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Black Holes with the Masses of Ordinary Stars

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Abstract

"Black holes" are stars that are believed to have such large masses and small sizes that light, consisting of photons, cannot overcome gravity and escape the star. Such a star becomes invisible. The condition, that one component escapes from a binary mass system is used to determine the parameters of a black hole. This condition is used in astronautics. However, it is questionable whether a star (for example, a quasar with a mass of $m_o = 10^{39}$ kg) and a photon of light (with a "mass of motion" of the order of $m_o = 10^{-35}$ kg) can be considered a binary mass system. Not to mention that any star simultaneously emits a huge number of photons in different directions, and before the photon is emitted from the star, the photon has no mass. A photon's mass is related to its motion. In existing popular science literature, one can find the assertion that a star with the parameters of the Sun, having turned into a black hole, will collapse into a sphere with a tiny three-kilometer radius. This article draws the reader's attention to the fact that a star with the mass of the Sun, having turned into a black hole, rotates rapidly and will be destroyed by centrifugal forces. Contrary to modern cosmological beliefs, the space around stars is not empty. It is filled with gaseous dark matter. Stars continuously absorb dark matter, increasing their mass. Therefore, photons emitted by the star at the speed of light are forced to overcome this oncoming current. If the speed of the counter-current of dark matter exceeds the speed of light, the star becomes invisible, that is, it turns into a black hole. A formula has been derived that determines this speed. Calculations using this formula have shown that stars with masses on the order of the Sun's mass can, as a result of catastrophic compression (collapse), turn into black holes with parameters close to those of "white dwarfs." Such stars, invisible black holes, should be at least as numerous in nature as white dwarfs. White dwarfs are close to the threshold of star visibility. It's no wonder astronomers don't see stars smaller than white dwarfs in the sky. This invisible mass is not taken into account by astrophysicists when estimating the masses of galaxies. This can lead to misconceptions about the structure, fate, and role of black holes in the dialectic of the Universe.

Keywords: Black Holes; Dark Matter; White Dwarfs; Gravitational Collapse; Stellar Rotation

Introduction

"Black holes" are stars that are believed to have such large masses m_0 and small sizes (r_0 -radii) that light (a chain of photons at the wavelength of light) cannot overcome gravity and escape the star. It is known that for one component to escape from a binary mass system, its velocity V must reach a certain critical value, called second cosmic velocity. This velocity is determined by the formula.

$$V = \sqrt{\frac{2fm_o}{r_o}}. \tag{1}$$

If we substitute the speed of light $C = 3 \times 10^8$ m/s in this expression instead of the speed body V and solve it relative to the radius of the star r_o, we obtain the value of the gravitational radius of a star with mass m_o:

$$r_o = \frac{2fm_o}{C^2}. \tag{2}$$

A light wave cannot escape a star if its radius is smaller than this value. Such a star would fade away from the rest of the universe, becoming a "black hole." It is impossible to see a "black hole." However, I have doubts about whether a star (for example, a quasar with a mass of $m_o = 10^{39}$ kg) and a photon of light ("mass of motion" of about $m_o = 10^{-35}$ kg) can be considered a binary mass system.

Not to mention the fact that any star simultaneously emits a huge number of photons in all directions, and before the photon was emitted by the star, the photon had no mass. The mass of a photon is related to its motion. Although condition (2) itself is correct for the interaction of two massive bodies, one of which greatly exceeds the mass of the other, I have doubts about the possibility of the existence of "black hole" stars satisfying this condition. To verify this, let's try applying it to a hypothetical star formed by the collapse of a normal star with initial solar parameters (mass $m_0 = 2 \times 10^{30}\ kg$, radius $r_{0C} = 7 \times 10^8\ m$, angular velocity $\omega_{0C} = 2.9 \times 10^{-6}$ c^{-1}).

