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On the Necessity to Replace the Spherical Shape of Black Holes with a Disc Shape and Doubling their Energy

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ABSTRACT

At the present time, black holes are reduced to the parameters of the Schwarzschild sphere. It is shown that Schwarzschild determined only half of the mass and energy of a black hole, and its spherical shape makes it difficult to interact with the external environment. The elimination of this drawback is the main goal of this work, and the substantiation of the shape, structure and parameters of black holes on the basis of the strict laws of the material world is its scientific novelty.

The Methods of Research: Used in the work are based on deduction and induction, as well as on the application of reliable laws of physics and the general principles of the theory of knowledge.

Work Results: It is proposed to replace the Schwarzschild sphere at the quantum level of the material world with a hole-die, which consists of 2 layers of hexagonal prisms of circular space quanta, formed from 6 regular trihedral prisms of elementary space quanta. The length of all their faces is λ_G=4.05126·10^{-35}m and is equal to the wavelength of the gravitational field forming this hole. Its energy and mass are doubled to the energy $E = mc^2$ due to the rotation of the gravitational field in it. The radical change of the disk hole-die by concentric columns per λ_G quantum is justified. A possible connection between black and white holes is shown.

Conclusion: Strict calculated dependences are found and numerical values are obtained on their basis, confirming the new parameters of disk-shaped black holes.

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Introduction

The work relates to the field of quantum physics, cosmic physics and cosmology, in particular, to the determination of the parameters and structure of black holes, as well as to the foundations of the material world and the entire Universe. The solution of these problems is necessary for a better understanding of the principles of building the foundations of the Universe, which is an urgent and important scientific task, which is currently the subject of the work of many scientists around the world. However, these problems have not been fully resolved yet. This is explained by the fact that black holes [1] are among the most mysterious objects of the Universe, since they even absorb light, which excludes the possibility of obtaining information about them directly. Therefore, the initial data on black holes were only theoretical, which were based on the solution of the problem of the formation of space-time, following from the equations of the general theory of relativity (GR) of Albert Einstein [2]. Such a solution was proposed in 1916 by Karl Schwarzschild [3] for a space in which the magnitude of the gravitational attraction does not allow any objects of the material world, including light quanta, to leave it. Initially, this state was not associated with the concept of "Black Holes", the author of this term is unknown, but its first public use was made on December 29, 1967 in a report by John Archibald Wheeler [4].

However, had predecessors [3]. One of them is the work of John Michell in 1784 [5], in which he used Newton's works on universal gravitation and the 2nd cosmic speed resulting from them [6]. Based on them, he suggested that if this speed exceeds the speed of light on the surface of a star, the light from the star will not be able to leave it. Since at that time the concept and interpretation of of "Black holes" did not exist, Michell therefore operated with the concepts familiar to astronomers, calling such a star “Black Star”. Prior to the report, black holes were called "collapsed stars" or "frozen stars" [4].

The interpretation of "Black holes" began to be used from the end of the 60s of the XX century [1]. Initially, they were considered hypothetical objects that exist only theoretically, as an abstraction,

in the form of an unrealizable solution to the Einstein equations [2], but in reality there are no such physical objects in the Universe, because they cannot be observed. However, since the 80s of the twentieth century, hundreds of theoretical papers appeared, in which the real characteristics of black holes were separated from the fictional ones, which made it possible to systematize them and develop methods for astronomical and radiological observations. They took into account that if the black hole itself cannot be observed, then it is possible to find its indirect signs – a shadow from the light absorbed by it. As a result, the first supermassive black hole in the center of the galaxy M 87 was clearly discovered. The first high-quality image of the shadow of a black hole, obtained on April 10, 2019 directly in the radio range with the Event Horizon Telescope, is shown in Fig. 1 [7].

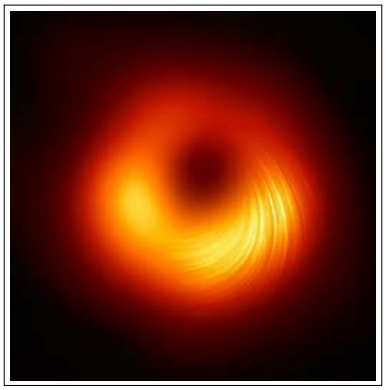

Figure 1: The shadow of the supermassive black hole at the center of the galaxy Messier 87, located 54 million light years from Earth

Since then, many black holes have been predicted and discovered in almost every galaxy, including our own galaxy, the Milky Way. Hundreds of publications have appeared on the subject of these studies, and it is almost impossible to cite them within the framework of one article. Therefore, in the proposed paper, the main attention is paid to the Schwarzschild sphere as the basis of black holes.

An Analysis of the State of the Problem has shown that the information about black holes obtained in recent years is based only on indirect astronomical observations of the zones surrounding them, which made it possible to single out a black spot of light absorption inside them, which is further identified as a black hole [8]. The structure inside this spot and the parameters of its structure have not been found on a rigorous physical basis, only the size-mass parameters of black holes within the Schwarzschild sphere are actually known, which are determined from the dependence (1) [3]:

$$M = \frac{c^2 r_G}{2G}(kg), \qquad (1)$$

where M – sphere mass, kg,

c – speed of light in vacuum: $c = 0,299792458 \cdot 10^9 (\text{change}) \frac{m}{s}$ [9],

r_G – sphere radius, m,

G – gravitational constant: $G = 6.67408(31) \cdot 10^{-11} \frac{m^3}{kg \cdot s^2}$. [9]

Based on dependence (1), is also to determine the gravitational radius r_G (2), which for the simplest version of black holes is the radius of the Schwarzschild sphere within its area [3]:

$$r_G = r_s = \frac{2GM}{c^2}(m). \qquad (2)$$

In this case, all the characteristics of the solutions of the Schwarzschild sphere are uniquely determined by only one independent parameter, the object's mass. This base is usually used to determine the Schwarzschild radii for objects with a known mass. For example, a black hole with a mass equal to the mass of the Earth has 9 mm (the Earth can become a black hole if you shrink it to that size). For the Sun, the Schwarzschild radius is about 3 km. For other black holes in the Universe, calculations of their masses and sizes are carried out only using indirect indicators, most of which are based on measuring the characteristics of the orbits of objects rotating around holes (stars, gaseous disks, sources of different types of radiation, etc. [8]). However, the listed tasks are beyond the scope of the work performed and are not considered in detail further.

