The Question of Primordial Black Holes

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The question of whether or not primordial black holes actually exist is examined. Stellar and supermassive black holes are described to offer a comparison. The lack of observable, hard supporting evidence, after 58 years, makes the concept of primordial black holes less and less likely, in spite of the imaginative, though somewhat unrealistic scenarios used to theorize their existence.

Primordial black holes have never been observed, and there is no hard evidence supporting their existence. Their predicted existence is based on the creative mathematics Igor Novikov and Yakov Zel'dovich, in their paper, *The Hypothesis of Cores Retarded during Expansion and the Hot Cosmological Model*, published in 1966. They predicted these black holes would have formed shortly after the theoretical Big Bang. These primordial black holes differ from the "observable" stellar and supermassive black holes, whose existence results when a large star gravitationally collapses in on itself

The theoretical primordial black holes (PMBs) have gradually come to vary in size, depending on what scenario they are being used to support. In some scenarios, they are subatomic and called micro black holes (different from the theoretical model of subatomic black holes popping in and out of reality), while other PMBs are larger, but invisible because they are black holes.

One highly imaginative model of primordial black holes suggests they exist at the center of various asteroids, planets, and stars. In Volume 46 of Physics of the Dark Universe, De-Chang Dai and Dejan Stojkovi published a paper titled *Searching for small primordial black holes in planets, asteroids and here on Earth*, which presents the theory that planets, asteroids, stars, and even possibly Terra, has a small black hole at its center. According to their theory, these small, "primordial" holes also create a hollow core at the center of the planet, asteroid, or star. The model uses mathematics to support its conclusions, but has no hard supporting observable evidence.

Another problem with this PBH model, at least in terms of Terra having a hollow core with a small primordial black hole at its center, is the existence of volcanic lava, which is pressured upward, not pulled downward toward the small PBH.

Stellar and Supermassive Black Holes

Observations have shown that stars going supernova require a certain amount of mass before collapsing in on themselves to form an "observable" or stellar black hole. (Stars lacking enough mass become either a dead star or a neutron star.) By definition, stellar black holes generate so much gravity, because of their extreme mass, that light cannot escape. "Stellar" black holes (the ones resulting from collapsed stars) do not emit or reflect light, essentially making them invisible.

In the Standard Model, massless photons are pulled back into the black hole. In the Ultra-Space Field Theory, the thermal field — made up of joined positrons and electrons, which "do" have a gravity field "and" support the electromagnetic field — is dragged into the black hole, and any EM waves lack the speed to escape.

Observable black holes are normally discovered by the effects they have on their immediate surroundings. Because they do not emit or reflect light, they are essentially invisible to telescopes. Their immediate surrounding environment, however, is another story, and is active and tumultuous. Black holes have north and south poles, and accumulate cosmic matter in its equatorial orbit in a pattern called an accretion disk. When a star in the accretion disk moves close enough during its orbit of the black hole, the hole's intense gravity compresses and stretches the star out, turning it into a stream of hot gas.

The gas particles within the accretion disk are heated to millions of degrees, and in the process generate detectable X-rays. Typically, black holes producing this sort of phenomena contain "at least" a few solar masses, and are often much larger. (One solar mass is based on the mass of our own sun.)

On a larger scale, a supermassive black hole has a mass of over a million suns, and as a consequence, behaves a little differently than its smaller sister black holes. Astronomers can determine the existence of a supermassive black hole in a galaxy by examining its spectrum of light. According to spectral observations of supermassive black holes, the gases orbiting it are hotter, and moving faster than the smaller ones. The more intense gravity of a supermassive black hole results in a hotter, more volatile accretion disk. In some cases, this results in super-heated matter shooting off as jets of gas millions of light-years long. These gas ejections have been observed by astronomers and are called outflows.

Primordial Black Hole Models and Their Weaknesses

From a gravitational perspective, "small" primordial holes lack the mass (and subsequent gravity) to prevent light from escaping. The lack of mass also suggests a lack of appropriately condensed matter — without gravity to compress the small primordial black hole, it would expand outward and begin to break up. A small primordial black hole cannot gravitationally sustain itself as a black hole.

In 2024, Bernard Carr and Florian K'uhnel presented the idea primordial black holes could be used as a replacement for, or explanation for, dark matter. They have described this theory in their paper, *Primordial Black Holes as Dark Matter: Recent Developments*. However, there are problems with this model.

The primary problem is a lack of supporting evidence. While there have been a few observations of unexplained gravitational lensing, these are so rare they cannot be used to explain the massive amounts of dark matter creating a gravitational pull throughout the universe. (Gravitational lensing is an observable phenomenon in which light is bent inward as it passes a gravity field. It happens with all gravity fields, but the stronger the gravity field, the more noticeable the effect.)

Yet another theory, created by Bernard Carr, and published in New Scientist, describes a model in which some black holes existed "prior" to the Big Bang. These theoretical primordial black holes would have existed before the Big Bang and are theorized to be at the center of supermassive black holes. (Because primordial black holes lack any observable hard supporting evidence to support their existence, the theory they existed prior to the "theoretical" Big Bang provides an excellent example of human imagination.)

While the concept of primordial black holes is imaginative, other than some creative mathematics, it lacks any hard supporting evidence.