed, they are closed and form rings of small radii. Therefore, **the local symmetry of the Field can be really spherical in a multidimensional space**. The field of high symmetry can generate spaces and particles of reduced symmetry. Thus, World-2 and World-3 have cylindrical symmetry (a thread of small diameter and a disk of small height), therefore, the real dimension of these worlds is 3. As to World-4, its dimension admits of all possible symmetries,

¹ Theorists believe that the mass of elementary particles is generated due to interaction with the field of the scalar Higgs boson. There is a strict rule in quantum mechanics: only the states with the same symmetry can interact with each other. So, can the Higgs boson, whose probability to exist in the Universe is zero, ensure the existence of mass of all possible particles (both bosons and leptons, scalar and vector particles)? Only Scalar Field has such an opportunity.

including spherical symmetry in three-dimensional space, in this case additional information is transferred from World-1 to World-4 [11, 12].

Thus, the Scalar Field enters through the zero-dimensional space; it carries information about all physical interactions in all layers of the Super-Universe. In addition, it is able to create matter and fields in one-dimensional, two-dimensional and three-dimensional spaces. It follows that the dimension of a multidimensional sphere, which corresponds to the dimension of the Scalar Field, must include all dimensions of one-dimensional, two-dimensional and three-dimensional spaces, and time and information dimensions as well. This **dimension of the Scalar Field admits an information link between neighboring spaces through a single delocalized point**. The delocalization of this point allows the Scalar Field to experience all processes in the Universe in real time. To do this, information from the Universe passes through this point into the neighboring space, and then returns through a distant point to the Universe. Within one Universe, the speed of information transfer equals the speed of light.

Once again, we note that in addition to the revealed dimensions, there are additional folded dimensions [19, 20]. Moreover, the length of any folded dimension is only 1-2 orders of magnitude greater than the elementary (fundamental) length. Due to the presence of such dimensions one can suggest that the diones (Planck particles) have at least a three-dimensional structure, however, they can move only in one dimension. Other dimensions are intended for demonstration of certain properties of particles, and not for their motion. Therefore, the mechanical motion of a particle is possible only along a certain dimension.

Similarly, we can describe the particle space structure of World-3, i.e., the world of quarks, where 2 dimensions are disclosed and at least one dimension is closed. This situation contributes to existence of motion only in two disclosed dimensions.

World-4 is much richer in particles and fields, so it needs at least 7 dimensions (3 of which are closed and one is a time dimension).

It should be reminded that conveniently described World-2 and World-3 three-dimensional spaces neither intersect nor have mutual dimensions with each other and with World-4. Thus, we come to a conclusion that the existing Super-Universe shall have at least (3 + 3 + 7) dimensions. And we get 14 dimensions, if we include the information dimension [11]. Therefore, the fundamental multidimensional sphere has 14 dimensions.

4. THE PROBLEM OF DARK MATTER IN COSMOLOGY

Hereinbefore it was pointed out that there is a discrepancy between the calculated average density of matter in the Universe and the value of density that is actually observed using astronomical means. The reason for this discrepancy had to be sought primarily in the model of the Universe creation, and it was needed to change and finalize it, etc. However, experts believed in the Standard Model as a dogma and could not stray from it. In this case, they purely phenomenologically introduced additional rules that would explain the current state of the Universe. The worst thing is that these postulated rules also contradicted the laws of physics.

In particular, the assumption of the flat Universe was proposed, resulting in creation of the inflationary model of the Universe, where the bulk of space was not filled at all. However, it is not clear from this assumption, what is the cause of superlight speed of space expansion? Once the space is completely empty, there are no reasons for such expansion. Moreover, this assumption contradicts **the law of the space-time-matter triunity**, discovered by A. Einstein. This law is expressed by the equation

$$R_{ik} - \frac{1}{2} g_{ik} (R - 2\Lambda) = \frac{8\pi G}{c^4} T_{ik}$$

that proves non-existence of space without time and matter. This law is binding on all physical fields.

Since there is no understanding of the value of the constant Λ among scientists, it is worth recalling that this constant expresses the spatial distribution of mass and charge of an elementary particle [10]. If $\Lambda = 0$, then the whole mass or charge is concentrated at a point of zero size, i.e., at a singular point, and the space around it has zero values of charge density and mass. It is shown in [10] that $\Lambda =$

$2.7958473 \cdot 10^{-56} \text{ cm}^{-2}$ in our Universe. On the other hand, the value of Λ is related to the size of the Universe and the average density of matter in the Universe.

Later, the scientists drew attention to the discrepancy between theoretical and observational values of density of the Universe matter. Nothing better has been devised than to say that dark energy and dark matter are responsible for such discrepancy [21-23]. A phenomenological theory was created, which was included in the program of COBE, WMAP, and Planck space telescopes operation. This approach led to the following results in space research: the matter of the Universe contains 5% of baryon matter, 23% of dark matter, and 72% of dark energy. Nobody knows what "dark matter" and "dark energy" are, but they believe in their existence. And this happens despite the fact that the physics of high energies and elementary particles is well studied. It is awful that the level of understanding the structure of our Universe by scientists has fallen so low. This fact recalls the belief of scientists of the 18th century in the caloric theory, which supposedly was responsible for heating the matter. But now there is additional information about the amount of dark matter and dark energy in the Universe, which changes. And this despite the fact that the amount of substance is constant in the Standard Model.