In modern theories of the black holes formation, the initial Schwarzschild solution (for a spherically symmetric black hole with mass, without its rotation and without electric charge [3]) was supplemented by material fields. Therefore, in addition to one parameter – the mass M (they are characterized by two more parameters in three combinations:

1. Angular momentum L is Kerr's solution (1963, Roy Kerr [10]) for a stationary axisymmetric rotating black hole without a charge.
2. Electric charge Q the Reisner-Nordström solution (1916, Hans Reisner and 1918 Gunnar Nordström [11]) for a static spherically symmetric black hole with a charge but no rotation.
3. With all three parameters M, L, Q the Kerr-Newman solution (1965, E. T. Newman, E. Couch, K. Chinnapared, E. Exton, E. Prakash and R. Torrens [12]), which is at the most complete solution for a stationary and axisymmetric black hole.

The presence of a magnetic charge in black holes is called into question [13].

Other solutions for black holes, which differ from the solution of [3], incl. [14], are not considered in this paper, but are taken into account.

There are also 4 options for the formation of black holes [15], of which the 1st and 2nd options are considered realistic, and the 3rd and 4th options are hypothetical:

1. The gravitational collapse (squeezing) of a rather massive star.
2. The collapse of the central part of the galaxy or protogalactic gas.
3. The formation of black holes immediately after the Big Bang (primary black holes).
4. The occurrence in nuclear reactions of high energies (quantum black holes).

The performed analysis shows that the parameters of black holes, beginning with the work of Schwatzschild [3], were substantiated on the basis of the Einstein equations [2]. In the proposed work, they are substantiated on the basis of fundamental physical constants.

One of the problems of describing the Black Hole on the basis of the space curvature equations in the framework of Einstein's GR and other mathematical theories [16] is that they admit the presence of zero and infinite values. In the solutions of Schwarzschild [3] and others [10] ... [14], only the external parameters of Black holes are determined, and unreal states, such as a singularity, are attributed to the internal ones. The traditional ways of studying them are based on the transition from macro-level objects to higher levels (planets, stars, galaxies, their clusters and to the entire Universe as a whole), or to deeper levels of the material

world (molecules, atoms, of elementary particles) [17]. But in all cases, they take into account zero and infinite parameters, which do not exist in real physics. [17].

In real physics it is substantiated [17] that all parameters of the material world are finite within the Planck values. Therefore, in this paper, the basis of the studies of black holes is a new direction - from the initial (zero) level of the material world, to higher levels: elementary particles, nuclei of atoms, atoms, etc. [17]. The main feature of initial level (hereinafter the Nastasenko level) is its formation on the basis of only 7 fundamental physical constants:

1. Frequencies v_U of oscillations of the waves of the gravitational (unified) field of the Universe (hereinafter, the Nastasenko constant [17, 18]).
2. Velocity c of wave propagation of the gravitational (Unified) field of the Universe, which is equal to the speed of light in vacuum [17, 9].
3. Planck's constant h [9].
4. Gravitational constant G [9].
5. Electric constant ε_{00} [9].
6. Magnetic constant μ_0 [9].
7. Wien's thermal constant b [9].

On this level of make possible to obtain strict physical dependences and their real numerical values for all physical quantities currently known at the present time in the material world [19–22], a number of which are presented for the first time.

Therefore, further attention is paid to the Planck's black hole [23], a hypothetical black hole with the minimum possible mass, which is equal to the Planck's mass m_p (3) with a minimum radius equal to the Planck length l_p (4), the numerical values of which are given in CODATA [9]:

$$m_p = \sqrt{(\hbar c/G)} = 2.17650 \cdot 10^{-8}\, kg, \qquad (3)$$

$$l_p = \sqrt{(\hbar G/c^3)} = 1.61621 \cdot 10^{-35}\, m, \qquad (4)$$

where $\hbar$ –circular Planck's constant: $\hbar = 1{,}054571817 \cdot 10^{-34}\ J \cdot s$.

Such an object is identical to a hypothetical elementary particle – a maximon [24], with a presumably maximum possible single mass in the Universe. The Planck's black hole is believed to be the end product of the evolution of ordinary black holes. However, the known information about it is reduced only to the parameters of the Planck's mass (3) and radius (4), so its further studies are needed, which was first performed in [25].

Within the framework of Nastasenko level [17], the structure of the Universe from minimal quanta of space [26] is rigorously substantiated. It was proved that these quanta cannot be spherical points (the traditional representation of quanta), because at the same time, the principles of quantization are violated – indivisibility and minimalist of possible values in the material world, since between the "minimal" spheres of diameter D_{min}, one can place a sphere of smaller diameter d (Fig. 2):

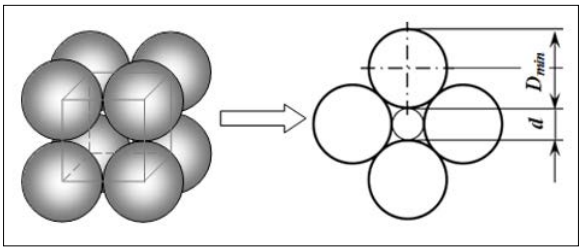

Figure 2: Grouping of quantum's of space of spherical shape

On the basis of these conditions, in [26] a minimal quantum of the Universe was proposed in the form of a hexagonal prism, consisting of 6 trihedral prisms of elementary quanta of space, which allows us to consider it circular (Fig. 3).

