A Detailed Polarimetric Study of a Type-II Solar Radio Burst with MWA

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Type-II solar radio bursts are plasma emissions generated by collisionless shocks in the corona and interplanetary space, typically driven by energetic solar eruptions such as flares and coronal mass ejections (CMEs). Their close association with such large-scale eruptions makes them relevant for space weather studies as well. The geoeffectiveness of a CME largely depends on the properties of the magnetic field it carries and how it interacts with the ambient solar magnetic field. Therefore, probing the magnetic field entrained in CMEs is crucial. The polarimetric properties of type-II bursts offer one of the few remote-sensing tools available for directly studying the strength and topology of magnetic fields in CME-driven shocks. However, reported polarization levels in the literature span a broad range, from negligible or weak polarization to strong circular polarization of several tens of percent. Most of the earlier studies are based on Sun-as-a-star observations, which provide spatially averaged measurements. Given the presence of multiple active regions and spatially varying polarized emission on the Sun, such integrated measurements are susceptible to beam depolarization, potentially leading to inaccurate results. To overcome these limitations, spatially resolved imaging is essential. The advent of new-generation instruments, like the Murchison Widefield Array (MWA), has made it possible to obtain high-dynamic-range, high-fidelity full-polar solar radio images with good temporal, spectral, and angular resolution. Leveraging these capabilities, we have conducted a detailed polarimetric imaging study of a type-II solar radio burst. Our analysis includes characterization of sources in both total intensity and polarized emission, along with an in-depth examination of their temporal and spectral evolution. This study represents an important step toward using polarimetric imaging to advance our understanding of type-II bursts and coronal propagation.