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Black Holes and Quasars

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Abstract: *The article indicates that Roger Penrose's theory of black holes, based on the General Theory of Relativity, is unable to describe the behavior of a system and, in particular, a black hole in dynamics, since the formation of new particles during the development of a black hole leads to a violation of symmetry in time. After the discovery of galactic dark matter and intergalactic dark energy, which form 95% of the mass-energy of the Universe, the further development of the theory of the origin and evolution of black holes lies on the path of rejection of the geometric theory of gravity in general relativity of Einstein and the recognition of a fifth interaction between dark and baryonic matter. New astronomical observations of recent years say with certainty that black holes in their development into quasars become not a gravedigger of baryonic matter, but the source of Baryonic Matter and Energy.*

Keywords: *dark matter, baryonic matter, black hole, quasar, Energy*

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1. INTRODUCTION

The black hole and the quasar are two of the most intriguing mysteries in the universe. No one can say with certainty what it is, why they exist and what processes occur inside them. A quasar cannot exist without a black hole, and a black hole, in turn, can do without a quasar. Many people know that quasars are the brightest objects in the universe. But the fact that quasars are born as a result of the evolution of black holes is still very few people know According to the results of astronomical observations of the Planck telescope, the Universe consists of [1]:

-dark energy (68.3%)

-dark matter (26.8%)

-common (baryonic matter) (4.9%)

Of approximately 5% of baryonic matter, 4/5 of the mass is in the interstellar medium, and only 0.5% of the average density of the Universe is concentrated in stars. Dark matter fills a fifth of galactic space. It has been found that a dark matter halo forms spheres around galaxies, stars, planets and black holes, which rotate with them [2].

By the way, for the discovery of the rotating nucleus of a superblack hole in the center of our galaxy, two other physicists, German Reinhard Henzel and American Andrea Gez, became laureates of the 2020 Nobel Prize, along with Roger Penrose. In the new cosmology, a dark matter halo can appear in the primary Universe as a rather dense object that can shrink (they say, collapse) under the action of gravitational forces into a black hole. The question arises whether such astrophysical configurations of the core – dark matter halo can be formed at all and whether they remain stable on cosmological time scales. A new article by Carlos R Argüelles, Manuel I Díaz, Andreas Krut, Rafael Yunis "On the formation and stability of fermionic dark matter haloes in a cosmological framework" gives an affirmative answer to this question [3]. Moreover, the results obtained prove that a dark matter halo with a core – halo morphology is a very likely outcome at the nonlinear stages of structure formation of black holes. In general, agreeing with the conclusions of the authors of the article [3]. In my article "Roger Penrose and black holes" it is indicated that the further development of the theory of the origin and evolution of black holes lies on the path of rejection of Einstein's geometric theory of gravity in general relativity and recognition of the fifth interaction between dark and baryonic matter [4]. The new concept of gravity allows one to describe the gravitational interactions of bodies similarly to the electric and magnetic interactions and does not contradict other experimentally substantiated approaches to describing the phenomenon of gravity and inertia, in particular, some models involving dark matter as a superfluid space medium [5]. At the same time, experiments show that if an external field acts on the vacuum, then due to its energy it is possible to create real particles [5]. Precisely because the vacuum is not a virtual, but a real physical object (dark matter) and has a structure, the polarization of the vacuum leads not to virtual, but to real radiative corrections to the laws of quantum electrodynamics [5]. In the theory of gravitation, vacuum polarization is also present, and theoretically it manifests itself at extremely small Planck distances ~ 10^{-35}m. It is assumed that the processes of gravitational polarization of the vacuum play an important role in cosmology [6]. Now the hope of updating the