

A Milky Way Filament that points to the Black Hole

A recently discovered giant filament – 2.3 light-years long – points toward Sagittarius A*, the supermassive black hole at our galaxy's heart.

The bright source near the bottom of this image, Sagittarius A* – pronounced Sagittarius A-star – is thought to be the location of the supermassive black hole at the centre of our home galaxy, the Milky Way. See the filament appearing to point toward it? The filament might be caused by high-speed particles kicked away from the black hole, or it might be something even stranger.

One of the most mysterious and interesting known locations in our neighbourhood of space is the centre of our home galaxy, the Milky Way. It's thought to contain a supermassive black hole, with a mass of some 4 million Suns. Astronomers call this region and its possible black hole Sagittarius A*. In 2016, **Farhad Yusef-Zadeh** of Northwestern University reported his discovery of an unusual filament in this region.

The filament is about 2.3 light-years long and appears to curve around the site of the black hole. Now, another team of astronomers has employed a new technique to obtain a high-quality image of the curved filament. These astronomers said their new image supports the idea that the filament is pointing toward the black hole. The new image has led to some fascinating speculations as to the nature of this mystery filament.

A paper describing the new image – and astronomers ideas based upon it – was published in the December 1, 2017 issue of the peer-reviewed *Astrophysical Journal Letters*.

Mark Morris of the University of California, Los Angeles, led the imaging study. He said in a December 20, 2017 statement from the Harvard-Smithsonian Center for Astrophysics (CfA):

With our improved image, we can now follow this filament much closer to the galaxy's central black hole, and it is now close enough to indicate to us that it must originate there. However, we still have more work to do to find out what the true nature of this filament is.

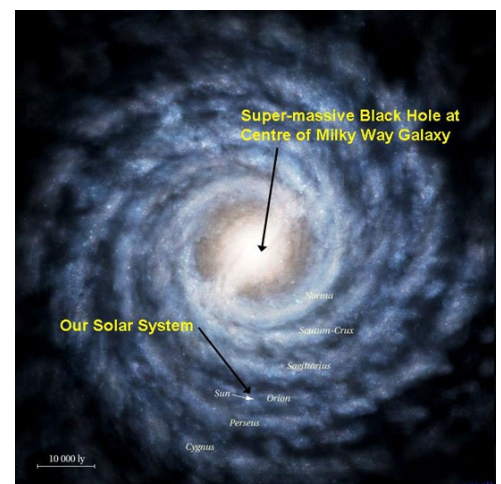
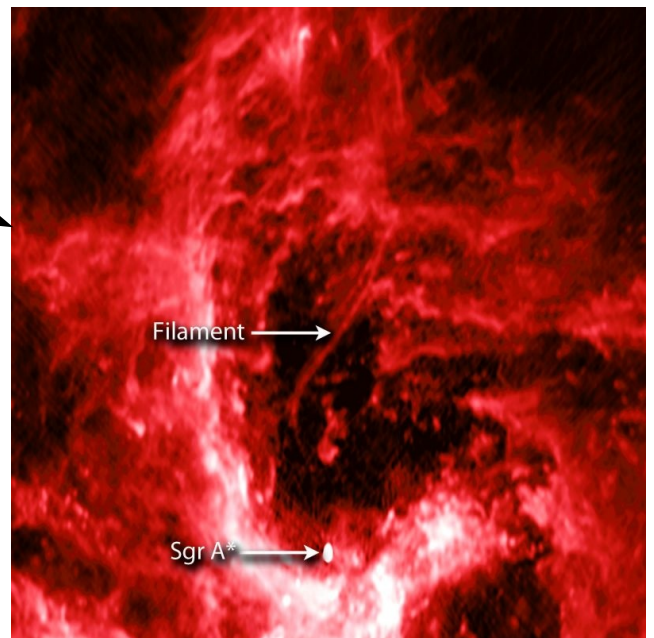
Researchers have considered three possible explanations for the filament:

- 1 The first is that it is caused by high-speed particles kicked away from the supermassive black hole. A spinning black hole coupled with gas spiraling inwards can produce a rotating, vertical tower of magnetic field that approaches or even threads the event horizon, the point of no return for infalling matter. This would reveal important information about the magnetic field in this special environment
- 2 The second, more fantastic possibility is that the filament is a cosmic string, theoretical objects that are long, extremely thin and carry mass and electric currents. Theorists had predicted that cosmic strings, if they exist, would migrate to the centres of galaxies. It would provide the first evidence for this highly speculative idea with profound implications for understanding gravity, space-time and the Universe itself.
- 3 The final option is that the position and the direction of the filament aligning with the black hole are merely coincidental.

Each of the scenarios being investigated would provide intriguing insight if proven true.

Even if the filament is not physically tied to Sgr A*, the bend in the shape of this filament is still unusual. The bend coincides with, and could be caused by, a shock wave, akin to a sonic boom, where the blast wave from an exploded star is colliding with the powerful winds blowing away from massive stars surrounding the central black hole.

Co-author **Miller Goss**, from the National Radio Astronomy Observatory in Socorro, New Mexico, said: *We will keep hunting until we have a solid explanation for this object. And we are aiming to produce even better, more revealing images.*



Drawing of the Milky Way Galaxy