

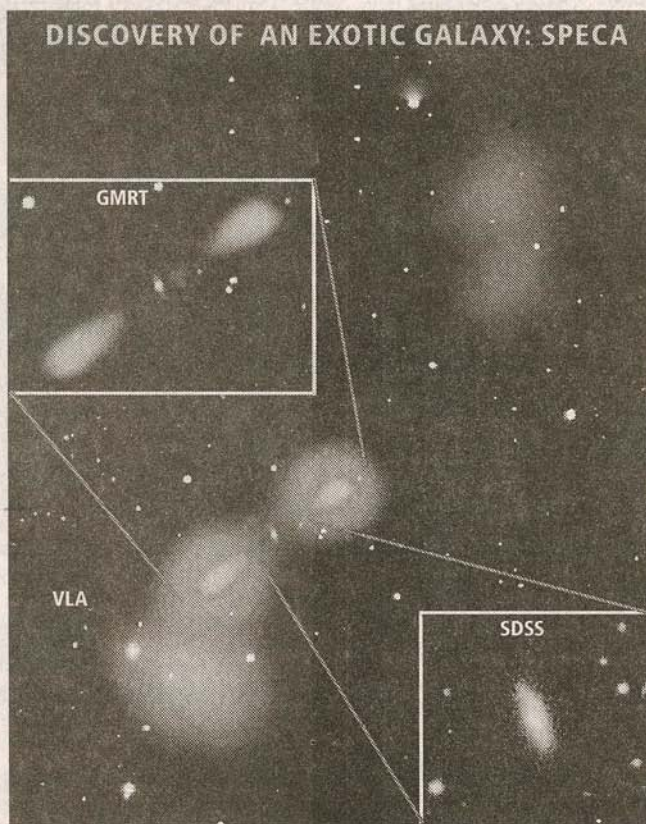
# 'Exotic' galaxy hints at new lessons on evolution of galaxies

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A UNIQUE galaxy, which holds clues to the evolution of galaxies billions of years ago, has now been discovered by an Indian-led international team of astronomers. The discovery, which will enable scientists to unearth new aspects about the formation of galaxies in the early universe, has been made using the Giant Meterwave Radio Telescope (GMRT) of the National Centre for Radio Astrophysics, Tata Institute of Fundamental Research (NCRA-TIFR). The GMRT is the largest and most powerful radio telescope in the world in the low frequency range of 150-1500 MHz.

"This is probably the most exotic galaxy with a black hole, ever seen. It has the potential to teach us new lessons about how galaxies and clusters of galaxies formed in the early universe," said Ananda Hota, who completed his PhD from NCRA-TIFR. Currently a post-doctoral research fellow at Taiwan's Academia Sinica Institute of Astronomy and Astrophysics (ASIAA), Hota discovered the galaxy which is being touted to have a combination of properties not seen before. Called Specra (Spiral-host episodic radio galaxy tracing cluster accretion), the findings have been recently published in the journal *Monthly Notices of the Royal Astronomical Society: Letters*.

The team of scientists have stated in their findings that Specra is only the second spiral



galaxy, as opposed to an elliptical galaxy which is known to produce large, powerful jets of subatomic particles moving at nearly the speed of light. Sandeep Sirothia of NCRA-TIFR said that Specra is a spiral galaxy, similar to the Milky Way, and is one of the rare type of radio galaxies where jet activity started and stopped three times. "Both elliptical and spiral galaxies have black holes, but Specra and another galaxy have been seen to produce large jets. It is also one of only two galaxies to show that such activity occurred in three

separate episodes. The reason behind this on-off activity of the black hole to produce jets is unknown. Such activities have not been reported earlier in spiral galaxies, which makes this new galaxy unique. It will help us learn new theories or change existing ones. We are now following the object and trying to analyse the activities," he said.

Besides Hota and Sirothia, the research team included DJ Saikia from NCRA; Chiranjib Konar, Youichi Ohyama, and Satoki Matsuchita from ASIAA; Suk Kim and Soo-

Chang Rey from Chungnam National University in Korea; and Judith H Croston from the University of Southampton in England. "The ongoing TIFR-GMRT sky survey is going to discover more Specra-like galaxies and the current discovery is a potential demonstrator," said Sirothia.

Another interesting finding by the team is that the outermost lobe of this galaxy gives a valuable insight about the surrounding medium, the environment inside it. They said in their findings that the outermost radio-emitting lobes are so old that their particles should have lost most of their energy and should have stopped producing radio emission. "This hasn't happened in case of Specra. More and detailed studies will give an indication as to how particles can exist for so long in the universe," said Sirothia.

Calling it a "missing link" to the early universe, the scientists anticipate that such activities were common in the early universe when black holes, galaxies and clusters were very young and in their formative era. "After 10 years of the first discovery, this is the second spiral-host large radio galaxy. The cause behind why present day radio galaxies do not contain young star forming disk is not clear. This is likely to serve as a missing link, what is rare in the present day universe and what may be a common phenomena in the distant past (several billion years ago)," said Hota.