

Black Holes Explained

Our solar system is in the Milky Way galaxy along with about 100 billion stars, some smaller and some larger than our Sun. There are about 10 billion galaxies in the Universe. So, there are about a trillion-billion stars in the Universe!

The Sun gives off a large amount of energy because it has a nuclear explosion in its core in which two hydrogen nuclei come together to create a helium nucleus. A helium nucleus has less mass than the two hydrogen nuclei; the mass difference is converted by Einstein's equation $E=mc^2$ into the energy given off. The heat of the fusion of the two hydrogen nuclei provides outward pressure that works against gravity force between its parts trying to make the Sun smaller. In about 5 billion years the Sun will run out of hydrogen to give off energy; it will eventually become a small cool star called a white dwarf as gravity shrinks it.

When a star about 20 times as massive as the Sun runs out of hydrogen it explodes in a Supernova and then the remainder shrinks due to the gravity force between its parts to such a small size that an object attracted to it will be taken in and can never escape. Such an object is called a black hole, because even light cannot escape from it. The gravitational attraction will tear the entering object into its component elementary parts.

Einstein's general theory of relativity (which should be called general theory of gravity) modifies Newton's theory of gravity and explains the existence and properties of black holes. It states that the extreme gravity in the neighborhood of a black hole makes space curved and the curvature of space due to gravity causes objects to move as if there were a force, but actually they move because space is curved by the mass of the black hole. Any object causes space to be curved. The Sun causes space to be curved, which makes the planets move around it and the Earth causes space to be curved, which makes the moon and satellites move around it.

Recently large complex devices in Louisiana and Washington state detected six pairs of black holes revolving around each other and then colliding creating larger black holes. The created black holes' masses ranged from 18 to 62 times the mass of the Sun. These are called stellar black holes. A black hole of 20 solar masses is about 12,000 smaller in size than the Sun!

At the center of most galaxies is a very large black hole, called a supermassive black hole. The mass of the one at the center of the Milky Way is about 4 million times the mass of the sun and about 17 times the size of the Sun.

For a black hole to have the size of the Sun (695,700 km) it would have to contain about 235,000 times the mass of the Sun.