

# What is a black hole?

Business



Black holes are what make physics fun. It seems these days that science is more about memorization than creativity.

Well, these strange children of Einstein will satisfy any curiosity for quite a while. What comes to mind when someone mentions a black hole? Most people will conjure up images of a dark, immortal, headless monster that devours matter with a voracious appetite. Not exactly. Loosely speaking, a black hole is a region of space surrounding a point of infinite density (a singularity). It is “black”, as the gravitational force of the singularity swallows all energy, including light. It is also a ‘hole’, literally as well as figuratively.

Think of a black hole as a space monster that swallows up matter.

Unfortunately, ‘space monster’ is not a good way to define a black hole.

Black holes are too lazy to go and hunt for matter, instead they just sit and hide until the unsuspecting star wanders across and is destroyed. The black hole grows fat from lack of exercise, and starts to ‘leak’ matter at a very slow rate. Assuming that this black hole has the mass of our sun, it will evaporate and die in a billion trillion trillion years. As you can see, once black holes are formed, they will stick around for a very LONG time.

Roughly speaking, this analogy is the life cycle of a black hole. In order to come up with a logical explanation for the existence of black holes, first imagine space and time are intertwined and form an elastic fabric extending infinitely in all directions. When an object of sufficient mass is placed on this space-time fabric, it will deform, stretched by the ‘weight’ of the object.

More concisely, space-time will form a slight indentation, dipping down below the object. This ‘bending’ of space-time is what we know as gravity.

Contrary to popular myth, a black hole is not a cosmic vacuum cleaner. If our Sun were to be suddenly replaced with a black hole of the same mass, Earth’s orbit around the Sun would be unchanged. Of course, temperature would plummet 360 degrees, and there would be no solar wind or solar magnetic storms affecting us. To be “sucked” into a black hole, one needs to cross inside the event horizon. At the event horizon, the escape speed is equal to the speed of light, and therefore once light passes through, even it cannot escape.

For objects of sufficient mass and density, the weight of the object will stretch space-time so much that the indentation formed becomes more of a well than a dent. For a black hole, this well is endless, leading to some strange properties. When objects approach a black hole, time slows and eventually stops as the object approaches the event horizon. In other words, if a watch were to collide with a black hole, the watch would stop ticking. Of course, the watch would be torn apart by tidal forces long before the event horizon, but that is another matter.

However, if you were a safe distance away from your watch, and watched it fall into the black hole, you would see it slow down and stop just before entering the event horizon. In other words, according to your reference point, the watch would never enter the black hole. The problem is, the laws of physics dictate the watch must enter the hole. This paradox goes back to how space-time is bent. As you get closer and closer to the black hole, time

is warped more and more until light takes an infinite amount of time to reach your eyes; the reason the watch appears to be stationary.

What would happen if someone fell into a black hole? Very simple: they would die. They would literally be stretched into a piece of human spaghetti, and then be crushed into a lump of carbon and hydrogen atoms. Even worse, the more our unlucky traveler tried to escape, the faster he would die. He would also be able to see the life cycle of the universe, but ultimately, all roads lead to the end. Fortunately, the nearest black hole is 60, 000 light years away, several trillion years by car. As a result of the space-time warp, it is theoretically possible to see the back of your head while in orbit around a black hole.

It also may be possible to travel instantaneously to anywhere in the universe by entering a black hole and being spit out of a 'white hole' (not proven). It has been recently proven that black holes emit radiation and eventually evaporate like large rain clouds. Black holes give scientists the ability to study what the universe was like before the big bang as well as quantum mechanics. They also may hold the key to future intergalactic and interstellar space travel. These monsters of nature are strange and fascinating, as long as no one gets sucked into one.

Normally I wouldn't spend so much time learning about such an obscure topic. However, mastering control of black holes will be instrumental to accumulation of wealth or possible plans of world domination. These benign arts of nature also may lead to alternate universes, along with other intriguing possibilities. Just make sure you don't fall in.