Based on the UMIE model, the author considered the processes that take place in the Universe and explain the reliable experimental results.

Firstly, let's compare electromagnetic and gravitational fields created by respective (electric and gravitational) charges, whose intensity depends on distance under the same law. It is known that electromagnetic radiation cannot go beyond a black hole, while this law does not apply to the gravitational field. However, in both cases the presence of quanta of the respective field is postulated. These quanta, carrying mass and energy, must be trapped by a black hole. In this approach to the structure of the Universe, the absorption of matter by a black hole should not be accompanied by the release of energy in the form of electromagnetic or gravitational waves, as well as mass particles. However, this conclusion contradicts the virial theorem and astronomical observations.

Recall that according to the virial theorem for centrally symmetric fields, the kinetic energy must be equal to half the potential energy with opposite sign. However, in the event of a star collapse or particle absorption by a star, the law of energy conservation must be observed. Hence, there is an excess kinetic energy that causes stars to explode. The same excess energy is released when a black hole captures matter from the surrounding space.

In [24] the author, using the UMIE model, gave a comprehensive explanation of processes that accompany absorption of substance from the environment by a black hole and absorption of another black hole. By reference to the laws of symmetry, it is shown that in the first case, the absorption of matter by a central black hole causes the ejection of a flux of fast particles from the poles of the black hole that feed the Fermi's bubbles. In the second case, galactic arms are formed. Moreover, galactic arms of different power arise in pairs. The Scalar Field is fully responsible for these processes. The excess kinetic energy forms streams of the Scalar Field, which in turn forms fluxes of fast particles that feed Fermi's bubbles and galactic arms. Simultaneously with the galactic arms, central bars are formed.

All these processes take place due to multidimensionality of the Scalar Field. It forms a gravitational field, which, unlike the electromagnetic, is a multidimensional one. Only the multidimensionality of the gravitational field allows it to freely leave the black holes. On the other hand, the multidimensionality of gravitational waves results in the fact that the gravitational interaction is almost 40 orders of magnitude weaker than the electromagnetic interaction. This relationship is explained by the fact that the gravitational field, being multidimensional, encompasses World-3 and World-2, where the density of matter is many orders of magnitude greater than in the Universe.

However, additional and very important information about the gravitational field exists. We are talking about the laws of hierarchy that enable our Universe to exist. It is known from systems theory that the probability of instability increases with increasing *complexity* of the system, that is, large systems should not exist in nature, which contradicts the facts. The analysis shows that only those large systems that are organized on a hierarchical principle can be stable. All other systems must come to the end in the process of evolution due to their instability. Hence, the result of the evolution of any natural large system consists in formation of its hierarchical structure [25]. Thus, Victor Kulish

proves that the principle of hierarchy is a fundamental law [25]. According to this law, every hierarchical level in the structure of the Universe must correspond to a **particular** type of interaction between the elements of this level.

We draw attention to the fact that modern physics knows only four types of interactions: weak, strong, electromagnetic and gravitational. V. Kulish singles out 10 interactions, starting with the general integrated interaction, which cannot be represented as the sum of four simple interactions, because physical processes in the initial singularity are essentially nonlinear. Besides, there are two types of electromagnetic interaction (in plasma and in atoms and molecules), and 5 types of gravitational interaction at different hierarchical levels (level of matter, level of planets, level of stars, level of galaxy and level of Metagalaxy). V. Kulish believes that the mentioned electromagnetic and gravitational interactions are in fact degenerated. This means that we have two groups of very close subtypes of interactions: electromagnetic and gravitational interactions.

Regardless of V. Kulish, the author hereof showed how gravitational interaction is realized at different hierarchical levels [13, 26]. To do this, the author used the Law of Unity as the supreme law in the Universe. The unity is absolutely indispensable, because it is assured throughout the Universe by **the mutual sensation of all identical elementary particles**. Basically, their identity is needed precisely for this. The mutual sensation of particles in the Universe is possible only due to **the instantaneous transfer of information** throughout the Universe. Such a possibility exists in the stratified Super-Universe. This means that at every hierarchical level, unity is ensured through the simultaneity of its existence. In other words, during the period of time discreteness (within one oscillation of the Scalar Field) the signal of unity covers the entire hierarchical level. Turning to the stratified Super-Universe, we notice effects that can be successfully used not only to synchronize the motion of matter in discrete time, but also to **instantaneously transfer information between arbitrary points of the World-4**.