After the catastrophic compression of the star, these parameters will change to the parameters of a "black hole" with the same mass $m_{\odot} = 2 \times 10^{30}\ kg$, but with a smaller radius $r'_{\odot} = 3 \times 10^3\ m$ (from equation (2)). From the condition of conservation of angular momentum, we determine the new angular velocity

$$\omega_{bh} = \omega_{\odot} \times \frac{r_{\odot}}{r'_{\odot}} = 1.6 \times 10^5 s^{-1}.$$

Next, we calculate the average density of this "black hole"

$$\rho_{bh} = \frac{3m_{bh}}{4\pi r_{bh}^3} = 1.8 \times 10^{20}\ kg/m^3.$$

The density of the "black hole" turned out to be 180 times greater than the density of the nucleus of a hydrogen atom (an α-particle), which is impossible. Let's continue our analysis. To do this, we'll write down the condition for the destruction of a black hole by centrifugal forces. This will occur if the centrifugal force exceeds the force of gravity at its surface F_{max}.

$$\frac{F_{\vartheta.b.}}{F_{max}} = \frac{4\pi^2 r_{bh}^3}{f^2 m_{bh} T^2} \tag{3}$$

The rotation period of a black hole is $T = \frac{2\pi}{\omega_{bh}} = 3.915 \times 10^{-5}\ s$. The gravitational constant is $f = 6.7 \times 10^{-11}\ N.m^2/kg^2$. With these values of these quantities, the ratio is

$$\frac{F_{\vartheta.b.}}{F_{max}} = 5.16$$

As we can see, the black hole in question would actually be torn apart by centrifugal forces. In popular science literature, one often encounters the assertion that a star with solar parameters, upon becoming a black hole, would collapse into a sphere with a tiny three-kilometer radius. However, I have not encountered a follow-up study showing that such a star would have an unrealistically high density and would be torn apart by centrifugal forces.

The theory of dark matter we present[1,2] also contains a reason that casts doubt on the existence of stars and black holes satisfying condition (2). In the "Theory of Dark Matter,[1,2]" stars and other material objects in the Universe are surrounded by a continuum of gaseous, invisible dark matter. This matter is primary in the structure of the Universe. It is mobile. Flows exist within it. It interacts with material bodies. This interaction consists of the continuous absorption of dark matter by baryonic bodies: stars, planets, molecules, atoms, elementary particles, and even photons of light. Over time, the masses of these bodies increase.

Every star absorbs gaseous dark matter. This gaseous dark matter flows toward the star's center uniformly along its radii at a velocity of $V_{ro} = \frac{f \cdot m_o}{\alpha \cdot r_o^2}$ [1,2].

Therefore, photons of light must overcome a countercurrent, regardless of the direction in which they move away from the star. This is similar to a swimmer swimming against the current. If the swimmer's speed does not exceed the speed of the water, they can swim indefinitely, but will never advance a single meter relative to the banks.

Taking these considerations into account, we believe that the speed of the dark gas flow toward the visible star nowhere exceeds the speed of light $C = 3 \times 10^8\ m/s$. Otherwise, the star would not be visible.

$$V_{ro} = \frac{f \cdot m_o}{\alpha \cdot r_o^2} < C. \tag{4}$$

Here the gravitational constant $f = 6.7 \times 10^{-11}\ N\ m^2/kg^2$. According to,[1,2] the coefficient is $\alpha = 1\ s^{-1}$. If this condition is violated, the star cannot be seen. The minimum radius of the visible star is determined from (4)

$$r_{o\min} = \sqrt{\frac{f \cdot m_o}{\alpha \cdot C}}. \tag{5}$$

It is believed that when a star with a mass comparable to the Sun exhausts the hydrogen in its core, it collapses, creating a "white dwarf" or "black hole."