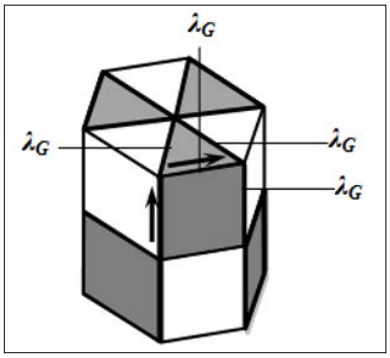

Figure 3: Proposed quanta of the space of the Universe with a single size λ_G of all elements included in it and their formation by quantum jumps

The length (quantum jumps) of all its elements λ_G equal to the wavelength (5) of the gravitational (Unified) field of the Universe [27, 28]:

$$\lambda_G = \frac{c}{v_G} = \frac{0.299792458 \cdot 10^{9}\left(\frac{m}{s}\right)}{7.4 \cdot 10^{42}\left(s^{-1}\right)} = 4.051249|432| \cdot 10^{-35}\,(m). \qquad (5)$$

where v_G – is the Nastasenko constant [17, 18], this is the frequency (6) of oscillations of the waves of the gravitational (Unified) field of the Universe, which, within the framework of the transformation of the numerical values c, h, G over a 40-year period of their study [9], asymptotically tends to $v_G \rightarrow 7.4 \cdot 10^{42}\ s^{-1}$ [17, 18, 9].

$$v_G = \sqrt{\frac{c^5}{Gh}} = \sqrt{\frac{\left[0.299792458 \cdot 10^{9}\left(\frac{m}{s}\right)\right]^5}{6.67408 \cdot 10^{-11}\left(\frac{m^3}{kg \cdot s^2}\right) \cdot 6.626070040 \cdot 10^{-34}\left(\frac{kg \cdot m^2}{s}\right)}} = 7.39994 \cdot 10^{42}\left(s^{-1}\right). \qquad (6)$$

where h – Planck's constant (7) [9]:

$$h = 6.626070040 \cdot 10^{-34}\, J \cdot s = 6.626070040 \cdot 10^{-34}\, \frac{kg \cdot m^2}{s}, \qquad (7)$$

Since the constant v_G is obtained from the 3 fundamental physical constants c, h, G according to strict physical dependence (6), it has the same level of significance and its negation is equivalent to the negation of the constants c, h, G.

Thus, the found circular quantum of the Universe space [26] differs from its traditional representation as a spherical point. It is a hexagonal prism, which is formed by simultaneous longitudinal and transverse (circular) quantum jumps by the value λ_G. This prism is formed by six elements that make it up – trihedral prisms (elementary quanta) with their common face along the central axis

of the circular quantum. Replacing the Planck's length l_p (4) by the wavelength λ_G (5) is due to the fact that the quantum jumps of gravitational waves λ_G cannot move in a circle on the planes of prisms. The circular motion is created by the sum of motions in the cross section of the hexagonal prism and must coincide with the quantum λ_G of their longitudinal jump, so the radius of the space quantum is also equal to λ_G, and not l_p. All elements of prisms are coordinated with each other (Fig. 3) and fully comply with the conditions of quantization parameters values in the material world.

An analysis of the proposed form of a circular quantum of space has shown that it is possible to distinguish two groups of three prisms in it, which alternate with each other. Therefore, it was proposed to associate these 3 prisms with three internal elements into a "minimal" quark, as opposed to the traditional representations of quarks from non-quantizable elements of a spherical shape [29]. In [26], one of these groups prisms was proposed to be considered a real quark, and the other, a virtual quark one. This ensures their virtual rotation by flowing into each other without loss of energy, which increases the overall stability of the space quanta of the Universe [26] and any other elements of space formed by them. On the Fig. 3 shows the connection between the "minimal" quarks in material world (the real quark is highlighted in gray and the virtual quark in white).

Based on the stability of the existence of two quarks in a circular quantum of space [26], this quantum can be considered the initial indivisible brick for building the material world, which scientists have been searching for since ancient times [30]. Therefore, it is further proposed to use it for structuring and building all other objects of the material world, incl. black holes.

The further formation of a Planck-level black hole was performed in [25] on the basis of a circular quantum of space [26], taking into account the possibility of violation of the symmetry of objects in the material world [31]. Therefore, in [25], a hypothesis was put forward about the possibility of the formation of a hole instead of the initial space quantum (by analogy with "vacancies" in crystal lattices [32], Dirac introduced the positron as a "hole" [33]). The probability P of such an event exists, which was first found in [25]. For a large number of N quanta in every 1 m^3 of the spherical space of the Universe (8), within its age of 13.8 billion years (ore $T = 4.35 \cdot 10^{17}$ s) and volume (9), the minimum probability value P (10) is sufficient, so that at least once the symmetry is broken, and the formation of a black hole takes place:

$$N = \frac{1}{6\frac{\lambda_G^{\,2}}{2}\lambda_G} = \frac{1}{3\lambda_G^{\,3}} = \frac{1\left(m^3\right)}{3\left(4.051249 \cdot 10^{-35}\right)^3\left(m^3\right)} = 6.11 \cdot 10^{101} \cdot (units). \tag{8}$$

$$V = \frac{4}{3}\pi R^3 = \frac{4}{3}\pi\left(Tc\right)^3 = \frac{4}{3}\pi\left[4.35 \cdot 10^{17}\left(s\right) \times 0.29979 \cdot 10^9\left(\frac{m}{s}\right)\right]^3 = 9.3 \cdot 10^{78}\left(m^3\right). \tag{9}$$

$$P = \frac{1}{N \cdot V} = \frac{1}{6.11 \cdot 10^{101} \times 9.3 \cdot 10^{78}} = 0.176 \cdot 10^{-180}. \tag{10}$$

With a real probability of symmetry breaking $P \approx 10^{-40} \ldots 10^{-60}$, black holes can exist in all elementary particles, atoms, molecules and other natural objects of macro and mega levels of the Universe. In this case, the **3rd variant** of the formation of black holes [15] is realized – after the Big Bang (primordial black holes), which was justified in [25] for the first time.

In addition, it is possible to supplement the 4 previously known variants of the formation of black holes [15] with the 5th variant – symmetry breaking and the appearance of holes (vacancies) in the total volume of the Universe space, which was also first substantiated in [25]. At the same time, it was shown for the first time in [25] that not only the translational motion of matter is created in the hole (the initial Schwarzschild solution for a spherically symmetric black hole [3]), but also its rotation. The rotation version is also introduced in the Kerr solution for a stationary axisymmetric rotating black hole [10]. These rotations shown confirm in Fig. 1 is light of streams. However, there charge [34] in a black hole is no, since the quanta of the space of the Universe do not have in [26], otherwise its presence would exclude any possibility of the existence of charged particles in the space of the Universe.