We have already mentioned that layers linking in the stratified space occurs only at one point, and this point is delocalized in each of the adjacent layers. Since information is transmitted through a point, then information from every point of World-4 is simultaneously transmitted to every point of World-3, and information from World-3 can be transmitted to any point of World-4. Thus, it is logical to conclude that **the Scalar Field can directly maintain synchronization and Unity of World-4**. Hence, the manifestation of the unity of all identical particles in the Universe is ensured by interaction between the layers of the stratified space of the Super-Universe, in particular, between particles of World-4 and World-3, due to multidimensionality of the Scalar Field.

It should be noted that the experimental data obtained by Kozyrev [27, 28] confirm the conclusions about the possibility of instantaneous transfer of information in the Universe.

Using this property of the multidimensional Scalar Field, the author in [29] showed that the Scalar Field is aware of all the properties of matter in the Metagalaxy at a given moment of time.

In view of the UMIE model, the author of this paper described in detail the fundamental interactions, taking into account the information exchange between particles in adjacent layers of the stratified space [29-31]. All fundamental interactions take place with the participation of the Scalar Field. At the same time, the processes take place simultaneously in World-4 and World-3.

It is already noted that the Scalar Field, being present near every elementary particle, is responsible for its mass. In order to create interaction between particles, it excites a vacuum particle at the expense of its own energy, and creates a virtual boson of fundamental interaction. This boson targetedly moves toward the partner particle. The energy of the Scalar Field transfers in the opposite direction. Then the virtual particle returns to the vacuum, generating creation of the next virtual particle.

Similarly, there is an electromagnetic interaction with participation of a virtual quantum of electromagnetic field. In this case, a standing electromagnetic wave is formed between the interacting particles, whose length is twice the distance between the interacting particles.

The similar process takes place in the case of gravitational interaction. However, there is a substantial difference between these two types of interaction. Electromagnetic interaction propagates in the Universe at the speed of light. Hence, it prevents interaction between distant particles on a cosmic

scale, as all planetary and stellar systems are in motion. Therefore, the electromagnetic interaction between the Earth and the Sun is not revealed.

As to the gravitational interaction, it occurs at every hierarchical level due to the fact that the Scalar Field is aware of location of matter in the Universe at any time. The Scalar Field is responsible not only for creating the mass of matter, but it also organizes multidimensional gravitational waves that ensure interaction between stars and stellar systems in galaxies, and between all galaxies in the Universe as well. And according to the Law of Unity, the transfer of this interaction takes place with the participation of World-3, so that the effective value of the speed of interaction transfer significantly exceeds the light speed. Therefore, the interaction is revealed between distant objects, despite their motion in the space of the Universe.

Thus, optical observations which capture matter that has emitted light billions of years ago, can detect no more than 8% of the density of matter in the Universe [32], while gravitational interaction registers the current state of matter distribution, i.e., all 100%. Therefore, this fact explains the above paradox. And it becomes clear that there is no dark matter and dark energy at all. The physics of the last century has worked hard enough to understand that such matter and energy cannot exist. All that is needed is to change the model of the Universe by rejecting the Standard Model.

5. CONCLUSION

Based on the analysis of information about dark matter in the Universe, and using the results of the own research, the following conclusions are given in the paper:

1. The Universe is an integral part of the Super-Universe, which is represented by a stratified space, and our Universe is one of the layers. The particular layers do not intersect, but possess an information link created by the multidimensional Scalar Field, which carries the fundamental code of the Super-Universe creation and evolution.
2. The Scalar Field is responsible for the masses of elementary particles. Every elementary particle is surrounded by a cloud of the Scalar Field. In turn, it allows the elementary particles of World-4 to demonstrate informational exchange with quarks of World-3.
3. The Scalar Field participates in all types of physical interactions. It excites bosons responsible for the interaction between particles, from the vacuum state to the virtual one. Then, the boson moves to another particle, and the respective energy of the Scalar Field moves toward it. Then, the virtual boson returns to its vacuum state.
4. The fundamental difference between electrostatic and gravitational interaction lies in the fact that electromagnetic interaction takes place within World-4, while gravitational interaction exists due to the transfer of a multidimensional wave set by the Scalar Field.
5. The multidimensionality of gravitational waves is caused by the fact that the gravitational interaction is almost 40 orders of magnitude weaker than the electromagnetic one. On the other hand, this fact is positive for the existence of the Universe, galaxies, stars, planets, for the existence of life on Earth.
6. The effective speed of gravitational waves varies at different hierarchical levels, resulting in the creation of planetary systems, star systems, galaxies, galaxy clusters. At all hierarchical levels, the actual massive objects enter into gravitational interaction. Thus, all 100% of matter in the Universe participates in gravitational interaction. It exhausts the paradox between the real density of matter in the Universe and the density that can be observed in astronomical research.
7. As it follows from the results given in the paper, there is no reason to consider unknown dark matter and dark energy. It is just needed to replace the model of the Universe creation. The UMIE model permits to understand real processes that take place in the Universe. Moreover, the laws of physics are not violated.

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