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Staff Article

Black Hole | ˈˌblak ˈhōl | (noun):

A region of space having a gravitational field so intense that no matter or radiation can escape. Black holes are theoretically formed when a massive star exhausts its nuclear fuel and collapses under its own gravity. If the star is massive enough, no known force can counteract the increasing gravity and it will collapse to a point of infinite density. Before this stage is reached, light itself becomes trapped within a certain radius known as the event horizon and the object becomes invisible (1).

Since black holes form from the death of massive stars, there is a theory that Earth was formed inside of one. Could Earth have been engulfed in a black hole vacuum?

After hearing the definition above, you might have answered a snarky ‘yes’ when considering all of the times your belongings seem to “disappear” in the metaphorical black hole room in your house. Once the item reappears in your room, it can quintessentially be seen as a white hole, the opposite of a black hole, which things only escape out of. It is also speculated that there are black holes here on Earth. These speculations are sometimes made by those that claim Bigfoot sightings. He would appear through the white hole and then disappear into a black hole rendering it impossible to capture him. Theories such as that one have led to more interest in whether we are among black holes.


(Bigfoot Sign 2)

I am sure you would like a yes or no answer right away. Although providing a one-worded answer might be as easy as that, let's explore why it might not be.

To start, there are three types of black holes. One type is the stellar black hole, which is a smaller type of black hole that forms when a large star collapses. There are many of these in the Earth's own galaxy, the Milky Way. Another type is the supermassive black hole, described as an enormous black hole that can be up to billions of times larger than the sun. This type of black hole is also found in the Milky Way. These black holes can grow by either gathering mass from the dust and gas they are surrounded by, from many stars collapsing together, or from smaller black holes merging. The third type is the intermediate black hole, which is medium in size and forms when stars are bunched together and collide like a domino effect. These have been hard to find but are suggested to be in small galaxies (3).


(Black Hole 4)

The question of whether we are residing in one of these black holes has been raised by scholars. Those that support that our universe was created by the Big Bang Theory have suggested that the Big Bang is a black hole. A black hole can be created when large amounts of mass exist in an area in space or when a star dies, leading some scientists to believe that the Big Bang is a black hole opening into another universe. The matter absorbed by this black hole is what started our universe. Theoretical physicist Nikodem Poplawski states that this is a great possibility because our universe is constantly growing due to more cosmic material being absorbed. In the end, we are unable to see what is inside of other black holes, so the best we can do is hypothesize (5). Robert Mann, a professor of physics and applied mathematics from the University of Waterloo, supports the theory of Earth residing inside of a black hole due to the collapse of a five-dimensional star. He explains that according to gravitational physics, we would be in a smaller dimension surrounded by a larger dimension, with the larger five-dimensional

star collapsing into a black hole in which we reside (6). Professor of physics and astronomy James S. Bullock from the show *How the Universe Works* proposes a theory. He states that as matter is crushed into the center of a black hole, it can be crushed no further. According to this theory, when a black hole reaches its maximum density and therefore explodes, a Big Bang would occur. The matter from the explosion would then cool to form atoms, followed by galaxies, stars, and planets. But the show goes on to disclaim that these are only theories and compelling ideas (7). There is an endless number of what-ifs, but there is mathematical evidence supporting these theories. The concept of Schwarzschild radius is the major support system for the Big Bang Black Hole theory. It determines how large a black hole is by calculating its mass. Ethan Siegel, a Ph.D. astrophysicist exclaims, “Remarkably, the Schwarzschild radius of a black hole with the mass of all the matter in the observable Universe is almost exactly equal to the observed size of the visible Universe! That realization, on its own, seems like a remarkable coincidence” (8). But is that enough to say that we are, in fact, living inside of a black hole? Some say that it is the math instead of physics that leads us to believe this black hole cosmological model theory that was originally proposed by theoretical physicist Raj Pathria and mathematician I.J. Good. Most cosmologists conclude that using the same set of equations for the interior of a black hole and the evolution of our universe is coincidentally the same answer (9).

Ethan Siegal also explains that we cannot firmly conclude that we are inside of a black hole because there are many more steps that need to be taken to strengthen this idea (8). Theoretical physicist Sean Carroll states that just because the universe radius and Schwarzschild radius are comparable, it does not automatically put us in a black hole. He explains that our universe is constantly expanding, prompting him to conjecture that the universe is a white hole (10). Upon interviewing senior Duquesne University Physics student Joshua Goodwill, he was open minded and stated his theory. He explained;

“I do not think we are living in a black hole, but I definitely see it is a possibility. I base my thoughts off Hawking Radiation, which is the idea that black holes dissipate into the universe over time. If we were to be living in a black hole, I feel as though Hawking Radiation would be present in our universe as we would see mass leaving the universe almost spontaneously. On the other hand, it is totally possible due to the large amounts of dark matter and dark energy we have found in the universe. Generally, it is hard to say since we know so little about the matter and energy in the universe.

Recently, physicists have determined the Cosmic Microwave Background (CMB), which has shown that the universe is not flowing in any particular direction. I feel as though we would be able to see the Hawking Radiation through the influx or outflux of the matter."

According to Amanda Gefter, a science writer for BBC Earth, no one knows what is inside a black hole. There could be anything in there, even a universe (11). We are constantly finding new information, and in 2019 scientists captured the first image of a black hole. This reassures us that we might gather new data in the future, which may tell us whether we are living in a black hole or not.

After all of that, you might still be asking, 'so are we living inside of a black hole?' Getting back to that yes or no answer I know you were wanting... we ultimately are unsure, but the vortex around the question is enough to suck you in.

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