Given that the proposed quantum-level hole-die differs from all previously known variants of black hole models, not only associated with the Schwarzschild sphere [10 – 12], but in other [13 – 15], and she was also presented for the first time in [25], therefore it has the level of scientific discovery [35], which allows you to give the hole-die the name of its discoverer "Nastasenko hole".

It should be taken into account that, within the framework of dependence (1), of starting from the parameters (5) of Nastasenko hole, and further on, all other Schwarzschild radii R (2) are multiples of the wavelength λ_G with the ratio R/λ_G. With the same multiple ratios (in leaps, i.e., in quanta) with each new layer λ_G, the mass M changes within the framework of dependence (11):

$$M = \frac{c^2 R}{2G} = \frac{c^2 n \lambda_G}{2G}\left(kg\right), \tag{11}$$

where n – ratio of the radius R of a black hole and the wavelength λ_G of the gravitational field:

$$n = \frac{R}{\lambda_G}. \quad (12)$$

In further research by the author of this article, dependence (11) was refined.

For the Schwarzschild sphere, the quantum-layered form was shown for the first time in [36], and for a cylindrical Nastasenko hole in [25]. Wherein in [25] chose and substantiated a layered cylindrical die with a quantum transformation level and the possibility of rotation of matter in it, in particular, the gravitational field. This choice is logically justified and does not contradict known physical laws, which makes it reliable. However, other characteristics and parameters of the Nastasenko hole in [25] are not defined.

The elimination of this drawback is the main goal of the work performed, and its scientific novelty is the substantiation of the hole-die structure and its parameters based on strict scientific provisions and reliable physical laws. To this end, the task was set to develop adequate theoretical foundations and methods of research that would provide more complete and reliable knowledge about the structure and parameters of black holes.

Working Methods

The performed work is based on the methods of deduction and induction in the study of the material world, as well as the application of reliable known laws of physics and general principles for the development of the theory of knowledge [37]. Other research methods have been used only partially. Complete methods are not yet known, since the work being performed is associated with fundamentally new scientific discoveries, the search for which is difficult to formalize with previously known technical methods and techniques work.

New Results of the Work and their Discussion

The scheme of the version of the formation of a quantum black hole proposed in [25] is shown in Fig. 4. This hole 1 of quantum level is surrounded by 6 quanta of space 2 shown in Fig.3. To view the hole in Fig. 4, the 2 closing columns of space quanta in the scheme are conditionally removed.

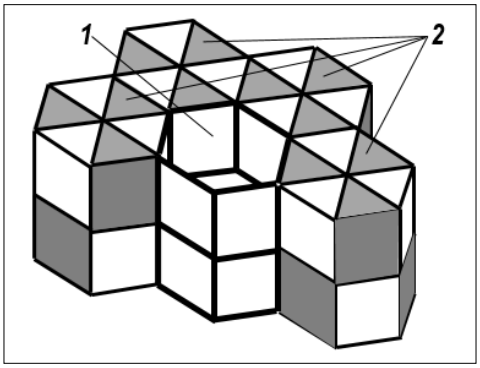

Figure 4: Schematic image of a quantum level hole (1) (Nastasenko holes) in the general array of space quanta (2)

Analysis of the scheme showed that the hole is an unfilled material formation and its energy state becomes less than the energy of the space quanta surrounding it (in the limit, equal to zero). By analogy with a liquid, the pressure drops sharply in a hole, therefore, all the matter surrounding it, which has energy, seeks to fill the resulting hole, and it is able to accumulate this energy. This principle is real, if we consider that at this level the dynamic viscosity is $2.49796 \cdot 10^{-70}$ *Pa*, and the kinematic viscosity is $4.84527 \cdot 10^{-27}$ m^2/s [19].

Further, the energy of the gravitational field of the Universe is taken as such energy, which structures the quanta of its space, is taken as such energy [26]. Therefore, to determine the structure and parameters of black holes, it was proposed to use the wave parameters of the gravitational (unified) field of the Universe (5) and (6), substantiated in [27, 28]. Based on them, it is assumed that the limiting energy for a quantum hole with dimensions λ_G, (Fig. 3 and 4) is the energy of the waves of the gravitational (unified) field of the Universe E_G (13) that form the hole, which follows from de Broglie's wave laws [6]:

$$E_G = h\frac{c}{\lambda_G} = 6.62607004 \cdot 10^{-34}\,(Js) \times \frac{0.299792458 \cdot 10^{9}\left(\frac{m}{s}\right)}{4.0512494 \cdot 10^{-35}\,(m)} = 4.903292 \cdot 10^{9}\,(J). \quad (13)$$

In this case, the mass characteristic of a quantum black hole will be the value m_G (14), which follows from the equality of the wave energy $E_G = hv_G$ according to de Broglie's law [6] and the relationship between the mass and its total energy according to the Einstein law $E_G = m_G c^2$ [6]:

$$m_G = \frac{E_G}{c^2} = \frac{h\nu_G}{c^2} = \frac{6.626070040 \cdot 10^{-34} \left(\frac{kg \cdot m^2}{s}\right) 7.4 \cdot 10^{42} \left(s^{-1}\right)}{\left[0.299792458 \cdot 10^9 \left(\frac{m}{s}\right)\right]^2} = 5.455647896 \cdot 10^{-8} (kg). \quad (14)$$

However, the mass M, obtained from the parameters of the Schwarzschild sphere (1) of the Planck level, will be the value (15), which coincides only with half of the initial energy mass value (14) of the gravitational field:

$$M = \frac{c^2 R}{2G} = \frac{c^2 \lambda_G}{2G} = \frac{\left[0.299792458 \cdot 10^9 \left(\frac{m}{s}\right)\right]^2 \times 4.0512494 \cdot 10^{-35} \left(\mathrm{m}\right)}{2 \times 6.67408 \cdot 10^{-11} \left(\frac{m^3}{kg \cdot s^2}\right)} = \quad (15)$$

$$= \frac{5.455647896 \cdot 10^{-8}}{2} (kg),$$

Thus, Schwarzschild in his solution [3] determined only half of the total mass and energy for a spherically symmetric immobile black hole, which is re-duced only to its kinetic energy. This is an unacceptable contradiction with Einstein's total energy law [6], which indicates a significant shortcoming of the theory [3], created by Schwarzschild.