standard model and recognizing the fifth fundamental interaction is associated with sensational experiments carried out by scientists at CERN and at an accelerator at a science center near Chicago. The new international corporation also includes physicists from Russia. Researchers were interested in the anomalous magnetic moment of muons, which does not coincide with what the calculations give by the Standard Model. Professor Mark Lancaster, one of the leaders of the study, said: “We are delighted that our data do not agree with the Standard Model, this opens up a future with new laws of physics, new particles and new forces never seen before.” [7]. Professor Yonotan Feng stated that the fifth interaction does not violate any laws of nature. The new scalar field may belong to a hypothetical dark matter particle - the protophobic X-boson, which, like the Higgs boson, creates a scalar field responsible for the fifth interaction between dark matter and ordinary (baryonic) matter. Dr. Jonathan Feng of the University of California, Irvine said in a 2017 press release: “For decades, we have known about four fundamental forces: gravity, electromagnetism, and strong and weak nuclear forces. The discovery of possible fifth force acting between baryonic and dark matter will completely change our understanding of the Universe, which will entail the unification of the fifth force and dark matter. The protophobic X boson of dark matter makes it possible to explain a number of experiments in which the anomalous magnetic moment of the muon is observed and is associated with the fifth interaction” [8]. The axial rotation of the black hole core is also associated with the fifth interaction between baryonic matter and quantum vacuum (dark matter). Taking into account all the properties of the magnetic field surrounded by black holes reaching 2000 Tesla and morein the new electrodynamics [9] makes it possible to detect, in addition to the well-known transverse Lorentz forces, also the longitudinal magnetic field forces generated in the quantum vacuum by displacement currents and causing the rotation of the nuclei of black holes, stars and planets [10]. By the way, for the discovery of the rotating core of a superblack hole in the center of our galaxy, two other physicists, German Reinhard Henzel and American Andrea Gez, became laureates of the 2020 Nobel Prize, along with Roger Penrose. At the edge of a black hole, the quantum vacuum is in a conditionally stressed state, as a result of which it is polarized in a quantum manner. Nothing of the kind follows from Einstein's General Theory of Relativity. Einstein's general relativity, in general, is incompatible with quantum concepts. And quantum theory, in turn, cannot operate with dimensionless material points that are manipulated by general relativity. Studying the behavior of quantum fields near a black hole, Stephen Hawking predicted that a black hole necessarily radiates particles into outer space and thereby loses mass [11]. This effect is called Hawking radiation (evaporation). To put it simply, gravitational and magnetic fields polarize vacuum (dark matter), as a result of which the formation of not only virtual, but also real particle-antiparticle pairs is possible. According to Hawking, on the surface of the event horizon, the direction of expansion of the generated particles ceases to be random, i.e. becomes polarized, namely, orthogonal to the BH surface [11]. The existence of stable Hawking radiation - the process of emission of various particles by a black hole - was first proved by specialists from the Israel Institute of Technology. The experiment, conducted by Israeli scientists, had to be repeated 97 thousand times over a period of 124 days. To create an analog of a black hole 0.1 millimeter long, the researchers required 800 rubidium atoms. It is assumed that in the future, experts will be able to extract energy from black holes using a singular reactor. According to the theory, the energy will be generated by Hawking radiation. Scientific material describing the creation of a sound-like black hole in the laboratory was published on February 19, 2021 on Phys.org. [12]. As a result, a huge amount of matter is thrown into the surrounding space of the black hole. This matter is a plasma of the most elementary particles of the universe. In fact, it is a huge and still very dense cloud of plasma, retaining the shape of a disk. Its rotation speed is close to the speed of light, and the direction of rotation coincides with the direction of rotation of the original black hole. Modern astronomers call such a disk a quasar.