The radius and average density of a star with the mass of the Sun at which the star disappears from view and becomes a "black hole" in accordance with (5) will be

$$\mathrm{r}_{0,\min} = 668.6\ km; \quad \rho = 1.6 \times 10^{12}\ kg/m^3 \tag{6}$$

The value of the minimum radius $r_{o\text{-}min}$ for stars with the mass of the Sun corresponds to the order of magnitude of the radii of actually observed white dwarf stars. The smallest of the known white dwarfs, the star Wolf 457,[8] has a mass $m_o = 1.01 \times 10^{33}\ g$ and a radius $r_o = 700\ km$. The minimum radius and average density for a black hole formed from this white dwarf will be

$$\mathrm{r}_{0,\min} = 470\ km; \quad \rho = 2.3 \times 10^{12}\ kg/m^3 \tag{7}$$

The «white dwarf» Van Maanen star has a mass of $m_0 = 0.28 \times 10^{30}\ kg$ and a radius of $r_0 = 4900\ km$. The minimum radius and average density for a «black hole» formed from this «white dwarf» would be

$$\mathrm{r}_{0,\min} = 250\ km; \quad \rho = 4.2 \times 10^{12}\ kg/m^3 \tag{8}$$

The white dwarf companion of Sirius has a mass of $m_0 = 1.7 \times 10^{30}\ kg$ and a radius of $r_0 = 20000\ km$. The minimum radius and average density for a black hole formed from this white dwarf would be

$$\mathrm{r}_{0,\min} = 616\ km; \quad \rho = 0.5 \times 10^{5}\ kg/m^3 \tag{9}$$

Thus, it can be said that white dwarfs are close to the threshold of star visibility. It's no wonder that astronomers don't see stars in the sky smaller than white and red dwarfs.

When considering the collapse of stars into "black holes," one must consider the wide variety of stars and the processes occurring within them. It is known[7,8] that stars emit large masses of matter. Thus, the Sun loses mass $7 \times 10^{14}\ kg/year$ through corpuscular radiation and, through radiation, loses mass $1.5 \times 10^{17}\ kg/year$. Corpuscular radiation and electromagnetic radiation are characteristic properties of all stars. For the most massive stars, the rate of mass loss can be very high. For example, a bright Wolf-Rayet supergiant emits $2 \times 10^{25}\ kg/year$, that is, 10 orders of magnitude more than the Sun.

"Black hole" stars will differ from visible "white dwarf" stars in that they have become invisible. They are surrounded by vortices of dark matter. They may have their own planets, moons, comets, and asteroids. Some galaxies may have as many such stars as white dwarf stars. These black holes and their companions are invisible. However, they exist.

A "dark hole" absorbs dark matter, just like any other visible star. However, "black holes" do not lose mass through corpuscular emission or radiation. Instead, their mass increases according to the law.[1]

$$m = m_o \cdot e^{\frac{\alpha \cdot t}{k}} \approx m_o \cdot (1 + \frac{\alpha}{k} \cdot t) \,. \tag{10}$$

The value $\alpha/k = 2.97 \times 10^{-18}\ c^{-1}$ is equal to the Hubble constant. t is time. Table 1 shows the calculated ratios of the baryon masses m at a given moment in time to their masses m_0 at the initial moment in time, ranging from 1 billion to 20 billion years. All elementary particles, atoms, molecules, as well as planets and stars, including our Earth, obey this law.

Table 1

Time (billions of years)	1	2	3	3.5	5	10	15	20
$m = m_o \cdot e^{\frac{\alpha \cdot t}{k}}$	1.1	1.2	1.33	1.38	1.61	2.59	4.17	6.62

Several scientific papers suggest that the masses of some galaxies are insufficient to explain some of the features observed in them. This suggests that such galaxies contain large, unaccounted-for masses of dark matter, which, according to these astrophysicists, supplement the missing masses needed to explain the observed features. However, the mass of dark matter in the space surrounding stars is not equivalent to the mass of baryonic bodies. Dark matter acquires the properties of baryonic mass only when these masses reach the speed of light in a vacuum. In this case, dark matter transitions from a gaseous state to a liquid state, adding to the mass of elementary particles and atomic nuclei.