This contradiction is eliminated by taking into account the transverse shift of elementary space quanta, which in [26] is associated with virtual rotation, and when pumping a quantum of energy, it becomes real. Since at the quantum level the rotation angles and their arcs are formed by stepwise jumps, this replaces the rotational energy with translational energy. With the same quantum jumps by the value λ_G for longitudinal and transverse displacement (Fig. 3) with the speed c of light in vacuum, their energy and mass (15) are the same and doubling. Therefore, dependences of the Schwarzschild sphere (1) and (2), for the hole-die mass M_F, take the form (16), and for the radius RF, the form (17) they do not have a coefficient 2, which was first shown in [38]:

$$M_F = 2\frac{c^2 R}{2G} = \frac{c^2 \lambda_G}{G} = \frac{\left[0.299792458 \cdot 10^9 \left(\frac{m}{s}\right)\right]^2 \times 4.0512494 \cdot 10^{-35} \left(m\right)}{6.67408 \cdot 10^{-11} \left(\frac{m^3}{kg \cdot s^2}\right)} = \quad (16)$$

$$= 5.455648 \cdot 10^{-8} \left(kg\right),$$

$$R_F = \frac{GM_F}{c^2} = 4.0512494 \cdot 10^{-35} \left(m\right). \quad (17)$$

The total energy E_F absorbed and emitted by such a hole-die with mass M_F (16) is equal to (18) and coincides with the gravitational energy (13):

$$E_F = M_F c^2 = 5.455648 \cdot 10^{-8} \left(kg\right) \times \left[0.299792458 \cdot 10^9 \left(\frac{m}{s}\right)\right]^2 = 4.9032918 \cdot 10^{-9} \left(J\right). \quad (18)$$

For the first time, these parameters were justified in [38]. Their correctness is confirmed by the fact that discrepancies between the size-mass parameters of the black hole and its event horizon radius are excluded.

Considering that within the framework of the equations following from Einstein's GR [2], a black hole can be not only absorbing matter, but also emitting it, i.e. be a “white hole” [39], so in [25] the 3rd hypothesis was put forward that a quantum black hole consists of 2 quantum layers, one of which works like a black hole, and the other layer works like a white hole. In a pair, they form a longitudinal hole-die. At the same time, 2 categories of dialectics are realized [37]: “Unity and struggle of opposites” and “Negation of negation”. Such a scheme of actions is implemented by a hole-die that is open to the external environment, and not by a sphere closed on itself, which, in principle, cannot exist at the initial level of the material world [17], since the quantization conditions are

violated in the minimal form (Fig. 2), when was proposed in [26].

A photo of a possible white hole is shown in fig. 5 [40]. It was discovered by the Hubble Space Telescope in the galaxy NGC 1097. The structure of this galaxy contains spirals and a central spot that is not black, but white central spot. Other signs of a white hole are substantiated in [41].

An open hole-die made of quantum layers of 2 hexagonal prisms of radius RF, which is a multiple of the wavelength λ_G of the gravitational (Unified) field of the Universe, has better opportunities for mass and energy exchange than the Schwarzschild sphere. Thus, the proposed quantum-layered form of a black hole in the form of a hole-die with a gravitational field rotating in it has a better basis for its existence in the material world than the Schwarzschild sphere [3].

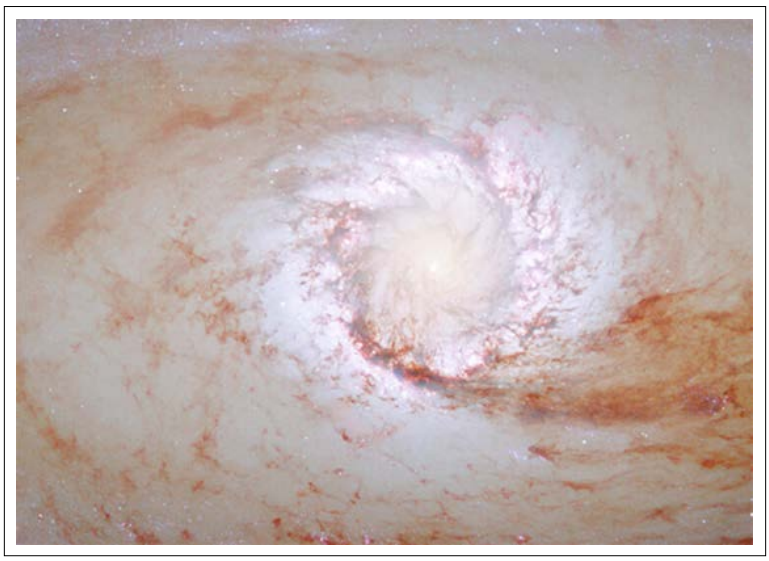

Figure 5. Photo of a possible white hole, with a bright white spot in the center

Therefore, the Nastasenko hole has every reason for its recognition in the scientific world and can be accepted as the starting point for further research.

The analysis of the layered structure of the hole-die (Fig. 4) showed that within the framework of the formation of the material world by indivisible circular quanta of space [26], the hole-die is associated with columns of adjacent neighboring circular quanta (Fig. 6), which repeat its hexagonal structure.

