



Polarised Emission from Faint Radio Sources

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This study **explores the polarised emission of the faint extragalactic radio sources** in the MIGHTEE (MeerKAT International Giga-Hertz Tiered Extragalactic Exploration, Jarvis et al., 2016) survey in order to systematically **study the nature, origin and evolution of cosmic magnetic fields**. MeerKAT is a South African 64 dish, 13.5 metre diameter, state-of-the-art radio telescope array operating in L-band (880 – 1680 MHz) that is a precursor of the Square Kilometre Array (SKA) telescope. MIGHTEE is a wide-area MeerKAT survey project targeting well known extragalactic deep fields with a wealth of multi-wavelength data. Reaching a sensitivity of 2 $\mu\text{Jy}/\text{beam}$ at a resolution of 6 arcseconds, MIGHTEE providing an opportunity to chart the evolution of polarised emission from distant galaxies over cosmic time.

The MIGHTEE survey detects polarised emission for a large number of radio sources down to total intensity flux densities of the order of 100 μJy . At these flux densities the source population is increasingly dominated by star-forming galaxies (SFGs) as opposed to active galactic nuclei (AGNs) which are dominant at high flux densities. While the radiation from SFGs originates mostly from forming and exploding stars, the emission from AGNs comes from a central supermassive black hole engine and enormously large relativistic jets that are driven by the gravitational force of the central black hole. Observations of the local universe show that both, AGN and SFG phenomena, are permeated by magnetic fields and polarised emission of AGN can be traced to very distant galaxies. However, polarised emission of SFGs at moderate distances (redshifts between 1 and 2) has not yet been detected. In order to understand the nature of galaxies we need to understand the contribution of magnetic fields through the galaxies' evolutionary stages.

We use multi-wavelength criteria to classify MIGHTEE radio objects as either SFG or AGN. We perform Rotation Measure Synthesis (RMSY) on the spectro-polarimetric data cubes and use the polarisation and RMSY spectra to search for polarised emission. A comparative analysis of the polarisation properties of SFGs and AGNs is performed. The analysis is extended to the lowest possible flux densities using stacking techniques. We will show preliminary results of the MeerKAT polarisation studies of radio sources down to a sensitivity at the micro-Jansky level.

From a population of 21479 radio sources down to a total intensity of 150 $\mu\text{Jy}/\text{beam}$ we detect polarised emission in 828 (3.9%) objects. Of these 286 (35%) also show evidence of AGN activity in multi-wavelength data. The remaining 542 objects (65%) show no evidence of AGN, and are potentially star-forming galaxies at high redshift. Further investigation is required to confirm the nature of these objects.

References

M. Jarvis, et al. "The MeerKAT International GHz Tiered Extragalactic Exploration (MIGHTEE)," *Proceedings of MeerKAT Science: On the Pathway to the SKA*, 25-27, May 2016, pp. 1-16, doi: 10.22323/1.277.006.