Early results from the DRAGONS survey

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Abstract

Faraday synthesis has made it possible to probe the complex patterns that the magnetized interstellar medium has imprinted on Galactic synchrotron emission through Faraday rotation. Previous radio polarisation surveys were limited to a few discrete frequencies. For Faraday synthesis, it is necessary to observe polarisation across a wide, densely sampled frequency band. An international collaboration known as the Global Magneto-Ionic Medium Survey (GMIMS) seeks to map Galactic synchrotron emission across the entire sky, north and south, through a series of wideband radio polarisation surveys observed with single-dish telescopes. The northern component of GMIMS will consist of three surveys in different frequency ranges, all observed at the Dominion Radio Astrophysical Observatory (DRAO). The high-band northern survey has been published (Wolleben et al., 2021), covering frequencies 1280 to 1750 MHz. I share the early results from DRAGONS (DRAO GMIMS of the Northern Sky), a low-band Northern GMIMS survey covering frequencies between 350 to 1030 MHz across declinations -20 to 90 degrees.
DRAGONS was observed between June 2022 and January 2023 using the new DRAO 15-m telescope. In the raw observations, the 680 MHz wide band is divided into 8175 evenly spaced frequency channels. In addition, the survey is fully sampled spatially, with 2880 unique scans of the sky taken over 147 nights. Data processing is currently underway to combine these scans into maps of total intensity (Stokes I) and the linear polarisation parameters (Stokes Q and U) using the basket-weaving software adapted from the S-band Polarisation All Sky Survey (Carretti et al. 2019).

We have generated initial maps from 35 frequency channels selected from the top end of the DRAGONS band, between 538 MHz and 1016 MHz. Figure 1 shows the zeroth and first-moment maps (Dickey et al. 2019) for the DRAGONS Faraday depth cube produced from these preliminary maps. In the Faraday synthesis technique, lower frequencies increase the resolution of the Faraday rotation information derived from the data, allowing us to discern more details about the magnetic field structures along the line of sight. We can already detect many distinct structures in the preliminary DRAGONS Faraday depth cube. Thus, by contributing lower frequencies to the northern GMIMS dataset, the DRAGONS survey will launch a new exploratory science of the polarisation properties of the Galaxy. The DRAGONS survey will also serve as a new absolutely-calibrated reference survey in both total power and polarisation products throughout the 350 – 1030 MHz band, providing single antenna reference data for higher angular resolution telescopes such as the Canadian

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Hydrogen Intensity Mapping Experiment (CHIME) and the renewed DRAO Synthesis Telescope.

References:

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