V124b An Iterative Reconstruction Algorithm for Faraday Tomography

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Faraday tomography offers crucial information on the magnetized astronomical objects, such as quasars, galaxies, or galaxy clusters, by observing its magnetoionic media. The observed linear polarization spectrum is inverse Fourier transformed to obtain the Faraday dispersion function (FDF), providing us a tomographic distribution of the magnetoionic media along the line of sight. However, this transform gives a poor reconstruction of the FDF because of the instrument's limited wavelength coverage. The current Faraday tomography techniques' inability to reliably solve the above inverse problem has noticeably plagued cosmic magnetism studies. We propose a new algorithm inspired by the well-studied area of signal restoration, called the Constraining and Restoring iterative Algorithm for Faraday Tomography (CRAFT). This iterative model-independent algorithm is computationally inexpensive and only requires weak physically motivated assumptions to produce high-fidelity FDF reconstructions. We demonstrate an application for a realistic synthetic model FDF of the Milky Way. CRAFT show more significant potential over other popular model-dependent and model-independent techniques by accurately capturing complex multi-scale features. The proposed approach will be of utmost importance for future cosmic magnetism studies, especially with broadband polarization data from the Square Kilometre Array and its precursors.