Project Details

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Project Title:
Interpretation of Coronagraph CME Observations using MHD Modeling and Synthetic White Light Images

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Summary:
The goal of this research is to understand the structure and dynamics of CMEs and their propagation through the corona from the Sun to 30 R(sun), the edge of the LASCO coronagraph field of view. Specifically, we will determine the relationship between the evolving CME density, as seen in projection in LASCO images, and the underlying magnetic structures of the CME and corona. At present, it is not known whether the bright leading edge of a CME represents compressed streamer plasma or overlying loop material or some combination. Part of the difficulty in interpreting white light images is due to line-of-sight and viewing geometry effects. To accomplish the goals, we will use time-dependent 3-D MHD modeling of CMEs to interpret coronagraph images. We will model specific CME events observed by LASCO near solar minimum starting with a realistic pre-event corona computed using observed photospheric fields (synoptic magnetograms) as boundary conditions. The density of the pre-event corona will be determined from LASCO observations by inversion. This will be the first such use of a 3-D MHD code to model the evolution of specific CME events propagating in a realistic corona. Using the Thomson scattering formulas, synthetic white light images will be computed from the MHD model and compared with the LASCO images to verify the model. CME dynamics are controlled by the magnetic fields, and the verified model can be used to relate the observed density structure to the underlying CME and coronal magnetic fields. We will use the sophisti-cated adaptive grid BATS-R-US MHD code, developed at the University of Michigan, which is well suited to handle the multiple spatial scales in this problem. The work is a collaboration between scientists at JPL, the University of Michigan, and the Naval Research Laboratory, combining their complementary skills. This work will contribute to understanding the propagation of CMEs and thus contributes directly to the LWS goal: building the necessary scientific understanding of the connected Sun-Earth system to effectively address effects of solar variability on life and society. Specifically, the work will develop new models for describing solar and geospace "disturbances that may affect human technology," and the model will be made available to the community. The work will significantly increase the science return from the SOHO/LASCO images by relating the white light density observations to the driving magnetic fields.

Publication References:

Summary: ''

Reference: 3D Reconstruction of White Light Coronagraph Images from Two Viewpoints - Liewer, Paulett C. JPL

Summary:

Reference: