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Supermassive Black Holes in Young Galaxy

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Abstract

The article considers the mechanism for creating massive black holes in young galaxies within the framework of the model of the Universe with minimum initial entropy (UMIE). It shows that galaxies form immediately after the Universe begins loading with matter. In this case, matter enters the Universe at a constant speed, increasing the mass of star embryos. The initial distance between the planes of galaxies is of the order of 0.1 m. At the same time, uncertainties in the initial coordinates of star embryos and galaxies, which are described by the Gaussian function, can be 0.02-0.05 m. This can cause several galaxies to merge, producing massive stars and massive central black holes in young galaxies. Unique cases are possible when the merged galaxies merge again, creating several massive holes.

Keywords: The UMIE model, the embryos of stars and galaxies, the merger of galaxy embryos, the creation of massive black holes in young galaxies.

Introduction

The problem of galaxy formation has long concerned astrophysicists since the Standard Model of the Universe was developed. With the discovery of the galaxy's divergence (Hubble, 1929), it became clear that, in retrospect, all matter must contract. Assuming that the mass of matter in the Universe is a constant, it can be understood that the compression of matter will lead to its heating. However, when creating the model, they forgot that compressing matter should lead to the creation of a black hole.[1,2] The calculation shows that the gravitational radius of the Universe should be $r_g \sim 7\cdot 10^9$ light-years. In this case, the birth of the Universe through the Big Bang would be impossible. This fact is not taken into account by the supporters of the Standard Model.

Thus, the model of the creation of the Universe (Georgy Gamow, 1946–1948), called the Standard Model, was born.

Based on G. Gamov's model, scientists believe that initially the Universe was in conditions characterized by high temperature and pressure in the singularity, that is, in the point where all matter was concentrated. As a result of the Big Bang, the Universe expanded. Pressure and temperature decreased. All known elementary particles appeared, and over time plasma recombined; hydrogen and helium atoms formed, and light separated from the plasma. This model is supported by the presence of relic radiation,[3,4] that is, microwave radiation, which is currently characterized by a temperature of -270.425 °C = 2.725 K.

Assuming that the initial diameter of the singularity point had finite dimensions (the Planck length is used in this case), the found initial temperature of the nucleus of the Universe was $\sim 10^{28}$ K.[5] The initial entropy was extremely large ($S_0 = 10^{88}$ J/K).[6]

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

For unknown reasons, in the presence of the Universe's large entropy, it structures itself into galaxies, stars, and planetary systems. All these processes should occur with a decrease in entropy. Fluctuations in the density of matter, which scatter, are not enough to create an ordered hierarchical system of the Universe.

There are many comments on the Standard Model. In particular, from Hubble's law, you can find the average density of matter in the Universe. However, astronomical observations find only 4-5% of matter. In this regard, the Standard Model has been radically modified. It is now called ΛCDM, where Λ is dark energy (70%), and CDM is Cold Dark Matter (25%). And only about 5% is ordinary matter. Experts replaced one nonsense with another, even worse. And the reason is that no one gave up on the Big Bang.

In addition to the aforementioned replacement of the Standard Model, many other models of the Universe's development impose additional violations of the Standard Model's laws of physics to satisfy the results of astronomical research.

In the Standard Model, matter is not born immediately after the Big Bang, but only after some time, in the era of nucleosynthesis. After a time of $\sim 10^{-6}$ s, quarks, leptons, and intermediate bosons are created; quarks merge into hadrons, and quark confinement occurs. After 380,000 years, the plasma recombines. It becomes transparent to radiation, which immediately leaves the matter. The strange thing is that we see the first created stars and galaxies and do not see how light separates from the plasma. In addition, the first stars and galaxies, which contain supermassive black holes at their centers, were born much earlier[7-10] than calculations based on all known models predict. At the same time, the masses of young galaxies were much smaller than the mass of the Milky Way galaxy.

Believing that all models of the creation of the Universe that require a Big Bang are wrong, the author of this post created his own model, called the Universe Model with Minimum Initial Entropy (UMIE). This model explains all known facts about the structure of the Universe without using dark energy and dark matter as non-existent elements.

The first galaxies in the UMIE model

The UMIE model is based on T.F.E. Kaluza's theory, which combined gravitational and electromagnetic interactions on the hypothesis that our world is represented as a curved five-dimensional space-time. As in four-dimensional space-time, it was believed that one coordinate is temporal and four are spatial.[11,12] The consequence of developing this theory is the Scalar Field (SF). This field is not a force field! It has completely different properties.[13] It does not need a field-carrier particle. For some unknown reason, physicists do not pay attention to this fact.

