

3D Reconstruction of the Electron Density in the Solar Corona

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We seek to model the structure of the solar corona with great precision. Given that our observations of the solar corona are two-dimensional snapshots, we employ statistical tomography to piece together the full picture. The method of tomography we use must be able to convert between observed brightness and density. The solar corona, being a quasi-neutral plasma of mostly ionized hydrogen and electrons, can be adequately represented with just one of the two particles. Because white-light is scattered by electrons, we choose to focus on the electron density. We propose a new method of tomographic reconstruction applied to coronal electron density. This new method is tested on two sets of synthetic data and its accuracy is discussed. The first case involves a simple rectangular structure. With sufficient parameters we find the mean square error to fall on the order of 10^{-1} or less. The second test engages more intricate structures through the Predictive Science Model, a boundary-driven solution to the magnetohydrodynamics equations that provides data like temperature, density, and magnetic field at all points in the solar corona. Although we find our method having trouble imaging the Predictive Science Model's synthetic data, our result clues us in to potential problems. We then discuss solutions to said problems, the future of the project, and what works will be built upon the findings in this study.