2. QUASARS - FACTORIES OF BARYONIC MATTER AND THE SOURCE OF ALMOST ALL NEUTRINOS

In the laboratory, for the first time, a substance was obtained that has properties identical to the plasma in the vicinity of a black hole. This is stated in the joint work of Russian, Japanese and French scientists [13]. In laboratory conditions, accretion disks of a black hole were obtained. This is the kind of structure that results from a diffuse material with a rotational moment on a massive central body. The compression of matter, as well as the release of heat as a result of the friction of the differentially rotating layers, leads to the heating of the accretion disk. Plasma flowing from one component of the system to another has a significant angular momentum: it appears due to orbital motion. Therefore, plasma particles cannot fall on the star radially. Instead, they move around it in Keplerian orbits. As a result, a plasma disk is formed, in which the velocity distribution corresponds to Kepler's laws. According to it, the layers located closer to the star will have high speeds. However, due to friction between the layers, their velocities are leveled, and the inner layers transmit part of their angular momentum outward. As a result, the inner layers approach the star and eventually fall on its surface. In fact, the trajectories of individual plasma particles are in the form of spirals that slowly twist. The radial displacement of matter in the accretion disk is accompanied by the release of gravitational energy, part of which is converted into kinetic energy (acceleration of gas movement when approaching a star), and the other part is converted into heat and heats the disk matter. Therefore, the accretion disk emits thermal electromagnetic radiation. The kinetic energy of the gas upon collision with the surface of the star is also transformed into thermal energy and radiated. The main property of the formation of such X-ray sources will be strong magnetic radiation. Its magnetic field and induction can reach several thousand Tesla, researchers from the LaPlaz Institute, NRNU MEPhI and the CELIA laboratory of the University of Bordeaux note in their work [13]. The uniqueness of the experiment is that the parameters of the obtained plasma do not need to be scaled; they correspond to the actual parameters of the plasma in the vicinity of the black hole of close binary systems of the Cygnus X-1 type. Matter with a temperature of billions of degrees, a density of 10^{18} particles per cm^3 and a frozen-in magnetic field of more than 2,000 Tesla was formed in the volume of the target for several picoseconds. It is these parameters that can be found in plasma in the active region of X-ray sources. The volume of incandescent magnetized matter was sufficient to have the main characteristics of its cosmic prototype. This was also facilitated by the experimental conditions, in particular, the fact that inside the plasma volume the magnetic fields were directed towards each other in such a way that in the area of contact of the opposing magnetic lines, the annihilation of the magnetic field took place, leading to the appearance of fluxes of electrons and positrons with velocities close to the speed of light. Since fast magnetic reconnection in the ergosphere should occur intermittently in the scenario proposed here, the associated emission within a few gravitational radii from the black hole is expected to display a bursty nature" [13]. This process resembles the creation of relativistic electron-positron pairs found in near-Earth space during reconnection - an explosive contact between two magnetic field lines in thin layers of the Earth's magnetosphere, studied in detail by the MMS mission [14]. The experiment showed that the technique developed by an international group can create not only quasi-stationary magnetic fields of record magnitude, but also simulate the state of the plasma arising in them with a high energy density of matter and electromagnetic energy. As a result, we get an electron-positron mixture in the vicinity of the black hole, consisting of approximately equal numbers of negative electrons and positive positrons. In a free state, electrons and positrons annihilate - this is an indisputable fact. However, in an accretion disk, electrons and positrons are not entirely free. They continue to rotate by inertia as part of the plasma disk at about the speed of light. And it is this speed, or rather the force of inertia, that keeps them from direct collisions and complete mutual destruction. At this stage, electrons and positrons form dipole structures - positroniums. Experimentally, such a pair was first discovered in 1951 by the German physicist Martin Deutsch and reliably established by Professor DB Cassidy and his assistant AP Mills Jr. in 2007 [15].

The substance of the plasma disk is gradually stratified into electrons-positrons and neutrons. The massive appearance of neutrons on the outskirts of the plasma disk marks a fundamentally new stage in the life of the formation of the universe. From this moment, the assembly line for the production of chemical elements begins to work. Experimental physics has established for certain that a free neutron decays into a proton and an electron in about 15 minutes. Due to this, the most widespread substance in the universe is born at the exit - hydrogen. Hydrogen atoms gradually accumulate inside the rotating plasma disc. At some point, the density of hydrogen reaches a critical value. and the free escape of neutrons from the plasma disk becomes difficult. The next cycle of synthesis of atoms of matter begins. Free neutrons are forced to combine with the protons of the previous hydrogen cycle. As a result, the familiar atoms are formed from two protons and one neutron. This is nothing more than the next chemical element in the periodic table - helium. Such cycles in a neutron centrifuge are repeated for each new chemical element. Moreover, the further along the periodic table we move, the denser the outer nucleon layer becomes and the fewer atoms of the new substance are formed at the exit. It is for this reason that in our universe, hydrogen makes up 70% of the total mass of all chemical elements. The described process allows us to understand how the synthesis of all chemical elements of the universe proceeds. This is not an explosive thermonuclear fusion in the depths of several generations of stars, but a neat assembly of atoms of chemical elements from elementary particles using a very fast plasma centrifuge. Such a synthesis of atoms of matter, in contrast to thermonuclear fusion, is an extremely energy-intensive process. In our case, the source of energy is a black hole. To be absolutely precise, its mass is multiplied by the square of the speed of light. Despite the colossal amount of this energy, the synthesis of chemical elements must sooner or later stop. Previously, astrophysicists believed that as soon as a quasar appears in a galaxy, the formation of stars in it ends almost immediately. Later, astrophysicists established that there are galaxies that live with quasars, but they are cold, that is, their reserves of cold gas are not exhausted, and the birth of stars can continue. Allison Kirkpatrick, assistant professor at the University of Kansas at Lawrence, says: "Galaxy CQ4479 shows us that the existence of active black holes does not always stop the birth of stars." This statement contradicts modern scientific knowledge about such systems [16]. Astrophysicists observe the cold quasar with NASA's unique SOFIA infrared telescope. It is installed on board a Boeing 747 aircraft. Astronomers are primarily concerned with the process of energy release near a black hole. If it increases, it can stop the formation of stars. Thanks to CQ4479, it became clear that even such a process as the presence of active black holes does not instantly affect the process of star birth. And this, of course, does not agree with the scientific predictions known so far [16]. For 2021, scientists have planned a new study with which they will try to find out whether this is happening in other galaxies, whether processes such as the birth and development of a star and the growth of a black hole are taking place inside them. at the same time. In addition, it will help to understand what effect quasars have on the shape of the galaxy in which they exist.

