
The Nature of Polarised Sources in MIGHTEE's Deep Fields

Abstract

The Nature of Polarised Sources in MIGHTEE's Deep Fields 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 cosmic magnetic fields in galaxies to high redshift. Tracing the presence and contribution of magnetic fields is an important aspect of understanding galaxy evolution. Reaching a sensitivity of $2 \mu\text{Jy}/\text{beam}$ at a resolution of 6 arcseconds, MIGHTEE is 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 $100 \mu\text{Jy}$. 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 the products of star formation, 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. Polarised emission of AGN can be traced to very distant galaxies. However, polarised emission of SFGs at moderate distances has been detected only once.

I use multi-wavelength criteria to classify MIGHTEE radio objects as either SFG or AGN. I 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. I 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 $150 \mu\text{Jy}/\text{beam}$ I detect polarised emission in 408 (1.9%) objects. Of these 349 (85.5%) also show evidence of AGN activity in multi-wavelength data. The remaining 59 objects (14.4%) 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. In addition, I show a polarisation stacking analysis of the faintest sources tracing the AGN and SFG population with cosmic time. Finally, I present the polarisation properties of a low number of resolved SFG in the XMM-LSS field.