In addition, the author used the concept of stratified space,[14] which is absolutely necessary for the existence of the Universe and all known interactions, as well as the law of hierarchical systems, without which a stable state of matter in the Universe is impossible.[15] Stratified space is a Super-Universe, which consists of zero-dimensional space (World-1), one-dimensional space (World-2), two-dimensional space (World-3), and our three-dimensional space (World-4). Initially, all these spaces were represented by collapsed spatial coordinates of fundamental dimensions. Through World-1, the SF[13] began to enter at a constant speed. In addition, time enters World-1 at a constant speed. In World-2, one (out of three) spatial coordinate expands; in World-3, two (out of three) spatial coordinates, and in World-4 – three (out of six) spatial coordinates. At the same time, all expanding spatial coordinates remain closed.

The entire Super-Universe is created simultaneously. However, it fills with matter in stages. The SF, entering through zero-dimensional space, carries energy and information about all physical interactions. In addition, it can create matter and fields in all layers of the Super-Universe. It follows that the dimension of the multidimensional sphere of World-1, which corresponds to the dimension of the SF, must include all dimensions of one-dimensional, two-dimensional, and three-dimensional spaces, as well as time and information dimensions. In work,[1] it is shown that the Super-Universe, and therefore the fundamental multidimensional sphere, has 14 dimensions.

In World-2, the SF creates dyons - Planck particles - which contain electric and magnetic charges (magnetic monopoles), and in World-3, quarks. The SF provides information about interactions between spaces.

The properties of the SF are significantly different from those of the electromagnetic field. While the electromagnetic field is capable of creating a particle-antiparticle pair under certain conditions, the SF creates a material object devoid of all quantum numbers except mass, for example, a bineutron or a complex of bineutrons in a singlet state. Such particles are born in three-dimensional space. Complexes of the corresponding particles are created in two-dimensional and one-dimensional spaces. Antimatter does not exist in our Universe. Since the SF is not a charge carrier, the matter it generates must be electrically neutral. Therefore, the law of conservation of total electric charge exists in all spaces.

The mass of elementary particles is formed due to the fact that there is an SF in the vicinity of each particle. Only the presence of SF is responsible for the processes of annihilation of a particle with an antiparticle, during which vacuum particles are created.[14]

The information connection between three-dimensional and two-dimensional spaces leads to the appearance of particles in two-dimensional space that are rigidly connected to the baryons of three-dimensional space. 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 $q_1 = \pm q_2/2 = \pm e/6$. The initial temperature of vacuum particles, and then of bineutrons in three-dimensional space, will be equal to 0 K. Later, new particles will be born mainly near existing particles (nucleons), increasing the mass of newly formed nuclei. Nuclear fission reactions will occur, leading to the birth of protons and electrons and heating matter. This explains why heavy chemical elements, including uranium and plutonium, are present on Earth, and why the central regions of all planets and stars are hot.

The creation of massive black holes in young galaxies

Let us consider the problem of creating massive black holes in the UMIE model. The Universe has a hierarchical structure, which determines the fulfillment of the Law of Similarity.[16] Moreover, in[16] the principle of hierarchical similarity was considered as a new fundamental law of physics. Therefore, according to the Law of Similarity, the birth of the Universe should be similar to intrauterine development and the birth of a child. That is, the Universe should be represented by a layered Super-space, as described above.[1]

SF in all spaces of the stratified Super-Universe creates particles of matter according to the formula $E = mc^2$. In World-4, SF creates bineutrons at a constant speed of $\upsilon_m = 10^{34}$ kg/s. At the same time, the initial density of the substance does not exceed the nuclear density.[1] This explains why there is no antimatter in our space.

The volume of the Universe at the beginning of its loading with matter ($r_4 = 9$ km)[1]:

$$V_3 = 2\pi^2 r_4^3 \approx 14390 \text{ km}^3$$

Estimates of the number of galaxies in the Universe give $4.6 \cdot 10^{10}$.[17,18] So, one galaxy has an average of 313 m^3. Let's inscribe the flat structure of the galaxy into a square with a side of (20 ± 5) m. In this case, the average distance between neighboring galaxies will be 0.5÷1.4 m.

Considering the fact that, according to the requirements of the hierarchy law, galaxy clusters were created immediately, the distances found were several times smaller R_0 = (0.1÷0.5 m).

We obtained the result for the average static distribution of matter at the initial moment of filling the Universe with matter. However, there could actually be fluctuations and uncertainties in the initial coordinates of the nuclei of stars and galaxies, which are described by the Gaussian function

$$R = R_0 \cdot exp\,(-\frac{(x-R_0)^2}{(2\cdot\sigma^2)})/\sqrt{2\pi\sigma^2},$$

where σ^2 is the variance of the random variable.

Figure. 1 shows the resulting statistical distribution of distances between galaxies as a function of the variance σ^2, for $R_0 = 0.1$ m, with the peak normalized to unity.