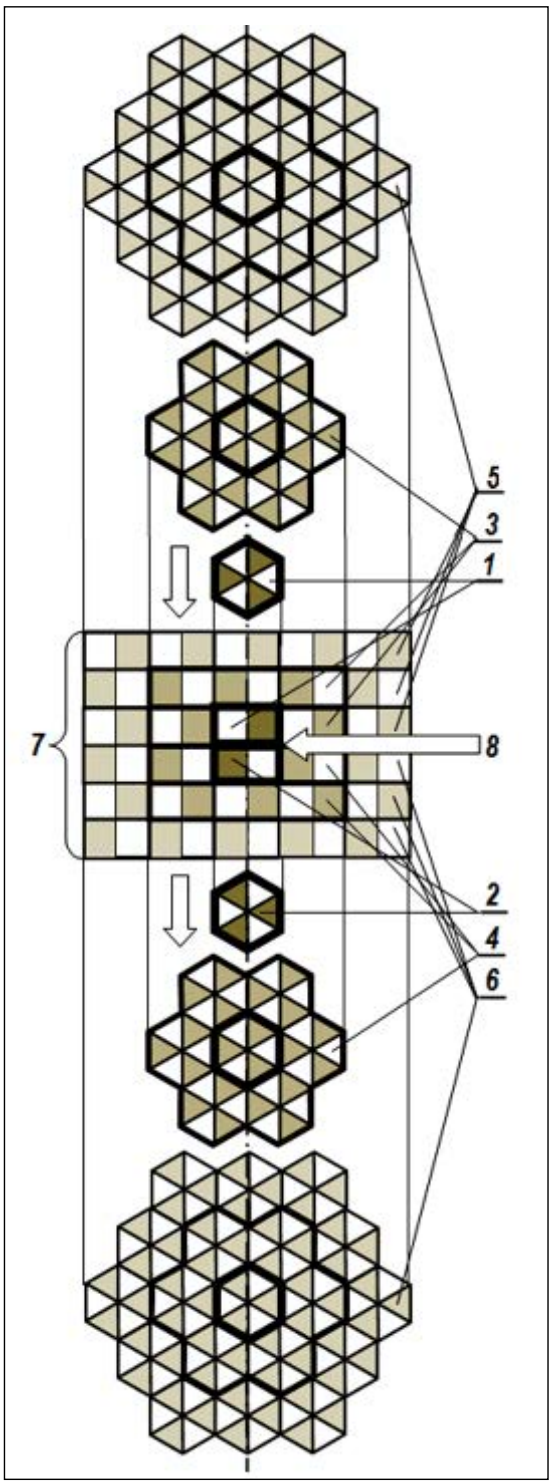

Figure 6: Incoming (1, 3, 5) and outgoing (2, 4, 6) quantum layers of a single Nastasenko hole, side view of the layers (7), transition zone (8)

The limit value of quantum mass (14) and energy (18), which hold even light and other electromagnetic waves, can accumulate one column of the structure (single hole-die). For the formation of this critical mass by elements with an atomic mass unit u = $1.6605390666 \cdot 10^{-27}$ kg [9], their required number will be the value (19):

$$N_u = \frac{M_F}{u} = \frac{5.455647896 \cdot 10^{-8}\,(kg)}{1,660539067 \cdot 10^{-27}\,(kg)} = 32.854679578 \cdot 10^{18}\,(units). \qquad (19)$$

When a black hole is surrounded by concentric rings of circular quanta of space, in each ring their number increases by 6 pieces in the ratio $6i+1$, where i – is the ordinal number of the ring, therefore, therefore, with a large number of i, the calculated dependence is simplified and amounts to (20):

$$N_F = \frac{(6i+1)}{2} i = 3i^2 \,(units). \qquad (20)$$

Then the number of quantum rings that form the critical mass of a black hole with the initial number of quanta $N_u = N_F$ (19), will be the value (21):

$$i_F = \sqrt{\frac{N_u}{3}} = \sqrt{\frac{32.854679578 \cdot 10^{18}}{3}} = 3.309314107 \cdot 10^9 \,(units). \qquad (21)$$

Thus, the funnel surrounding one hole-die have over $3.3093141 \cdot 10^9$ concentric rings of circular quanta of space (21), which constitute a dangerous zone for drawing any matter into this hole-die.

Radius R_v of the funnel and its influence for a single hole-die is the value (22), which is 10 orders of magnitude greater than the radius of black hole:

$$R_v = \lambda_G i_F = 4.0512494 \cdot 10^{-35}\,(m) \times 3.30931411 \cdot 10^9 \,(units) = 1.3406857 \cdot 10^{-25}\,(m). \qquad (22)$$

The number (19) of hydrogen atoms or proton-nucleons placed on the area of a circle of radius (22) is the minimum number that is necessary to form and maintain the stability of black holes. Their quantitative (23) and mass (24) densities exceed by many orders of magnitude the mass density of neutron stars $10^{11}\ldots10^{12}$ kg/m^3 [42].

But it is much inferior to the mass density of a black hole in the form of a hexagonal prism hole-die (25). Therefore, the formation of a black hole from a neutron star will begin only after density (24) is reached.

$$\delta_{V\,i} = \frac{N_u}{\frac{4}{3}\pi R_V^3} = \frac{32.85468 \cdot 10^{18}\,(units)}{\frac{4}{3}\pi\left[1.3406857 \cdot 10^{-25}\,(m)\right]^3} = 3.254825 \cdot 10^{93}\left(\frac{units.}{m^3}\right). \qquad (23)$$

$$\delta_{mi} = \frac{uN_u}{\frac{4}{3}\pi R_V^3} = \frac{1,660\ 539\ \cdot 10^{-27}\left(\frac{kg}{units}\right) \cdot 32.85468 \cdot 10^{18}\,(units)}{\frac{4}{3}\pi\left[1.3406857 \cdot 10^{-25}\,(m)\right]^3} = 0.540476 \cdot 10^{68}\left(\frac{kg}{m^3}\right). \qquad (24)$$

$$\delta_F = \frac{M_F}{\frac{3\sqrt{3}}{2} R_V^3} = \frac{5.455648 \cdot 10^{-9}\,(kg)}{\frac{3\sqrt{3}}{2}\left[4.051249 \cdot 10^{-35}\,(m)\right]^3} = 0.3158113 \cdot 10^{94}\left(\frac{kg}{m^3}\right). \qquad (25)$$

After the accumulation of mass (16) and energy (18), a "breakdown" of the black hole occurs and they are thrown into a circular quantum of space adjacent to the base of the hole, which then radiates them like a white hole. In the space quanta adjacent to the black and white hole, this mass and energy change in relation (26), (27) until the indices of the initial quanta are reached:

$$M_i = \frac{m_G}{6i}(kg), \qquad (26)$$

$$E_i = \frac{E_G}{6i}(J), \qquad (27)$$

where i – is the serial number of the quantum layer in the system of concentric columns-quanta of the Universe space.

