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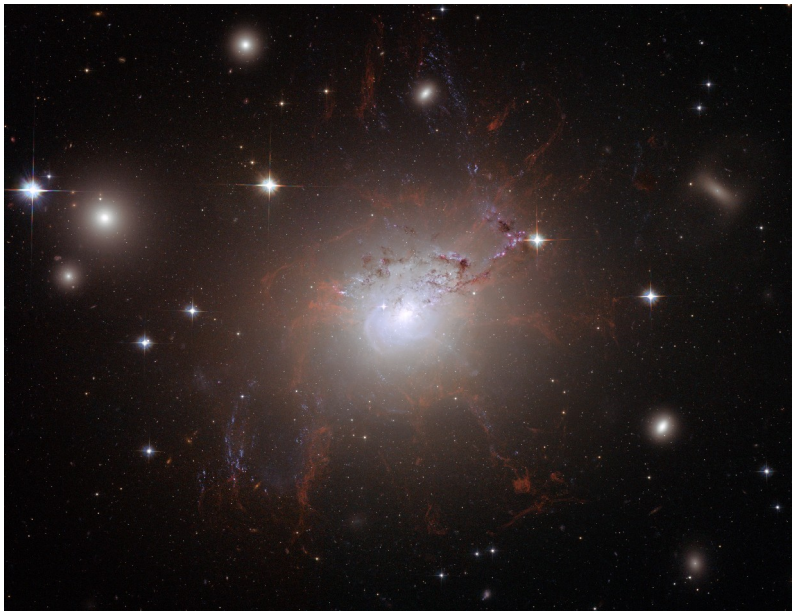
EMBARGO: Please note that this story is intended as a Wednesday for Thursday item and is therefore embargoed until 00:01 BST on Thursday, August 21st

Magnetic secrets of the Perseus Cluster revealed



Spectacular new pictures taken through the Hubble Space Telescope have helped a Cambridge University-led team of scientists to unravel a 100 million-year-old mystery about a giant galaxy deep in space.

The images, which will be published on Thursday this week (August 21st), show a number of "filaments" – vast but delicate threads of gas which emerge from the centre of a galaxy called NGC 1275, situated 235 million light years away.

For years, astronomers have puzzled over how these beautiful structures have survived. The filaments reach out from their home galaxy into the Perseus Cluster; a hostile, high-energy environment with a strong, tidal pull of gravity at its core.

These combined forces should have ripped apart the filaments in a very short period of time, causing them to collapse into stars. Instead, they have withstood their inhospitable climes for more than 100 million years.

Now, for the first time, images from Hubble have allowed researchers to observe the filamentary structure in unprecedented detail. Using these data, they were able to demonstrate that the strong magnetic fields in the region give the filaments a skeletal structure which is enough to enable them to resist gravitational collapse.

Their study, reported in *Nature*, not only promises to enhance our understanding of more distant galaxies but provides important clues about how black holes affect their

surrounding environment. The filaments are a by-product of a supermassive black hole at the core of NGC 1275 interacting with gases in the Perseus Cluster.

This immense black hole blows out bubbles of radio-wave emitting material into the Perseus Cluster. In the wake of these bubbles, cold gas from the heart of the galaxy is also dragged out into long streams to form the filaments.

The observations were made by a team led by Professor Andy Fabian, from the Institute of Astronomy at the University of Cambridge. Using the Hubble Space Telescope Advanced Camera for Surveys, they were able to differentiate individual threads of gas and determine their physical properties. In the images, the filaments show up as red, lacy structures surrounding the bright, central galaxy.

The study found that the amount of gas contained in a typical filament thread is around one million times the mass of our own Sun. The structures are only 200 light-years wide, often surprisingly straight, and extend for up to 20,000 light-years.

Thinner filaments are more fragile, meaning that they require stronger magnetic fields for support. By using the Hubble data to determine the filamentary structure, therefore, the researchers were able to estimate the strength of the magnetic fields around them and demonstrate how it is this which has maintained their structure against collapse.

“We can see that the magnetic fields are crucial for these complex filaments, both for their survival and integrity,” Professor Fabian said. “Without them, these beautiful structures would be unable to withstand their surroundings and would collapse into stars.”

The study will enable the team to interpret observations of similar networks of filaments in other, even more remote central cluster galaxies that cannot be observed in anything like the same detail as NGC 1275. The threads are also the only visible light manifestation of the intricate relationship between the central black hole and the surrounding gas of the Perseus Cluster, making the data an important asset in the study of black holes as well.

The study will be published in *Nature* on Thursday, August 21.

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Copies of the report and images can be provided on request. Interviews with members of the research team can also be arranged.

Notes for editors

1. The Hubble Space Telescope is a project of international co-operation between ESA and NASA.

2. The authors of the science paper are: A.C. Fabian, R.M. Johnstone, J.S. Sanders (University of Cambridge, UK), C.J. Conselice (University of Nottingham, UK), C.S. Crawford (University of Cambridge, UK), J.S. Gallagher III (University of Wisconsin, USA) and E. Zweibel (University of Wisconsin, USA)