

High-resolution radio study reveals widespread faint black hole activity in nearby galaxies

प्रविष्टि तिथि: 06 JUL 2026 3:56PM by PIB Delhi

High-resolution radio investigations of nearby galaxies have revealed a hidden population of weakly active black holes in the local Universe that was so far difficult to detect.

Hunting these hidden monsters is essential as they can inject energy into their surroundings through jets and outflows, influencing star formation rates and the long-term evolution of galaxies.

Astronomers believe that almost every galaxy harbours a massive black hole at its centre. However, many of these black holes remain extremely faint and spotting them was a challenge.

An international team of astronomers, including Dr. Aru Beri from the Indian Institute of Astrophysics (IIA), an autonomous institution under the Department of Science and Technology (DST), used the e-MERLIN radio array, to observed 280 nearby galaxies selected from the Palomar sample and probe their central regions on parsec scales.

The researchers detected compact radio emission from the centres of nearly one-quarter of the galaxies, revealing the presence of weakly accreting supermassive black holes that are often missed in conventional observations. Most detected sources appear extremely compact, while a smaller fraction shows jet-like radio structures extending over several parsecs.



Fig 1: The locations of the 7 e-MERLIN radio telescopes across the UK, functioning as an interferometer (Credits: Jodrell Bank, UK)

The study represents one of the first statistically complete high-resolution radio surveys capable of isolating faint black hole activity in nearby galaxies. Earlier studies either lacked the sensitivity and angular resolution needed to separate weak nuclear emission from surrounding stellar activity or focused

on smaller and potentially biased galaxy samples. By targeting a large and well-defined sample at very high radio resolution, the researchers were able to systematically uncover low-level black hole activity in ordinary nearby galaxies.

To strengthen these findings, the radio observations were complemented with X-ray data from NASA's Chandra X-ray Observatory. The combined observations helped confirm that the detected emission is powered by actively accreting supermassive black holes rather than by stellar processes such as star formation, supernova remnants, or X-ray binary systems within the galaxies.

The results suggest that faint, low-level black hole activity may represent the dominant mode of black hole growth in the present-day Universe. The study also highlights the importance of high-resolution radio observations in revealing a population of weakly active black holes that often remain hidden in conventional galaxy surveys.

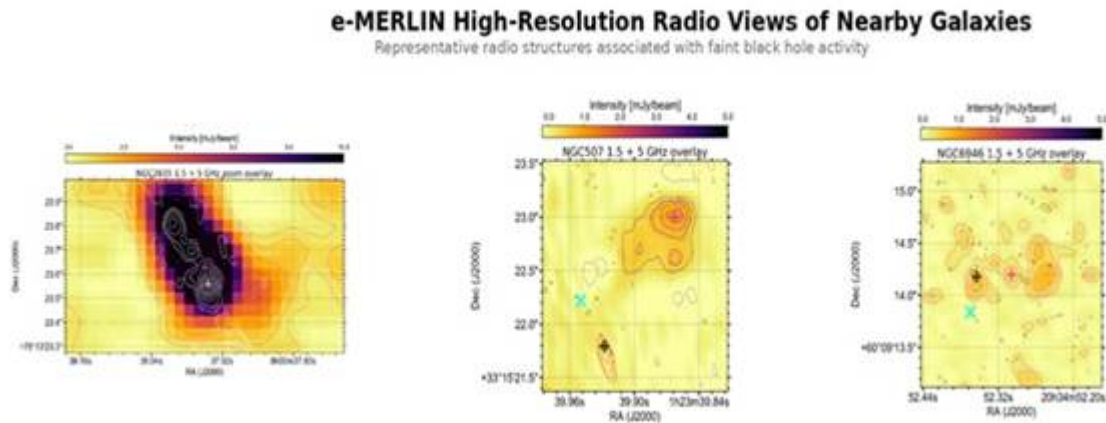


Fig 2: e-MERLIN images of some radio galaxies

This study was published in the Monthly Notices of the Royal Astronomical Society and was authored by D. R. A. Williams-Baldwin and an international team of collaborators, including Aru Beri, a faculty member at IIA.

Publication Link: <https://academic.oup.com/mnras/article/548/2/stag532/8527739>

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