Dependences (26) and (27) determine the density of mass and energy in quantum layers, which grow from layer to layer they are absorbed by the black hole and decrease when they exit the white hole in reverse order. The change in the mass and energy density in quantum layers in Fig. 6 is shown by the different of their coloring. The shape of the funnel consisting of hexagonal prisms is shown in Fig. 7.

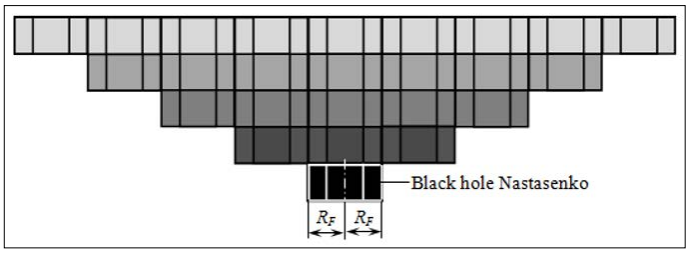

Figure 7: Formation of a funnel at the entrance of a black hole-die (side view)

In addition to single ones, the existence of multifilament structures is possible, in which mass (28) and energy (29) increase by the number n (12):

$$\Sigma M_F = M_F n = 5.455648 \cdot 10^{-8} n(kg), \quad (28)$$

$$\Sigma E_F = E_F n = 4.9032918 \cdot 10^{-9} n(J). \quad (29)$$

For real objects, the number n of quantum hole-die is determined by the ratio of their mass M to mass M_F according to the calculated dependence (30), and for energy – according to dependence (31). Since the mass of black holes is estimated in the masses of the Sun $M_\odot = M_S = 1.988744 \cdot 10^{30}$ kg,[43], then we gets for it:

$$n_S = \frac{M_S}{M_F} = \frac{1.988744 \cdot 10^{30}\,(kg).}{5.455648 \cdot 10^{-8}(kg)} = 0.3645294 \cdot 10^{38}\,(\text{units}), \quad (30)$$

$$E_S = E_F n_S = 4.903292 \cdot 10^{-9}\,(J) \times 0.364529 \cdot 10^{38} = 1.788739 \cdot 10^{29}(J). \quad (31)$$

Considering that the black hole mass and radius (17) are directly proportional to each other, each new mass quantum M_F leads to an adequate increase in the radius R_F. Then the number n is the coefficient of increase in the black hole radius, which for the Sun will give radius R_gS (32), which was shown for the first time in 1 [38]:

$$R_{gS} = 2R_F n_S = 2 \cdot 4.051248 \cdot 10^{-35}\,(m) \cdot 0.364529 \cdot 10^{38}\,(units) = 2.953599 \cdot 10^{3}\,(m). \quad (32)$$

This value coincides with the currently declared radius of a black hole with the mass of the Sun $R_gS = \cdot 10^3$ m [43] to within 4 decimal places [38]. The discrepancy is due to the accuracy of the gravitational constant G used in the data calculations and in the declared calculations.

Thus, on a rigorous basis, it is confirmed:

1. In a black hole, its space rotates in the form of flows of its energy and mass.
2. Quantum-layered structure of black holes by concentric rings of hexagonal prisms of the same mass M_F, in which its density decreases in proportion to the area of the i-th ring within the framework of dependence (33):

$$\delta_i = \frac{M_F}{9\sqrt{3} i R_F^{\,3}} \left(\frac{kg}{m^3} \right). \quad (33)$$

3. The black hole has not a spherical shape, but a circular disk form with the parameters of concentric Nastasenko hole, where energy and mass revolve.
4. Strict calculated dependences are found and numerical values are obtained on their basis, which confirm the new parameters of circular disk form black holes.
5. Since there are no black holes that do not rotate, it should therefore be recognized that the Schwarzschild theory [3] for black holes is outdated.

For multi-die black holes, the dangerous radius (22) increases in proportion to the ratio of their mass to the mass of a single die, and for a black hole with the mass of the Sun M_S will be the value (34), which are also 10 orders of magnitude greater than the size of the original hole. This value (34) is commensurate with the size of the boundaries of the solar system (the aphelion of the planet Pluto is $4.545 \cdot 10^{12}$ m, Oort cloud dwarf planet Sedna – have radius orbit $1.4373\ 10^{14}$ m [44]):

$$R_v = R_F i_F \frac{M_S}{M_F} = 4.05125 \cdot 10^{-35}(m) \times 3.309314 \cdot 10^{9}\,(units) \frac{1.988744 \cdot 10^{30}\,(kg)}{5.455648 \cdot 10^{-9}\,(kg)} = \quad (34)$$

$$= 4.887193 \cdot 10^{13}(m)$$

It should be taken into account that at large values of n, the hexahedral structures of the circular quanta of space are transformed into circles, and the hole-die into a cylinder of height $R_F = 4.051248 \cdot 10^{-35}$ m. This process is explained by the growth of the minimum possible deformations in the border zones between circular quanta within the average statistical error from their sizes λ_G, which gives the radius value (35), commensurate with the sizes of elementary particles:

$$R_R = \sqrt{\lambda_G} = \sqrt{0{,}4051249 \cdot 10^{-36}} = 0.6364942 \cdot 10^{-18}\,(m). \qquad (35)$$

The contraction of the tops of the hexagons in a circle is based on the principle of minimal action and energy consumption in the material world incl., based on the laws of thermodynamics, in which the gravitational radius tends to the same curvature along the perimeter of the entire circle.

The number n of hexahedral circular space quanta in the hole-die, after which their layer shrinks into a circle, is (36):

$$n_R = \frac{1}{\sqrt{\lambda_G}} = \frac{1}{\sqrt{0{,}4051249 \cdot 10^{-36}}} = 1.571106 \cdot 10^{18}\,(\text{units}). \qquad (36)$$

The found new size-mass parameters of a black hole in the form of quantum layers of a hexagonal prismatic hole-die are obtained on the basis of strict physical and mathematical dependencies and do not contradict previously known reliable physical laws and patterns, which confirms their reality. At the same time, new knowledge about the energy, mass and size of black holes can change the current knowledge about dark energy and dark mass of the Universe. Other opportunities have also been created for conducting research in related fields of science and technology related to the fundamentals of the material world and the Universe.