Figure. 1 shows that with a sufficiently large variance σ, neighboring galaxies can merge. As a result, as a result of the statistical distribution, mergers of two or more galaxy nuclei are possible. The calculation shows that at σ=0.01, galaxy mergers are unlikely. However, already at σ=0.02 about 1.84·106 binary galaxies can be created. This value will increase by 2-3 orders of magnitude with an increase in the value of σ (Figure. 1).

It is clear that the probability of creating a black hole in merged galaxies will be the greater the number of galactic nuclei merged into one galaxy.

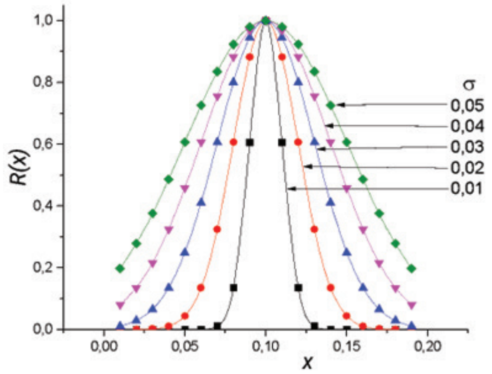

Figure 1. The distribution of distances between galaxies at the time of their birth

If the average distance between stars in the Galaxy is considered equal to 3÷5 light years, then in the germ of galaxies it will be 0.6÷1 mm. Of course, with the expansion of space, this distance increases with an average speed of ~2 km/s. And at the same time, the mass of the star increases at an average rate of $4.76 \cdot 10^{12}$ kg/s.[1] Fluctuations in the distances between galaxy nuclei should ensure a distribution of distances between galaxies. In addition, galaxy mergers are also possible from the mergers of stellar cores. There should not be many of them, but they will ensure the appearance of giant stars that exist in our time.

Finally, because the distance between stars in galaxy nuclei was very small, and even smaller in merged galaxies, this raises the possibility of creating massive black holes.[8,9] Therefore, it is not surprising that in young galaxies, which have a diameter of the order of 50 light years and a mass $<10^9\ M_\odot$, massive black holes already exist, the mass of which can reach 5% of the mass of the young galaxy.[8]

Here we consider the case in which galaxy nuclei, whose centers lie on the same axis, merge. However, there are unique cases in which merged galaxies that do not share a common axis merge.[19] In such galaxies, astronomers can observe several massive black holes. In addition, it is possible that at the initial moment, separate formations from a large number of galaxy nuclei are possible, as a result of which a supermassive central black hole may be created, which will form a spherical region of matter, the outer part of which will be represented exclusively by hydrogen and helium atoms.

So, galaxies are created immediately after the beginning of the influx of matter into the Universe. As space expands, the size of the galaxy also increases. At the same time, the mass of stars increases over time due to the birth of bineutrons in the vicinity of existing nucleons. When a large mass is reached, atomic nuclei decay, forming all known isotopes; the matter heats up, and the star begins to emit thermal radiation. So, the heating of stars and the inner regions of planets is due to ordinary radiation processes. Moreover, the condensation of created atoms of the same nature in the inner regions of stars and planets will cause atomic explosions, which are accompanied by deep-focus earthquakes on the Earth and by constant explosions on the Sun's surface. It is necessary to understand that in the central part of the Sun, according to the laws of thermodynamics, the nuclei of heavy chemical elements are concentrated. Therefore, the thermonuclear reaction of combining protons into helium nuclei will be simply impossible.

When stars reach a certain luminosity, modern telescopes can observe them. Of course, first, they will be recorded by infrared and radio telescopes because of the low temperature of the star's surface. Therefore, we will see galaxies not immediately after the birth of the Universe, but only when they reach a certain critical mass.

It is worth noting that gravitational interaction reflects the current state of galaxies,[17] while astronomical studies record the past of the material system of the Universe, where all material objects increase their mass over time. This means that in astronomical studies we see only 4-5% of the total mass of matter in the Universe.[20]

Conclusion

In the UMIE model, galaxies are created immediately after the start of the loading of the Universe with matter. The initial distance between the planes of galaxies is of the order of 0.1 m. At the same time, the uncertainties in the initial coordinates of the star nuclei and galaxies, which are described by the Gaussian function, can be 0.02-0.05 m. As a result, there will be a high probability of merging several galaxies and stars in them. This can lead to the formation of massive stars, as well as a massive central black hole in young galaxies.

When stars reach a certain radiative capacity, modern telescopes detect them. Therefore, we will not see galaxies immediately after the birth of the Universe, but only when they reach a certain critical mass.

Gravitational interaction shows the current state of galaxies,[17] while astronomical studies record the past of the material system of the Universe. Since stars and galaxies increase their mass over time, astronomical studies show only 4-5% of the total mass of matter in the Universe.

