**BLACK HOLE**

‘Black Hole’, a cosmic body of extreme intense gravity, is a region of space-time where gravity is so strong that no particles or even electromagnetic radiation such as light can escape from it. Black holes are some of the strangest and most fascinating objects in outer space, they are also extremely dense. The theory of general relativity predicts that a sufficiently compact mass can deform space-time to form a black hole. Black hole is tremendous amount of matter crammed into a very small, infact zero amount of space. The result is a powerful gravitational pull, from which not even light can escape and therefore no information can be gathered or insight as to what life is like inside. If anyone jump into the black hole with feet first, then the gravitational force on the toes would be much stronger than that of pulling on one’s head. Each bit of the body would also be elongated in a slightly different direction. Therefore, one would literally end up looking like a piece of spaghetti.

Black hole can be formed by the death of a massive star. When such a star has exhausted the internal thermonuclear fuels in its core at the end of its life, the core becomes unstable and gravitationally collapses inward upon itself and the outer layer of the stars are blown away. The crushing weight of constituent matter falling in from all sides compresses the dying star to a point of zero- volume and infinite density called the singularity. The singularity at the center of a black hole is known as the ‘ultimate no man’s land’ – a place where matter is compressed down to an infinitely tiny point and all conceptions of time and space completely break down and it does not really exist. Something has to replace the singularity but we are not exactly sure about that.

Black holes can be big or small. Scientists think that the smallest black holes are as small as just one atom. These black holes are very tiny but have the mass of a large mountain. Mass is the amount of matter or ‘stuff’ in an object. Another kind of black hole is called ‘stellar black hole’, whose mass can be upto 20 times more than the mass of the sun. There may be many many stellar mass black holes in the galaxy of the earth (Milky way). Stellar black holes are formed when the centre of a very massive star collapses in upon itself. This collapse also causes a supernova or an exploding star that blasts part of the star into space. Scientists think that the ‘supermassive black holes’ are formed at the same time as the galaxy they are in. These supermassive black holes have masses that are more than 1 million suns together. Scientists have found proof that every large galaxy contains a supermassive black hole at its center. The supermassive black hole at the centre of the Milky Way is called Sagittarius A. It has a mass equal to about 4 million suns and would fit inside a very large ball that could hold a few million earths. Scientists think that the smallest black holes are formed when the universe began. Stellar black holes are formed when the center of a very big star falls in upon itself or collapses. When this happens it causes a supernova. A supernova is an exploding star that blasts part of the star into space. Most black holes form from the remnants of a large star that dies in supernova explosion (smaller stars become dense neutron stars, which are not massive enough to trap light). Scientists think supermassive black holes were made at the same time as the galaxy they were in.

A black hole is a place in space where gravity pulls so much that even light cannot get out. The gravity is so strong because matter has been squeezed into tiny space - this can happen when a star is dying. Since no light can get out, people can’t see black holes – they are invisible. Space telescopes with the special tools can help to find out black holes – the special tools can see how stars, that are very close to black holes act differently than other stars. A black hole cannot be seen because strong gravity pulls all of the light into the middle of the black hole. But scientists can see how the strong gravity affects the stars and gas around the black hole. Scientists can study stars to find out if they are flying around or orbiting a black hole. When a black hole and a star are close together, high-energy light is created. This kind of light cannot be seen with human eyes. Scientists use satellites and telescopes in space to see that high-energy light. NASA is using satellites, spacecrafts and telescopes that are travelling in space to learn more about the black holes – this system help the scientists to answer questions about the universe. Scientists can’t directly observe the black holes with telescopes that detect x-rays, light or other forms of electromagnetic radiation. We can however infer the presence of black holes and study them by detecting their effect on other matter nearby. If a black hole passes through a cloud of interstellar matter – it will draw the matter inward in a process called accretion. A similar process can occur if a normal star passes close to a black hole. In this case black holes can tear the star apart as it pulls it towards itself. As the attracted matter accelerates and heats up, it emits x-rays that radiate into space. Recent discoveries offer some tantalizing evidence that black holes have a dramatic influence on the neighbourhoods around them – emitting powerful gamma ray bursts, devouring nearby stars and spurring the growth of new stars in some areas while stalling it in others.

Albert Einstein first predicted the existence of black holes in 1916, with his General Theory of Relativity. The term ‘black hole’ was coined many years later in 1967 by American astronomer John Wheeler. After decades of black holes being known only as theoretical objects, the first physical black hole ever discovered was spotted in 1971. Then in 2019, the Event Horizon Telescope (EHT) collaboration released the first image ever recorded of a black hole. The EHT saw the black hole in the center of galaxy M87 while the telescope was examining the event horizon or the area past, for which nothing can be escaped from a black hole. The image maps the sudden loss of photons (particles of light). It also opens up a whole new area of research in black holes, now that astronomers know what a black hole looks like. Thus so far the astronomers have identified three types of black holes : Stellar black holes, Supermassive black holes and Intermediate black holes. Historically, astronomers had believed that no mid-sized black holes exist. However recent evidence from Chandra, XMM-Newton and Hubble strengthens the case that mid size black holes do exist. One possible mechanism for the formation of super-massive black holes involves a chain reaction of collisions of stars in compact star clusters that results in the building up of extremely massive stars, which then collapse to form intermediate-mass black holes. The star clusters then sink to the center of the galaxy, where the intermediate-mass black holes merge to form a supermassive black hole.

Don’t let the name fool you: ‘a black hole is nothing but empty space’. Rather it is greater amount of matter packed into a very small area. Let us think of a star ten times more massive than the sun squeezed into sphere approximately the diameter of New York City. Similarly, the result is a gravitational field so strong, that nothing, not even light can escape. The idea of an object in space is so massive and dense that light could not escape it – that has been around centuries. Most famously black holes were predicted by Einstein’s General Theory of Relativity, which clearly showed that when a massive star dies; it leaves behind a small, dense, remnant core. If core’s mass is more than about three times the mass of the sun – the equations showed that the force of gravity overwhelms all other forces and produces a black hole. The sight of a black hole weighs heavily on our human mind as a deep archetypal symbol. It conjures up ideas about a portal to mystery, danger, evil or nothingness. It invites, lures or sucks us into the unknown into the unconscious into the mystical void.

Slowing of time is extreme near black hole. From the viewpoint of an observer outside the black hole, time stops. Inside the black hole, the flow of time itself draws falling objects into the center of the black hole. No force in the universe can stop this fall anymore than we can stop the flow of time. For outside observers, a black hole is one solidary element and there is no proper time inside the black hole but there is only the observed coordinate time according to our space coordinates.

No, a black hole is not really a hole at all. A black hole is an object just like any other, except that is extremely dense. The term ‘hole’ was used because whatever falls into a black hole is trapped forever.