

Project Details

ROSES ID: NRA-01-OSS-01

Selection Year: 2002

Program Element: Independent Investigation: Solar Helio LWS

Project Title:

3D Reconstruction of White Light Coronagraph Images from Two Viewpoints

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Summary:

Proposal Objectives: We propose to systematically investigate the 3D electron density distribution reconstructions from white light coronagraph images, and their limitations, which are achievable from only two solar viewpoints in the ecliptic plane. The future STEREO mission, due for launch in 2005, will carry twin copies of the SECCHI experiment, each with three white light coronagraphs. The coronagraph reconstructions have the special difficulties of minimally determined solutions (only two viewpoints) and optically thin lines-of-sight. We employ a reconstruction technique using the PIXON algorithm, a mathematically sophisticated method whose execution time scales only as the number of voxels N , not as a power of N , and which should produce reconstructions from 1024x1024 CCD white light images in less than a day. Research plan: We will apply our reconstruction technique to synthetic data and to existing solar observations for scientific investigation of polar plumes, equatorial streamers, and CMEs. We will develop our 3D reconstruction technique to incorporate the geometry and physics of solar coronal observations from arbitrary vantage points; investigate initial reconstructions from simple geometrical volumes; use reconstructions of existing SOHO LASCO data to investigate geometry and hydrostatic equilibrium of polar plumes; use reconstructions of existing SOHO LASCO data to study the evolution of equatorial streamers, their relationship to active regions, and their comparison to extrapolated magnetic fields; and investigate the effects of noise, velocity, viewing angle (elongation), image contrast, and background models on the reconstructions of synthetic CMEs produced from MHD models. Relevance to NASA programs: STEREO is the first space mission of the Living With A Star program, and it is imperative that techniques for analysis of the STEREO observations, including those from the SECCHI coronagraphs, be developed before actual launch of the spacecraft. 3D reconstruction from coronagraph images supports the development of "new techniques and models for predicting solar/geospace disturbances," where it can be used to distinguish and model Earth-directed CMEs observed by future missions such as STEREO.

Publication References:

Summary: "

Reference: 3D Reconstruction of White Light Coronagraph Images from Two Viewpoints - Cook, John W. NRL