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Extended Radio Sources from the GEMSS survey

Sudheesh T P*[(1)], Ruta Kale[(2)], Paul K T[(1)], Pratik Dabhade[(3)], Shishir Sankhyayan[(2, 4)], and Joe Jacob[(5)]
(1) CHRIST(Deemed to be University), Bengaluru, 560029, e-mail: sudheesh.tp@res.christuniversity.in; paul.kt@christuniversity.in
(2) NCRA-TIFR, Pune, INDIA; e-mail: ruta@ncra.tifr.res.in
(3) Observatoire de Paris, LERMA, College de France, CNRS, PSL & Sorbonne University, 75014, Paris, France; e-mail: pratik.dabhade@obspm.fr
(4) Tartu Observatory, University of Tartu, Observatooriumi 1, 61602 Toravere, Estonia; e-mail: shishir.sankhyayan@ut.ee
(5) Newman College, Thodupuzha, Kerala, INDIA; e-mail: drjoephysics@gmail.com

Superclusters of galaxies are the largest over-dense structures in the Universe. In the hierarchical model of evolution, structures are believed to be formed through the gravitational clustering of matter. Recently, a massive supercluster named Sarawsati was discovered at an intermediate redshift of 0.3 [1]. The structure contains around 43 galaxy clusters and is surrounded by a series of filaments and large voids [1]. Galaxies are harbored in all these environments and the different density environments which the supercluster can provide are ideal for studying the evolution of galaxies in tandem with their environments. Here, we aim to study the extended radio galaxies from the part of the sky which contains the Saraswati supercluster. Since extended radio emission from galaxies can scale from tens of kiloparsecs to a few megaparsecs, they can be probes of the environments on all these scales. The presence, extent, and morphology of extended radio sources in different density environments can provide a better picture of the role played by the environment in radio galaxy evolution.

We report the study of the extended radio sources from the Galaxy Evolution and Magnetisation of the Saraswati Supercluster (GEMSS) survey. The survey is conducted over the Saraswati supercluster region using the upgraded Giant Metrewave Radio Telescope (uGMRT) at 408 MHz. The final survey data has a resolution of 8" and a mean rms of 65 μJy/beam. From the survey region, we identified a good fraction of extended radio sources of various morphologies. Upon visual classification, we found that around 22% of the sample are Fanaroff-Riley class I sources, 59% are Fanaroff-Riley class II sources, and 19% of sources are without any distinctly identified morphologies. Sources with a wide range of redshifts and linear sizes are reported here. The estimated radio powers and equipartition magnetic fields falls within the typical ranges for extended radio galaxies. The deep and sensitive limited area survey enables us to identify extended radio sources with a wide range of morphologies, redshifts, linear sizes, and powers from different environments of the supercluster region. Sources with flux density as low as 6 mJy and redshifts as far as 2 are identified from the survey. Around 43% of the identified sources are bent-tailed (BT) radio source candidates. We estimated the association of the radio sources with known clusters and the results show that the majority of the cluster-associated sources are bent-tailed which is in agreement with existing studies on the preference of BT sources to occupy dense regions like clusters. The rest of the sources are either part of less massive groups or field galaxies or part of unidentified clusters. We also estimated a few additional parameters to explain the bent-tail nature of individual BT sources.

1. J. Bagchi, S. Sankhyayan, P. Sarkar, S. Raychaudhury, J. Jacob, and P. Dabhade, "Saraswati: an extremely massive 200 megaparsec scale supercluster," *The Astrophysical Journal*, **844**, 1, 2017, p.25.