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Results of the 2009 MESSENGER Faraday Rotation Experiment

On November 9, 2009, during the longest solar minimum in a century, the MESSENGER spacecraft en route to Mercury was in superior conjunction allowing the acquisition of Faraday rotation measurements. At 1.66 solar radii (456 Mm from the surface) on November 8th, MESSENGER's 8GHz radio frequency signal was absorbed. The observations taken on November 8th, 10th, and 11th show a 5 minute periodicity as well as other fluctuations and a strong rotation across a thin magnetic field structure.

MESSENGERs radio frequency signal was acquired by the Green Bank Telescope with its spectral processor and J.L. Margot's RADAR instruments. Most of the spectral processor data were lost; however, the RADAR instrument performed nominally recording the raw radio frequency samples of the incoming signal. Direct comparison of the raw radio frequency plane of polarization calculations to the spectral processor measurements shows that the technique described in Jensen and Russell (2007) generates the same average plane of polarization but with a larger variance.

Modeling of the sources of error contributing to the variance in the Jensen and Russell (2007) plane of polarization calculations show a weak dependence on signal noise, a significant dependence on frequency scintillation, and a strong dependence on the Alfven wave frequency of magnetic field rotations relative to the 100 second integration time of each plane of polarization calculation.

We will discuss the Jensen and Russell (2007) technique relative to the estimation of error, the presence of magnetic field fluctuations with/without electron density fluctuations, the variation of the fluctuation spectrum relative to solar maximum in 2002, and the potential candidates for the strong rotation coronal structure observed on the 10th.

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