FIRST discovery of dozens of new giant radio galaxies

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Astronomers from the University of Wisconsin-Madison and elsewhere report the discovery of 63 new giant radio galaxies as part of the Faint Images of the Radio Sky at Twenty cm survey (FIRST). The findings are

detailed in a paper published Nov. 15 on the pre-print server *arXiv*.

The so-called giant radio galaxies (GRGs) are radio galaxies with an overall projected linear length exceeding at least 2.3 million light years. They are rare objects grown in low-density environments. In general, GRGs are important for astronomers to study the formation and the evolution of radio sources.

Many GRGs are double-lobed radio galaxies that have become known as double radio sources associated with active galactic nuclei (AGN), or DRAGNs. They can be difficult to identify in radio surveys as lobes of radio galaxies may be detected as multiple sources. Therefore, many detectable GRGs may remain unidentified. FIRST, utilizing the Very Large Array (VLA), due to its low frequency and good sensitivity to extended sources, has the potential to unveil the presence of many new GRGs.

That is why a team of astronomers led by University of Wisconsin-Madison's Soren Ramdhanie decided to analyze FIRST in order to search for previously undetected GRGs. They employed the DRAGNhunter algorithm to identify double-lobed radio galaxies in the FIRST data and investigated the newfound sources.

"DRAGNhunter identifies DRAGNs by pairing cataloged extended radio sources based on their separation and relative alignment, then uses the likelihood ratio approach to search for the probable host galaxy in the AllWISE catalog," the researchers explained.

As a result, Ramdhanie's team has initially identified 80 giant radio galaxies in the FIRST dataset using the DRAGNhuster algorithm. It turns out that 17 of the detected GRGs are within 5 arcseconds of known galaxies of this type and are not new discoveries.

The newfound GRGs were found at redshifts between 0.51 and 1.32. Only six galaxies of the sample have spectroscopic redshifts, while the remaining 57 have estimated photometric redshifts. The GRG with the highest redshift is designated DELS J225125.27−025451.8.

The largest GRG reported in the study received designation DELS J093016.68+114241.4. It has a projected linear size of nearly 4 million light years and was found at a redshift of 1.14. The smallest one, DELS J234027.85+003057.4 at a redshift of 1.01, has a projected linear size of 2.3 million light years.

The study also found that the new GRGs have 1.4 GHz luminosities ranging from 25.34 to 27.09 W/Hz. The flux density of these galaxies is dispersed and it was measured to be between 7.14 and 337.85 mJy.

Further studies of the newfound GRGs are required in order to shed more light on their properties. The astronomers added that some of these GRGs may have been identified as extended radio galaxies in previous catalogs.

More information: Soren Ramdhanie et al, The Discovery of 63 Giant Radio Galaxies in the FIRST Survey, *arXiv* (2023). DOI: 10.48550/arxiv.2311.09079