PRESS NOTE

National Centre for Radio Astrophysics
Tata institute of Fundamental Research, Pune

Indian Astronomers Discovers 34 new Giant Radio Sources Using the Giant Metrewave Radio Telescope (GMRT)

A team led by Indian radio astronomers reported the discovery of 34 new giant radio sources (GRSs) from the TIFR GMRT Sky Survey Alternative Data Release 1 (TGSS ADR1) at 150 MHz. Some of these are among the most distant objects of this type. Two of these objects defy the widely accepted notion about their environments. The GRSs are among the largest objects in the Universe, and their enormous size and rarity puzzles astronomers as to how they grew to such a gigantic size.

The Giant Metrewave Radio Telescope (GMRT) is located in India near Khodad village, approximately 90 km north of Pune. The GMRT was built and is being operated by the National Centre for Radio Astrophysics (NCRA) of the Tata Institute of Fundamental Research (TIFR). From 2010 to 2012, a survey was performed using the GMRT to map the radio sky at 150 MHz, known as the TIFR GMRT Sky Survey (TGSS) covering about 90% of the sky.

The team of astronomers consists of two PhD students, Netai Bhukta (SKBU, India) and Souvik Manik (MCC, India), and two astronomers, Sabyasachi Pal (MCC, India) and Sushanta K. Mondal (SKBU, India). They used TGSS for their research due to its low frequencies and the sensitivity of the GMRT. The team discovered 34 giant radio sources during their research.

Giant radio sources, some of the Universe's most colossal structures, span millions of light years, equivalent to lining up several tens of Milky Ways in a row. At the heart of GRSs lies a supermassive black hole, typically with a mass ranging from ten million to one billion times that of the Sun. Serving as the central engine, this black hole pulls in surrounding matter, which becomes ionized, creating a powerful electromagnetic force that propels the material outward to the edges. The resulting jets of hot plasma produce massive lobes of radio emissions, spanning much greater distances than the visible size of the galaxy.

Astronomers believe that GRSs represent the final stage of radio galaxy evolution due to their enormous sizes. Such enormous projected lengths of GRSs make them interesting candidates for understanding the evolution of radio sources and studying the intergalactic medium that confines the lobes far from the parent galaxy. However, detecting such GRSs is challenging because the bridge emission connecting the two lobes is often not visible. Low-frequency ra-

dio surveys are better suited for identifying this population than higher-frequency radio surveys, as the aged plasma is brighter at low frequencies.

Two of the GRGs (J0843+0513 and J1138+4540) challenge the common understanding that GRGs grow in low-density environments. Researchers have said that the environment alone does not play a major role in the exceptionally large size of GRGs. They plan to present new GRG samples in their forthcoming articles, along with detailed physical properties based on multi-wavelength observations, to unveil the mystery. This discovery has been published in the Astrophysical Journal Supplement Series (ApJS) of the American Astronomical Society (https://doi.org/10.3847/1538 ; active from 30th July 2024)

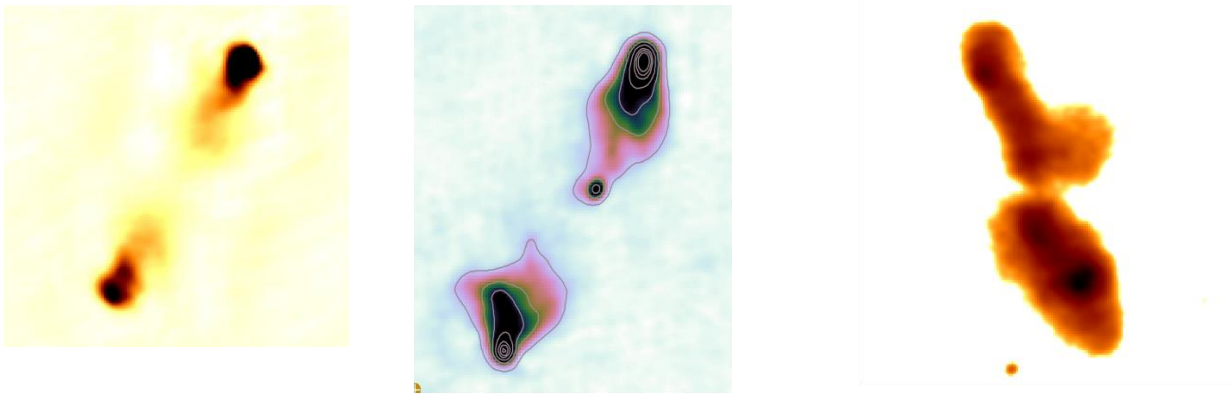

Figure1: Some of the Giant Radio Sources exhibiting complex structures and morphology.

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