

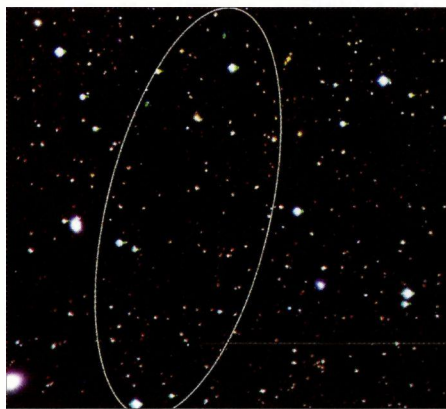
Radio astronomers observe a possible dark-matter galaxy

An international team of astronomers has discovered what appears to be an invisible galaxy made almost entirely of dark matter – the first ever detected. The mystery galaxy, VIRGOHI21, lies in the Virgo cluster of galaxies, some 50 million light-years from Earth.

Astronomers know that the visible galaxies contain more than the luminous matter observed; the rotation velocities indicate the presence of haloes of large amounts of dark matter. However, simulations of cold dark matter in the universe predict more dark haloes than galaxies, leading to the idea that there are dark haloes without stars: dark galaxies.

The team, from the UK, France, Italy and Australia, has been searching for dark galaxies by studying the distribution of hydrogen atoms throughout the universe through their emissions at radio wavelengths, in particular using the 21 cm line of atomic hydrogen. VIRGOHI21, a huge cloud of neutral hydrogen with a mass 100 million times heavier than the Sun, was first seen with the University of Manchester's Lovell Telescope at Jodrell Bank, UK. The sighting was later confirmed with the Arecibo telescope in Puerto Rico.

The speed at which it spins indicates that there is more to VIRGOHI21 than hydrogen. The rotation velocity implies a mass 1000 times greater than the amount of hydrogen, and at the distance of the Virgo cluster this should be in the form of a galaxy



Left: the ellipse on this image, taken by Cardiff astronomers using the Isaac Newton Telescope, La Palma, shows the region of the sky where the dark galaxy was found. Right: on the basis of the radio measurements, astronomers observing at optical wavelengths would expect to see the ellipse filled with a spiral galaxy, like NGC 7479 shown here. (Courtesy Nik Szymanek using the Faulkes Telescope North, Maui, copyright FTLLC.)



shining at 12th magnitude. However, when the team studied the area in question using the Isaac Newton Telescope in La Palma, Canary Islands, they found no visible trace of an optical counterpart for VIRGOHI21.

Dark galaxies are thought to form when the density of matter in a galaxy is too low to create the conditions for star formation. The observations of VIRGOHI21 may have other explanations, but they are consistent with the hydrogen being in a flat disc of rotating material – which is what is seen in ordinary spiral galaxies. Similar objects that have

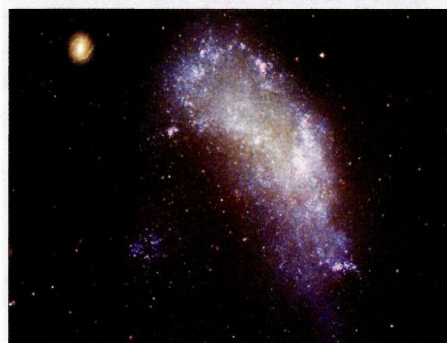
previously been discovered have since turned out to contain stars when studied with high-powered optical telescopes. Others have been found to be the remnants of two galaxies colliding, but in this case there is no evidence for such an encounter.

The team first observed the dark object in 2000, but it has taken almost five years to rule out the other possible explanations.

Further reading

R Minchin *et al.* www.arxiv.org/abs/astro-ph/0502312.

Picture of the month



What happens when a galaxy falls in with the wrong crowd? Under the gravitational grasp of a large gang of galaxies, called the Fornax cluster, the irregular galaxy NGC 1427A is plunging into the group at 600 km s^{-1} . Located some 62 million light-years away from Earth in the direction of the constellation Fornax, NGC 1427A shows numerous hot, blue stars in this image obtained by the Hubble Space Telescope. While the Fornax cluster contains hundreds of individual galaxies, there is a considerable amount of gas lying between them. When the gas within NGC 1427A collides with the Fornax gas, it is compressed to the point that it starts to collapse under its own gravity. This leads to the formation of the myriad of new stars seen across NGC 1427A, which give the galaxy an overall arrowhead shape that appears to point towards the upper right, in the direction of the galaxy's high-velocity motion. (Courtesy NASA, ESA and the Hubble Heritage Team [STScI/AURA].)