References

1. P. O. Kondratenko, "The birth and evolution of the Universe with minimal initial entropy," *Int. J. Phys. Astron*. 3(2), 1–21 (2015). https://doi.org/10.15640/ijpa.v3n2a1
2. P. O. Kondratenko, Model of the Universe's Creation with Minimal Initial Entropy: Fundamental Interactions in the Universe (LAP LAMBERT Academic Publishing, 2017), 130 p.
3. P. J. E. Peebles, "The Standard Cosmological Model," in Rencontres de Physique de la Vallée d'Aosta, edited by M. Greco (1998), p. 7. https://ned.ipac.caltech.edu/level5/Peebles1/frames.html
4. S. M. Andrievsky and I. A. Klymyshyn, Course of General Astronomy (Astroprint, Odesa, 2010), 478 p., ISBN 978-966-190-338-5.
5. D. S. Gorbunov, V. A. Rubakov, Introduction to the Theory of the Early Universe: The Theory of the Hot Big Bang (INR RAS, Moscow, 2006), 464 p., ISBN 978-5-382-00657-4.

6. D. S. Gorbunov, V. A. Rubakov, Introduction to the Physics of the Early Universe: Cosmological Perturbations, Inflation Theory (Krasand, Moscow, 2010), 564 p., ISBN 978-5-396-00046-9.
7. D. Yang, J. F. Hennawi, F. Guarneri, et al., "Euclid: Discovery of 31 new quasars at 6.6 < z < 7.8," *Astron. Astrophys*. 711, A104 (2026). https://doi.org/10.1051/0004-6361/202658883
8. A. J. Taylor, V. Kokorev, D. D. Kocevski, et al., "CAPERS-LRD-z9: A gas-enshrouded little red dot hosting a broad-line active galactic nucleus at z = 9.288," *Astrophys. J. Lett*. 989, L7 (2025). https://doi.org/10.3847/2041-8213/ade789
9. L. Ighina, A. Caccianiga, T. Connor, et al., "X-Ray Investigation of Possible Super-Eddington Accretion in a Radio-loud Quasar at z = 6.13," *Astrophys. J. Lett*. 990(2), L56 (2025). https://doi.org/10.3847/2041-8213/aded0a
10. G. Roberts-Borsani, P. A. Oesch, R. Ellis, et al., "JWST spectroscopic insights into the diversity of galaxies in the first 500 Myr: Short-lived snapshots along a common evolutionary pathway," *Mon. Not. R. Astron. Soc*. 548(3), stag701 (2026). https://doi.org/10.1093/mnras/stag701
11. W. Hurewicz, H. Wallman, Dimension Theory, Princeton Mathematical Series, Vol. 4 (Princeton University Press, Princeton, NJ, 1941), 232 p.
12. Yu. S. Vladimirov, Space-Time: Explicit and Hidden Dimensions (Nauka, Moscow, 1989), 191 p., ISBN 5-02-000003-9.
13. P. O. Kondratenko, "Scalar Field in Model of the Universe with Minimal Initial Entropy," *Int. J. Adv. Res. Phys. Sci*. 4(4), 23–31 (2017).
14. I. L. Gerlovin, Fundamentals of a Unified Theory of All Interactions in Matter (Energoatomizdat, Leningrad, 1990), 433 p., ISBN 5-283-04642-7.
15. V. V. Kulish, Hierarchic Electrodynamics and Free Electron Lasers: Concepts, Calculations, and Practical Applications (CRC Press–Taylor & Francis Group, 2011), 697 p., ISBN 978-1-138-11351-0.
16. V. V. Kulish, Hierarchic Electrodynamics and Free Electron Lasers: Concepts, Calculations, and Practical Applications (CRC Press–Taylor & Francis Group, 2011), 697 p.
17. P. O. Kondratenko, "Universe Hierarchy and Gravitational Interaction," *Int. J. Adv. Res. Phys. Sci*. 10(9), 1–9 (2023). https://doi.org/10.20431/2349-7882.1009001
18. I. Labbé, P. van Dokkum, E. Nelson, et al., "A population of red candidate massive galaxies ~600 Myr after the Big Bang," *Nature 616(7956)*, 266–269 (2023). https://doi.org/10.1038/s41586-023-05786-2
19. H. Übler, G. Mazzolari, R. Maiolino, et al., "BlackTHUNDER: Evidence of three massive black holes in a z-5 galaxy," *Astron. Astrophys*. 712, A80 (2026). https://doi.org/10.1051/0004-6361/202557419
20. P. O. Kondratenko, "The Evolution of the Universe in a Model with Minimal Initial Entropy," *Int. J. Adv. Res. Phys. Sci.* 6(3), 24–36 (2019).