Spectacularly bright object in Andromeda caused by 'normal' black hole

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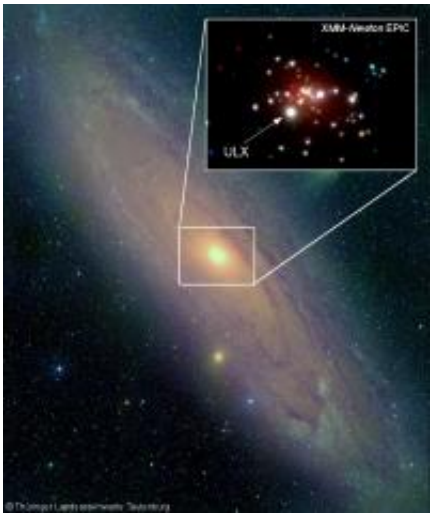


A Hubble Space Telescope optical image of our nearest neighbour galaxy, Andromeda (M31), with the inset an X-ray image of the active centre made with the XMM-Newton observatory. The newly discovered ULX is highlighted. Credit: MPE

(PhysOrg.com) -- A spectacularly bright object recently spotted in one of the Milky Way's neighbouring galaxies is the result of a "normal" stellar black hole, astronomers have found.

An international team of scientists, led by Dr. Matt Middleton, of Durham University, analysed the Ultraluminous X-ray Source (ULX), which was originally discovered in the Andromeda galaxy by NASA's

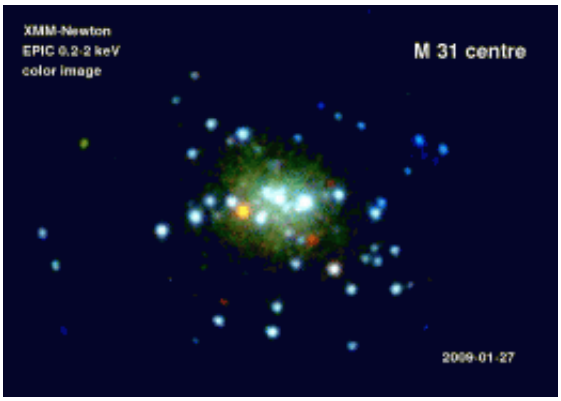
Chandra x-ray observatory. They publish their results in the journals Monthly Notices of the Royal Astronomical Society and Astronomy and Astrophysics.

Many ULXs are too far away for astronomers to study, but the relatively close proximity of Andromeda to the Milky Way – around 2.5 million light years – gave the team opportunity to study the phenomenon.

The researchers say their study could begin to answer the question about what causes ULXs. Some scientists believe they are caused by relatively small black holes, a few times the mass of our Sun. These black holes rapidly pull in gas and dust which forms an "accretion disc" and heats up causing the material to emit X-rays.

Other scientists say ULXs are caused by material being dragged in by an intermediate-sized black hole formed from the merger of many stellar black holes with a mass perhaps 1,000 times bigger than the Sun.

The Durham-led findings link the ULX spotted in Andromeda to a normal stellar black hole formed after a massive star exploded as a supernova.



An animated gif based on X-ray images from XMM-Newton, showing the ULX from the time it was first seen to enter outburst at the end of 2009 and its decay

until it 'switched off' sometime in 2010. Credit: MPE

Dr Middleton, of Durham University's Department of Physics, said: "ULX sources are still pretty exotic.

"But our work shows that at least some are linked to the normal black holes left behind after the death of massive stars, objects that are found throughout the Universe, and the way that they drag in surrounding material.

"The ULX in Andromeda flared up because of the black hole's voracious appetite for new material."

Using data from Chandra, the XMM-Newton X-ray observatory, the Swift gamma ray observatory and the Hubble Space Telescope the research team were able to watch a sharp decline in the outburst from the ULX that took place over the next few months.

This decline had not been seen in any ULX before, but is common in stellar-mass X-ray binaries in the Milky Way where a normal star is in close orbit around a black hole. Measurement of energy emissions from the ULX also allowed the team to rule out low rates of accretion that would be expected from an intermediate-mass black hole.

They concluded that the Andromeda ULX had the mass of a large star, in this case about 13 times the mass of the Sun.

Dr. Middleton said: "We would like to follow up this work by watching another outburst from the Andromeda ULX. The problem is that these are likely to happen only every few decades so we could be in for a long wait before this source erupts again."

The team hope that the ongoing monitoring of Andromeda by orbiting X-ray observatories may find other ULXs in the same galaxy, giving them another chance to test their theory.

Dr. Middleton said: "If we do manage to spot another ULX outburst in Andromeda it will be a big help in understanding the extreme behaviour of black holes and the way they pull in matter – something of great importance in shaping the wider universe."

The research work in the UK was funded by the Science and Technology Facilities Council.

More information: The new work will be published in "The missing link: a low mass X-ray binary in M31 seen as an ultraluminous X-ray source", Middleton, M. J. et al, *Monthly Notices of the Royal Astronomical Society*, in press.
A preprint can be downloaded from adsabs.harvard.edu/abs/2011arXiv1111.1188M

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