Black holes' true power revealed by 'Russian doll' galaxy

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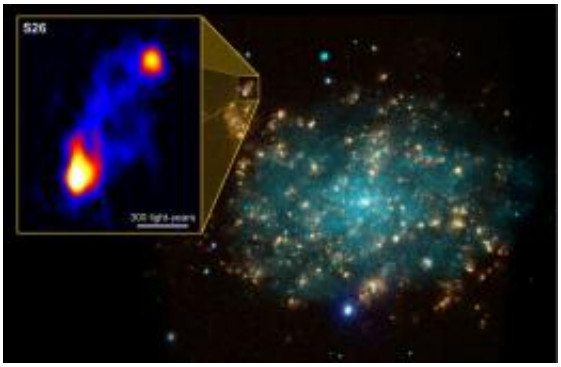

A composite image showing the position of the 'miniature galaxy' S26 in the galaxy NGC 7793. The image of S26 is a radio image, made with a CSIRO telescope while the image of the galaxy is made from combined X-ray and optical data. Image credit - Soria et al / CSIRO / ATCA; NGC 7793 - NASA, ESO and NOAO.

Following a study of what is in effect a miniature galaxy buried inside a normal-sized one – like a Russian doll – astronomers using a CSIRO telescope have concluded that massive black holes are more powerful than we thought.

An international team of astronomers led by Dr. Manfred Pakull at the University of Strasbourg in France has discovered a ‘microquasar’ – a small black hole, weighing only as much as a star, that shoots jets of radio-emitting particles into space.

Called S26, the black hole sits inside a regular galaxy called NGC 7793, which is 13M light-years away in the Southern constellation of Sculptor.

Earlier this year Pakull and colleagues observed S26 with optical and X-ray telescopes (the European Southern Observatory's Very Large Telescope and NASA's Chandra space telescope).

Now they have made new observations with CSIRO's Compact Array radio telescope near Narrabri, NSW. These show that S26 is a near-perfect analogue of the much larger 'radio galaxies' and 'radio quasars'.

Powerful radio galaxies and quasars are almost extinct today, but they dominated the early Universe, billions of years ago, like cosmic dinosaurs. They contain big black holes, billions of times more massive than the Sun, and shoot out huge radio jets that can stretch millions of light-years into space.

Astronomers have been working for decades to understand how these black holes form their giant jets, and how much of the black hole's energy those jets transmit to the gas they travel through. That gas is the raw material for forming stars, and the effects of jets on star-formation have been hotly debated.

"Measuring the power of black hole jets, and therefore their heating effect, is usually very difficult," said co-author Roberto Soria (University College London), who carried out the radio observations.

"With this unusual object, a bonsai radio quasar in our own backyard, we have a unique opportunity to study the energetics of the jets."

Using their combined optical, X-ray and radio data, the scientists were able to determine how much of the jet's energy went into heating the gas around it, and how much went into making the jet glow at radio

wavelengths.

They concluded that only about a thousandth of the energy went into creating the radio glow.

"This suggests that in bigger galaxies too the jets are about a thousand times more powerful than we'd estimate from their radio glow alone," said Dr. Tasso Tzioumis of CSIRO Astronomy and Space Science.

"That means that black hole jets can be both more powerful and more efficient than we thought, and that their heating effect on the galaxies they live in can be stronger."

The study was made possible by a recent upgrade to the Compact Array, which can now do work of this kind five times faster than before.

More information: Roberto Soria, et al. "*Radio lobes and X-ray hotspots in the microquasar S26*." In press in *Monthly Notices of the Royal Astronomical Society*. Available online on the MNRAS website and at arxiv.org/abs/1008.0394

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