

## Giant space cloud may be powered by black holes

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An enormous cloud of roiling plasma in space may be drawing its energy from black holes, new observations suggest. Such clouds might be sources for the mysterious particles that occasionally crash into Earth's atmosphere at ultra-high speed.

Plasma is a form of matter in which electrons have been ripped from their atomic nuclei, leaving behind a cloud of charged particles. Astronomers can detect plasma as a result of the radio waves emitted by free electrons when they interact with magnetic fields in their environment.

But most radio observations focus on small patches of sky, so they cannot detect very large structures. The newly discovered plasma cloud was discovered in a survey designed to overcome that problem.

Philipp Kronberg of the Los Alamos National Laboratory in New Mexico, US, led a team that used the Arecibo Observatory in Puerto Rico (facing [potential closure](#)) and the Dominion Radio Astrophysical Observatory in Penticton, Canada. The combined observations are very sensitive to faint sources over a very large patch of sky – equivalent to the width of 16 Full Moons laid side by side.

The researchers discovered a cloud of plasma about 8 million light years across, or 80 times the width of our galaxy, the Milky Way. It is so huge that it appears five times as large as the Full Moon, even though it is millions of light years away.

If humans could see radio waves, the cloud would look like a large, faint blob. "You wouldn't need the magnification of a telescope to see it at all – although you would need radio eyes," Kronberg told **New Scientist**.

### Energetic jets

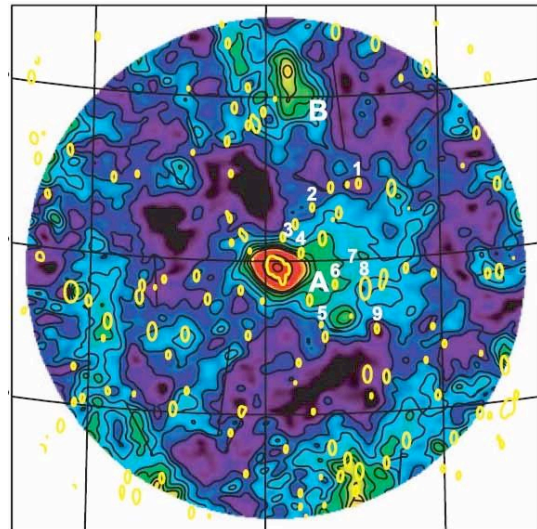
Astronomers have never seen an isolated cloud of plasma of this sort before. The radio observations indicate that the plasma particles are moving around at high speed, but the energy source that keeps them so agitated is uncertain.

The object, called Region A, is in the general neighbourhood of a dense collection of galaxies called the Coma Cluster, which lies 300 million light years from Earth. But the cloud appears to be too distant from the cluster to be powered by it.



[Enlarge image](#)

The heart of the Coma cluster of galaxies can be seen in this image taken at visible wavelengths (Image: Kitt Peak)



[Enlarge image](#)

A giant plasma cloud appears as an extended blue blob to the right of the red patch at centre, which is the Coma cluster of galaxies. Galaxies suspected of harbouring supermassive black holes are marked as numbered yellow ovals (Image: Philipp Kronberg et al/LANL/Arecibo Observatory/DRAO)

The cloud does overlap with a loose grouping of seven radio-bright galaxies. Such galaxies are thought to contain extremely massive black holes at their centres, and the cloud's discoverers suspect it is these black holes that power the cloud.

Such black holes often have powerful jets of magnetised material streaming from them. The jets may stir up intergalactic gas, transforming it into a high-energy plasma.

### At the limit

Energetic particles escaping from such clouds could potentially make their way to Earth as mysterious "ultra high energy cosmic rays", Kronberg says. UHECRs, as they are known, are so powerful that astronomers do not understand what could accelerate them to such high energies.

The radio observations can only detect the cloud's lower-energy particles, which are trapped by the cloud's own magnetic field. But higher energy particles in the cloud may be able to escape, he says. "If they're high enough energy, then they would just zoom out of the cloud," he says.

But such high energy cosmic rays lose speed when travelling large distances. Region A is at the limit of how distant such a source could be and still hit Earth with ultra-high energy particles, Kronberg says. Something similar, but closer – a relatively nearby galaxy with black hole jets – would be an even better candidate source for the UHECRs hitting Earth, he says.

"The results are really exciting because they are the clearest detection [of such a plasma cloud] far from a rich cluster of galaxies," says Lawrence Rudnick of the University of Minnesota in Minneapolis, US.

### Collapsing stars

But he says it is too early to tell whether such objects supply the UHECRs. "What these objects do is keep open that debate, because they say you can't just dismiss yet these large-scale structures as playing a role in that," he told **New Scientist**.

Another possible origin of UHECRs is the collapse of massive stars to form black holes. These violent events give off bursts of gamma rays and, some astronomers speculate, ultra-high energy particles as well.

In 2006, a less isolated cloud of plasma was reported around galaxy cluster Abell 3376, with similar dimensions to Region A (see ['Big bang gas' in cosmic particle accelerator shock](#)). Astronomers suspect that cloud is the result of gas from outside the cluster colliding with the cluster's own gas.

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