In addition to baryonic matter, astrophysicists have established that quasars of supermassive black holes in the centers of galaxies are the source of almost all neutrinos that come to Earth from space [17, 18]. Neutrinos, which travel at very high speeds, are good candidates for hot dark matter. In particular, they do not emit or absorb light - they appear "dark". It has long been assumed that neutrinos, which come in three different types, have no mass. But experiments have shown that they can change (fluctuate) from one species to another. Crucially, scientists have shown that this change requires mass on them - making them a legitimate candidate for hot dark matter. Several years ago, physicists at the Pierre Auger Observatory discovered the first hints that all of these particles are of extragalactic origin. Three years ago, researchers at the IceCube Antarctic Neutrino Observatory discovered one of the possible sources of these neutrinos - blazar TXS 0506 + 056. Blazar is located in the constellation Orion, from which light travels to Earth for about 4.33 billion years. The formation of superluminal neutrinos is associated with the collision of ultrahigh-energy protons with surrounding photons, at which neutrinos appear and a proton disappears. Protons or heavier nuclei accelerated to ultra-high energy near a dark hole collide with atomic nuclei or low-energy photons. In this case, π- and K-mesons are formed, the decay of which gives rise to cosmic neutrinos of high energies. It can be assumed that baryonic matter (proton) passed into a particle of hot dark matter (neutrino) with energy absorption. The process leading to the production of gamma rays and neutrinos generated by the interaction of protons with acceleration to ultrahigh energies with matter is presented in (Fig.1) [17].

Although neutrinos react very weakly with matter, the probability of a reaction increases with energy, therefore superluminal neutrinos were confidently detected by the IceCube observatory in the observations of Moscow State University professor Vladimir Lipunovo in June 2020 over the part of the Universe in which TXS 0506 + 056 is located [19].

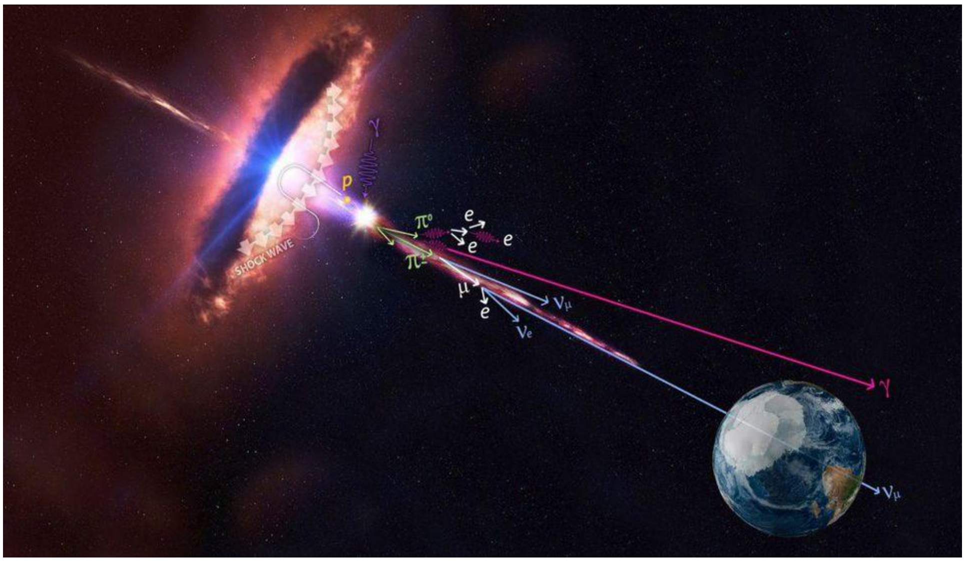

Figure1. *Artistic depiction of how blazar accelerates protons that generate pions, which in turn generate neutrinos and gamma rays. Neutrinos are always the result of hadron reactions.*

3. Conclusion

Thus, new astronomical observations of recent years say with certainty that black holes in their development into quasars become not a grave-digger of baryonic matter, but the source of Baryonic Matter and Energy.

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