In our opinion, astrophysicists are still stuck with the idea that dark matter consists of very small particles, similar in properties to known elementary particles. They are numerous, but they are invisible because they are so tiny. Nevertheless, astrophysicists hope to capture a dark matter particle, despite the fact that dark matter is primordial matter (proto-matter) with its own properties. “Black holes” with masses on the order of the Sun are quite numerous (no less numerous than “white dwarfs”) and could well make up for the mass deficit missing in these astrophysicists’ calculations.

A visible star, having become a “black hole,” ceases to emit energy but continues to receive it from the surrounding dark matter continuum and accumulate it within itself. Dark matter, possessing mass and velocity, falls into cosmic bodies and also contributes kinetic energy to them. In this case, the power due to the kinetic energy of dark matter introduced into the body will be written in SI units as follows[1]

$$N_{moon} = \frac{dm}{dt}\frac{V_r^2}{2} = \frac{f^2 \frac{\alpha}{k} m_0^3}{\alpha^2 r_0^4} e^{\frac{\alpha}{k}t} \tag{11}$$

Where N_{moon} is the gravitational absorption power r_o is the radius of the body. The value $\alpha/k = 2.97 \times 10^{-18}\ s^{-1}$ is equal to the Hubble constant is the gravitational constant. t is time.

Let us assume that during the collapse of a star with a mass of the order of the solar mass $M_C = 2 \times 10^{30}\ kg$ and a radius $r_{oC} = 695700$ km, the radius of the star decreased according to (6) to a value of $r_{o,min} = 668.6\ km$. Such a star became a “black hole” with a density of $\rho = 1.6 \times 10^{12}\ kg/m^3$, characteristic of “white dwarfs”. For the “black hole” under consideration, the power absorbed by the star from the dark matter continuum at a given moment in time ($t = 0$) will be

$$N_{moon} = \frac{dm}{dt}\frac{V_r^2}{2} = \frac{f^2 \frac{\alpha}{k} m_0^3}{\alpha^2 r_0^4} e^{\frac{\alpha}{k}t} = \frac{(6.7\times10^{-11})^2(2.97\times10^{-18})(2\times10^{30})^3}{(6.686\times10^5)^4} e^{\frac{\alpha}{k}t} = 0.533\times10^{30}\ W \tag{12}$$

It is noteworthy that the energy of the explosion of “supernova” stars[7,8] is $E_{max} = 10^{42}\dots10^{44}$ Joules. For information, 1 billion years $= 3.15 \times 10^{16}\ s$. The time interval during which the “black hole” will accumulate such energy after its formation will be

$$t = \frac{E_{explosion}}{N_{loss}} = \frac{(10^{42}\dots10^{44})}{0.533\times10^{30}} = 1.88\times(10^{12}\dots10^{14})\ c = 59.7 \text{ thousand years} \dots 5.97 \text{ million years} \tag{13}$$

Apparently, an explosion (of the black hole) could occur after this, as by this time the black hole has accumulated the amount of energy observed by astronomers in supernova explosions. Developers of the theory of supernova explosions should take into account the replenishment of their mass and energy from the dark matter continuum of space. This phenomenon is currently not taken into account by modern cosmology when analyzing the energy of stars and other celestial bodies.

The collapse of a star with a mass comparable to the Sun can result in the formation of a white dwarf star. So-called supernova explosions are associated with white dwarfs. Type La supernovas form as a result of the collapse of white dwarfs. When the mass of white dwarfs reaches the Chandrasekhar limit of 1.44 solar masses, a type La supernova occurs, and the white dwarf becomes a neutron star. Note: hypothetical neutron stars exist only in theoretical calculations by physicists. Their creation was based on the assumption that their density is equal to (and cannot be greater than) the density of a proton (the nucleus of a hydrogen atom). Such stars are not observed in practice. They were needed to explain the very high rotation speed of pulsars. If such stars really existed, they would become black holes.

