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INDIAN ASTROPHYSICISTS SPOT RARE MERGER OF THREE JUMBO BLACK HOLES

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There are supermassive blackholes, which are several million solar masses in size, at the centres of galaxies, and these are known as Active Galactic Nuclei. A representational image.

A rare merging of three supermassive black holes has been spotted by a team of astrophysicists from the Indian Institute of Astrophysics (IIA), working with Professor Francoise Combes from the Paris Observatory. This is only the third time such an event has been observed and the findings were published as a letter in the journal *Astronomy and Astrophysics* in June.

The team were observing the merging of two galaxies — NGC7733 and NGC7734 — in the earth's celestial neighbourhood when they detected unusual emissions from the centre of the latter and a curious movement of a large bright clump within it, having a different velocity than that of NGC7733. Inferring that this was a separate galaxy, the scientists named it NGC7733N.

All three merging black holes were part of galaxies in the Toucan constellation. They are quite far away given that the earth's nearest galactic neighbour — the Andromeda galaxy — is 2.5 million light years away. Yet the paper describes these as nearby galaxies.

"In astronomy everything is relative. When we study the solar system, we say Mercury is closer and Jupiter is far… Compared to our nearest neighbour Andromeda galaxy, the galaxies NGC7733, 7734 and 7733 N are quite far away, but compared to the size of universe, they are nearby galaxies," explains Jyoti Yadav, a Ph.D. student at the IIA and the first author of the paper.

In an email to *The Hindu* , Mousumi Das, also from the IIA and another author of the paper along with Sudhanshu Barway, says the team were studying the active galactic nuclei in the two massive barred spiral galaxies NGC7733 and NGC7734 and that the detection of the third was surprising. "It was a bit like buy two and get one free," says Dr. Das. "The PI of the project confirmed our suspicions using spectroscopic data from a European telescope called MUSE in Chile."

The group observed these galaxies with a near infrared telescope in South Africa. "Then, later on, because they appeared interesting, we also observed them with the UVIT [onboard the first Indian space observatory ASTROSAT]," says Dr. Das. "We also found optical data in the MUSE archive. So, we did not have to do the optical spectroscopy."

Final parsec

In a press release, the team explains that if two galaxies collide, their black holes will also come closer by transferring the kinetic energy to the surrounding gas.

The distance between the black holes decreases with time until the separation is around one parsec (3.26 light-years).

The two black holes, however, are then unable to lose any further kinetic energy to get even closer and merge. This is known as the final parsec problem.

But the presence of a third black hole can solve this problem.

“The two can come closer when another black hole or a star passes by and takes away some of their combined angular momentum,” explains Dr. Das. Thus, the dual merging black holes merge with each other in the presence of a third.

Many Active Galactic Nuclei (AGN), or supermassive black hole at the centre of a galaxy, pairs have been detected in the past, but triple AGN are extremely rare, and only a handful have been detected before using X-ray observations.

“Multiple accreting black holes [AGN] may be more common in our universe and especially common in galaxy groups. So the growth of black holes may be driven by such mergers in groups,” says Dr. Das.

The study used data from the Ultraviolet Imaging Telescope (UVIT) on board the first Indian space observatory ASTROSAT, the European integral field optical telescope called MUSE mounted on the Very Large Telescope (VLT) in Chile and infrared images from the optical telescope (IRSF) in South Africa.

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