Effects of a Southward Shift of the Heliospheric Current Sheet on Faraday Rotation Observations of a Coronal Mass Ejection

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Coronal mass ejections (CMEs) are large eruptions of magnetized plasma that are ejected from the Sun and play an important role in space weather. CMEs produce energetic particles and enhance terrestrial current systems that can create geomagnetic storms on Earth, cause major grid blackouts, and disrupt satellite signals. One method that has proven successful in determining the strength and structure of the coronal magnetic field and physics of CMEs is Faraday rotation (FR), which is the rotation of the plane of polarization when linearly polarized radiation propagates through a magnetized plasma. Previous observations of CME Faraday rotation have all been limited to a single line of sight (LOS; such as Howard et al., 2016, *Astrophys. J.,* 831, 208 and Kooi et al., 2017, *Solar Phys*., 292, 56), whereas we report the first successful observations of Faraday rotation through a CME using *multiple* lines of sight: 13 LOS across seven target radio fields. These observations were made on 31 July, 2015 using the *Karl G. Jansky Very Large Array* (VLA) at 1-2 GHz frequencies using a constellation of radio sources at heliocentric distances of 8.2-19.5 solar radii, and are the first *triggered* VLA observations of CME Faraday rotation.

The advantage of multiple LOS is that we can definitively determine the CME strength and helicity, therefore removing ambiguity surrounding the absolute sign of the CME's axial magnetic field. Leading up to the day of our observation, multiple CME events were present. Two large CMEs initially erupted on July 30 and early July 31, causing a noticeable restructuring of the corona off the eastern limb of the Sun in both LASCO-C2 and C3 coronagraph images. In this presentation, we report radio Faraday rotation results for three of the seven radio fields – a total of 6 LOS – which were occulted by one leg of a weaker CME (discussed in Kooi et al., 2020, submitted) and the evolving heliospheric current sheet. The Earth-side heliospheric current sheet shifted 8° southward in heliospheric latitude, increasing the expected positive FR by a factor of 2.56 at 13.3 solar radii and 2.10 at 19.3 solar radii. The CME, though, introduced a larger, negative FR that dominated the observed Faraday rotation profiles for each LOS.