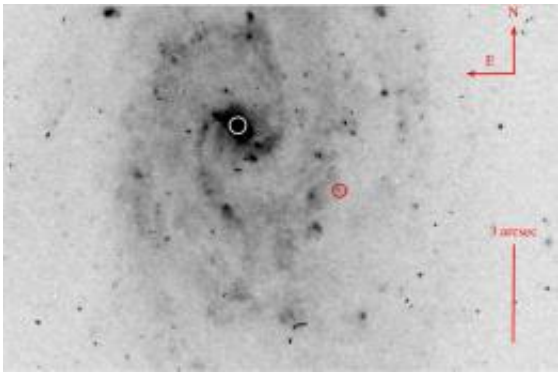
Supermassive black hole is thrown out of galaxy

May 11 2010



A Hubble Space Telescope image of the galaxy studied by Marianne Heida. The white circle marks the centre of the galaxy and the red circle marks the position of the suspected offset black hole. Image: STScI / NASA

(PhysOrg.com) -- Undergraduate student Marianne Heida of the University of Utrecht has found what appears to be a supermassive black hole leaving its home galaxy at high speed. As part of an international team of astronomers, this extraordinary discovery appears in a paper in the journal *Monthly Notices of the Royal Astronomical Society*.

For her final year project, Marianne worked at the SRON Netherlands Institute for Space Research, used the Chandra Source Catalog (made using the orbiting Chandra X-ray Observatory) to compare hundreds of thousands of sources of X-rays with the positions of millions of galaxies. Normally each galaxy contains a supermassive black hole at its centre.

The material that falls into black holes heats up dramatically on its final journey and often means that black holes are strong X-ray sources.

X-rays are also able to penetrate the dust and gas that obscures the centre of a galaxy, giving astronomers a clear view of the region around the black hole, with the bright source appearing as a starlike point. Looking at one galaxy in the Catalog, Marianne noticed that the point of light was offset from the centre and yet was so bright that it could well be associated with a supermassive black hole.

The black hole appears to be in the process of being expelled from its galaxy at high speed. Given that these objects can have masses equivalent to 1 billion Suns, it takes a special set of conditions to cause this to happen.

Marianne's newly-discovered object is probably the result of the merger of two smaller black holes. Supercomputer models suggest that the larger black hole that results is shot out away at high speed, depending on the direction and speed in which the two black holes rotate before their collision. In any case, it provides a fascinating insight into the way in which supermassive black holes develop in the centre of galaxies.

Marianne's research - which was carried out under the supervision of SRON researcher Peter Jonker - suggests this discovery may be only the tip of the iceberg, with others subject to future confirmation using the Chandra Observatory. She comments: "We have found many more objects in this strange class of X-ray sources. With Chandra we should be able to make the accurate measurements we need to pinpoint them more precisely and identify their nature."

Finding more recoiling black holes will provide a better understanding of the characteristics of black holes before they merge. In future, it might even be possible to observe this process with the planned LISA satellite,

an instrument capable of measuring the gravity waves that the two merging black holes emit. Ultimately this information will let scientists know if supermassive black holes in the cores of galaxies really are the result of many lighter black holes merging together.

More information: The research results have been accepted for publication in the journal Monthly Notices of the Royal Astronomical Society, under the title "A bright off-nuclear X-ray source: a type IIn supernova, a bright ULX or a recoiling super-massive black hole in CXO J122518.6+144545". The authors are: Peter G. Jonker (SRON), Manuel A.P. Torres (Harvard-Smithsonian Center for Astrophysics), Andy C. Fabian (Cambridge), Marianne Heida (Utrecht), Giovanni Miniutti (Centro de Astrobiologia), Dave Pooley (Wisconsin). A preprint of this paper can be seen at arxiv.org/abs/1004.5379

Provided by Royal Astronomical Society