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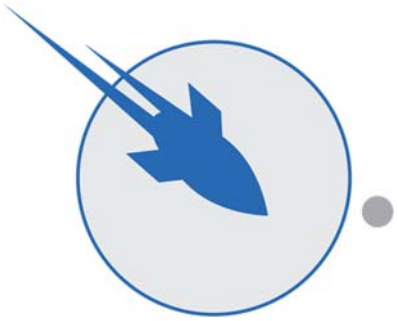
The Cosmic Giants: How Big Can a Black Hole Be?



Black holes come in a variety of sizes, from small to incredibly massive. Black holes are born from the remnants of massive stars that have exhausted their nuclear fuel. When these massive stars can no longer support their own gravitational forces, they undergo a catastrophic collapse, leading to the formation of a black hole. The size of the resulting black hole is directly related to the mass of the star that gave birth to it.

Stellar-Mass Black Holes

The most common type of black holes in the universe are stellar-mass black holes. These black holes typically have a mass between three and twenty times that of our sun. When a massive star reaches the end of its life cycle and explodes in a supernova, the core that remains can collapse to form a stellar-mass black hole. These black holes can have event horizons with radii as small as a few kilometers.

Intermediate-Mass Black Holes

Intermediate-mass black holes fall between stellar-mass and supermassive black holes in terms of size. These black holes have masses ranging from hundreds to thousands of times that of our sun. The origin of intermediate-mass black holes is still a subject of research, but they may form through the merging of smaller black holes or by accreting matter over time.

Supermassive Black Holes

At the heart of most galaxies, including our own Milky Way, lie supermassive black holes. These cosmic giants have masses ranging from millions to billions of times that of our sun. Their enormous sizes are a result of long-term accretion of matter and merging with other black holes over cosmic time. The supermassive black hole in the center of the Milky Way, known as Sagittarius A*, has a mass of approximately four million times that of our sun.

The Largest Known Black Holes

The largest known black holes are the supermassive black holes found at the centers of galaxies. One of the most massive black holes discovered so far is TON 618, located in the constellation Canes Venatici. TON 618 is estimated to have a mass exceeding sixty-six billion times that of our sun, making it one of the largest black holes known.

The Limit to Black Hole Size

While supermassive black holes can reach colossal sizes, there is a limit beyond which they cannot grow. This limit is determined by the Eddington limit, which relates the luminosity of a black hole to its mass. If a black hole were to exceed this limit, the radiation produced by the infalling matter would push it back, preventing further growth.