Extragalactic science from the Multifrequency Snapshot Sky Survey (MSSS)

Research Field
Radio Astronomy

Project Suitability
Honours
Masters

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The Multifrequency Snapshot Sky Survey (MSSS; Heald et al. 2015, A&A, 582, A123) was the first northern sky survey carried out at low radio frequencies (below 250 MHz) with the Low-Frequency Array (LOFAR), a pan-European radio telescope with its core located in the Netherlands. With a competitive combination of bandwidth, sensitivity, and angular resolution, MSSS will facilitate novel science in areas such as supernova remnants and HII regions, nearby galaxies, pulsars, radio transients, and extended objects such as giant radio galaxies, clusters and relics. It will also have significant legacy value in the scientific literature: in combination with the GLEAM-X survey from the upgraded Murchison Widefield Array (MWA) in Australia, an all-sky, low-frequency catalogue at a resolution of an arcminute and better will be possible.

In anticipation of a first public data release, the MSSS team is conducting a variety of quality control checks on the data products. You will play an important role in these efforts by analysing a selection of large-area (200 square degrees), multi-band (119-158 MHz) mosaics that cover the entire northern sky. Not only will key metrics be assessed, but given that each mosaic is expected to contain up to 1000 radio sources, you will have the exciting opportunity to carry out scientific studies on a selection of interesting, and indeed sometimes unusual objects (e.g. see Stewart et al. 2016, MNRAS, 456, 2321; Clarke et al. 2017, A&A, 601, A25 and figure below; Chyzy et al. 2018, A&A, 619, A36). In this project, the science focus will be on extragalactic sources, such as, for example, the aforementioned giant radio galaxies, clusters and relics, as well as other potential topics such as high-redshift radio galaxies and compact steep-spectrum sources.

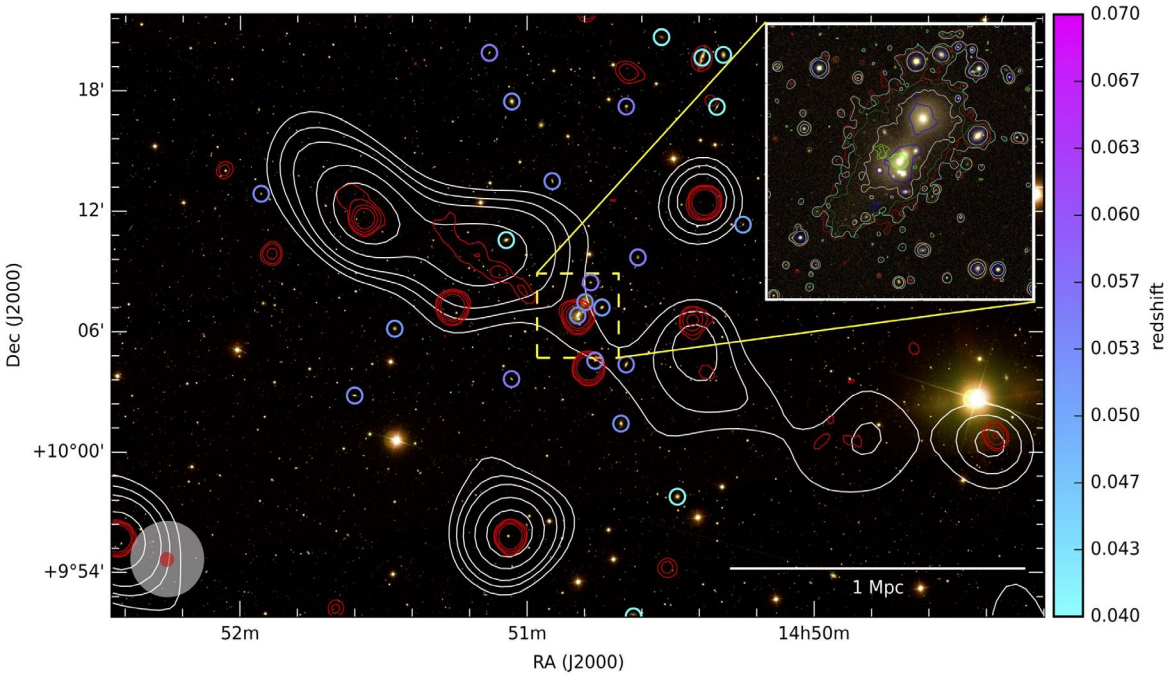

Figure: MSSS has resulted in the discovery and detailed study of a new 2.56 Mpc giant radio galaxy associated with a disturbed galaxy group (UGC 9555). This image illustrates the huge extent of radio emission, stretching larger on the sky than the full moon. LOFAR contours are displayed in white, and the NVSS 1.4 GHz survey in red. The inset shows the host galaxy group. Lime green contours from the 1.4 GHz FIRST survey show compact radio emission from the AGN and its jet. Coloured contours are smoothed bands from the Sloan Digital Sky Survey (SDSS), indicating the disturbed nature of the group that hosts this interesting radio source. Further details can be found in Clarke et al. 2017 (A&A, 601, A25).