Thus, we can conclude that there are no real physical objects, such as the Schwarzschild sphere, it's a mathematical abstraction that does not reflect the process of entry and accumulation of energy and mass in it. This is a clear example of the errors of the modern dominance of mathematics in the description of processes and natural phenomena without taking into account their physical essence. This is explained by the fact that the dimensions (5), energy (13) and mass (14) are interconnected on the basis of strict physical dependencies, consisting of fundamental physical constants c, h, G. Since there are no other theories in which a quantum of space has dimensions that are less than the value (5), and energy and mass are greater than the values (13) and (14), therefore they can be considered limiting values in the material world.

However, from the reverse side, black holes are not yet visible, and the hypothesis [41] is insufficiently strict. Therefore, it is not yet possible to confirm or refute the hypothesis about the energy output and the unity of black and white holes in the form of a hole-die, although space objects are known that radiate energy. To solve this problem, further development of new theories and real research is required.

These data allow us to conclude that a black hole is not an abstract singularity with unclear characteristics, but has real physical parameters. The new parameters and shape of black holes proposed in this paper are well substantiated and do not contradict the known laws of the material world. They eliminate contradictions between the size-mass characteristics of black holes and their event horizon, which confirms their correctness. Such justification became possible on the basis of the transition to the initial level of the universe. [17].

The conclusions made significantly expand the available knowledge about black holes. New scientific data have been obtained that determine the structure, structure and parameters of black holes have the level of scientific discoveries [35].

The calculated dependences found and their final solutions (10) ... (36) testify to the reality of all the hypotheses put forward, the achievement of the goals set in this work and solving all the tasks set in it.

General Conclusions and Scientific Discoveries made in this Article

1. The Schwarzschild sphere at the level of Planck dimensions and masses does not correspond to the general principles of quantization of the material world, which excludes the reality of the existence of its spherical shape and the conditions for its interaction with the material objects, of physical fields and quantum's of the Universe space, surrounding of this sphere.
2. Schwarzschild in his stationary model of a black hole, which has no rotation and charge, determined only half of its mass and energy, which reduces it only to the kinetic energy of the longitudinal motion and contradicts the total energy following from Einstein's law $E = mc^2$ and the energy of gravitational field $E = hv_G$ with the frequency of its waves oscillation $v_G = 7.4 \cdot 10^{42}$ s^{-1}.
3. The previously known options for the formation of black holes are supplemented with a new option - symmetry breaking in the material world and the appearance of holes (vacancies) in the total volume of the Universe space instead of its initial quanta, which makes clear the process of formation of primary black holes, incl. after the Big Bang.
4. Matter and energy, which form and fill black holes, is reduced to the mass m_G and energy E_G of the gravitational (Unified) field of the Universe $E_G = hv_G$, with its wavelength $\lambda_G = 4.05126 \cdot 10^{-35}$ m and the frequency of their oscillations $v_G = 7.4 \cdot 10^{42}$ s^{-1}, while the energy in black holes changes by quantum jumps with a maximum value of $E_G = 4.90329 \cdot 10^9$ J, and the mass changes by quantum jumps with a maximum value of $m_G = 5.45565 \cdot 10^{-8}$ kg.
5. The Schwarzschild sphere should be replaced by a prismatic of hole-die, which is formed by two layers of circular quanta of space in the form of regular hexagonal prisms, consisting of 6 regular trihedral prisms of elementary space quanta with their common face on the central axis of the circular quanta and their face length $\lambda_G = 4.05126 \cdot 10^{-35}$ m.
6. In the proposed of hole-die, as a model of a quantum black hole, the longitudinal and transverse motion of the gravitational field in it by quantum jumps by the value λ_G at the speed of light c is taken into account, which supplements of the energy and mass of the hole-die to the total energy $E =$

mc^2 due to the sum of the kinetic energies of the longitudinal and transverse motions matter with no electrical charge.

7. The minimum number of hydrogen atoms or protons-nucleons required for the formation and for the stability of a disk quantum black hole is value $u_F \sim 32.855\text{-}10^{18}$ units.
8. Theoretically substantiated the radius of the funnel at the entrance to the hole-die, from which the contraction of mass and energy begins in the black hole. It is shown that for single-filament black holes it exceeds by 10 orders of magnitude its initial radius $R_F = 4.05126\text{-}10^{-35}$ m and is $R_v = 1.3406857 \cdot 10^{-25}$ m, and the density of matter, after which the formation of black holes begins, is $\delta_v = 0.540476 \cdot 10^{68}$ kg/m^3 at the final density of matter in black holes $\delta_F = 0.315811 \cdot 10^{94}$ kg/m^3, which is many orders of magnitude higher than the density of neutron stars $\delta_n = 10^{11} \ldots 10^{12}$ kg/m^3.
9. Big-sized hole-dies are formed from quantum single hole-dies closely adjacent to each other, having the shape of hexagonal prism-columns with total energy E_F and mass M_F in each, and their number n is determined by the ratio of the mass M of a real object to the quantum mass $M_F = 5.45565\text{-}10^{-8}$ kg according to the dependence $n = M/M_F$, which in the same proportion increases the number of hydrogen atoms, protons or nucleons required for their formation and support of its funnel, and of its radius.
10. The shape of the hole-die, open for contacts with the external environment, makes it possible to unite in it a black hole, which absorbs matter, and a white hole, which emits it, which corresponds to the principles of general relativity, but requires further theoretical and experimental confirmation.
11. With the number of hexagonal prism hole-die $n > 1.5711 \cdot 10^{18}$ pieces in one natural object, their faces can flat in a circle with a cylinder radius $R > 0.6365 \cdot 10^{-18}$ m, which is commensurate with the size of elementary particles.
12. All the found structures and parameters of the hole-die, as well as their physical and mathematical laws and descriptions, strictly follow from the objectively existing laws of the material world, which fundamentally change the previously known scientific knowledge about black holes and are proven in this work for the first time, which meets all the criteria for scientific discoveries [35]. So they can be recognized of them, and the developed hole-die can get the name of its discoverer "Nastasenko hole" $R_gS = 2.953250 \cdot 10^3$m.

Conflict of Interest, Acknowledgments and Thankfulness

The work was carried out by the author independently, on the basis of his own scientific works using reliable laws of physics and open literary sources [17, 25, 26, 36, 39].

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