It is believed that the white dwarf has already exhausted its nuclear fuel. However, after its formation, the white dwarf continues to glow, powered by stored thermal energy. Remarkably, the white dwarf, continuing to glow and cool, has existed for approximately 5 billion years without diminishing its luminosity. Therefore, it has been suggested that the glow is maintained by dust falling onto its surface from the dust disk surrounding the star. This process should apparently increase the white dwarf’s mass to the Chandrasekhar limit and replenish the white dwarf’s luminosity. This, too, is a theoretical assumption.

In theory,[1] the process of dark matter absorption (11) is accompanied by energy replenishment. For the white dwarf Wolf 457,[8] with a mass $m_o = 1.01 \times 10^{33}\ g$ and a radius $r_o = 700\ km$, the power absorbed by the star from the dark matter continuum at a given moment in time ($t = 0$) will be

$$N_{moon} = \frac{dm}{dt}\frac{V_r^2}{2} = \frac{f^2 \frac{\alpha}{k} m_0^3}{\alpha^2 r_0^4} e^{\frac{\alpha}{k}t} = \frac{(6.7\times10^{-11})^2\ (2.97\times10^{-18})(10^{30})^3}{(7\times10^5)^4} e^{\frac{\alpha}{k}t} = 0.0555\times10^{30}\ W \tag{14}$$

It has been established that "white dwarfs shine significantly less brightly than the Sun." We will be neglected by the radiation from "white dwarfs" in our study, but we will keep this in mind. The lower time interval during which the naturally occurring white dwarf Wolf 457 could accumulate the energy of a "supernova" explosion $E_{sun} = 10^{42} \ldots 10^{44}$ Joules is

$$t = \frac{E_{sun}}{N_{moon}} = \frac{(10^{42} \ldots 10^{44})}{0.533 \times 10^{30}} = 1.88 \times (10^{12} \ldots 10^{14})\ c$$
$$= 59.7 \text{ thousand years } \ldots \text{ } 5.97 \text{ million years} \quad (15)$$

Actual time may be slightly longer than this value. For reference, 1 year = 3.15×10^7 *s*.

Results

Stars, including invisible "black holes," are surrounded by a continuum of dark matter. As they leave the star, photons of light must overcome a counter-current of dark gas. If the speed of photons of light ($C = 3 \times 10^8$ *m/s*) is less than the speed of the dark gas flow toward the star's center, the star turns into a "dark hole." Incorrectly using condition (3), derived for the case of one component escaping from a binary mass system, leads to unrealistic values for the density and size of the "black hole" (with a mass on the order of the Sun).

A study has revealed the presence of invisible solar systems in the Universe around "black holes" with masses comparable to the Sun. Such systems should be at least as numerous as white dwarf stars.

The mechanism behind "supernova explosions," caused by the excessive accumulation of energy entering "black holes" from the dark matter continuum along with the absorbed masses of dark matter, has become more fully understood. Astronomers claim that such "supernova" explosions occur in the Milky Way galaxy every 300 years.

References

1. S. G. Burago, *The Nature of Dark Matter and Dark Energy of the Cosmos* (SCIence, Moscow, 2021), p. 264. ISBN 978-5-4365-7123-2.
2. S. G. Burago, *The Nature of Dark Matter and Dark Energy of the Cosmos* (ResearchGate, 2022).
3. S. E. Frish and A. V. Timoreva, *Course of General Physics*, Vols. 1–3 (Fizmatgiz, Moscow, 1961).
4. B. M. Yavorsky and Yu. A. Seleznev, *Physics* (Fizmatlit Publishing House, Moscow, 2000).
5. O. D. Khvolson, *Course of Physics*, Vol. 1 (GTTC, Moscow, 1934).
6. D. G. Kikin and P. I. Samoylenko, *Physics (with the Basics of Astronomy)* (Vysshaya Shkola, Moscow).
7. T. A. Agekyan, Stars, Galaxies, *Metagalaxy* (Nauka, Moscow, 1981).
8. V. A. Bronshten, *Hypotheses about Stars and the Universe* (Nauka, Moscow, 1974).
9. N. V. Kochin, I. A. Roze, and I. A. Kibel, *Theoretical Fluid Mechanics*, Part 2.