Project Details

ROSES ID: NNH08ZDA001N
Selection Year: 2009
Program Element: Focused Science Topic

Topic: Use Inner Heliospheric Observations to better constrain Coronal Mass Ejection (CME) and Solar Energetic Particle (SEP) Event models.

Project Title:
Single- and Multi-View 3D Localization and Analysis of Coronal Mass Ejections

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Summary:
Single- and multi-view white light imaging of coronal mass ejections (CMEs) in the corona

oers exciting possibilities for meeting research and space weather forecasting needs. Since

the launch of the dual STEREO (Solar Terrestrial Relations Observatory) spacecraft, we

have worked to develop and test the geometric localization technique [Pizzo and Biesecker,

2004], which utilizes a series of lines of sight from the two STEREO/COR2 coronagraphs

to determine gross propagation characteristics of CMEs in three-dimensional space. This

technique is now mature and can regularly be used for space weather forecasting, using

highly-compressed, near-real-time beacon data, and for research purposes, using the standard

science quality data. The method enables us to compute the location and velocity, including

speed and direction, for any CME observed by STEREO. Therefore, we propose to regularly

apply this technique to upcoming STEREO data in the lead-up to solar maximum, and

especially at solar maximum. We will catalog our results and make them available to the

Living With a Star community to facilitate their use in MHD and other numerical codes

that track the progress of CMEs in the inner heliosphere. It is our belief that the future

forecasting e cacy of such models requires accurate model boundary conditions, including

the parameters of transient disturbances that are launched into the code.

In addition, we also propose to develop a near-real-time tool for use in our space weather

forecast center that uses single-view polarimetric imaging from STEREO or SOHO to determine

gross CME properties. The polarimetric imaging tool also has important scienti c

application in analyzing the internal structure of a CME.

The following goals of this proposal are applicable to space weather forecasting and have

clear scienti c value:

Create a catalog of gross CME characteristics using geometric localization applied to

the STEREO beacon data stream;

Use accurate statistical knowledge of gross CME properties obtained from geometric localization to explore associations among solar surface, coronal, and interplanetary structures and disturbances for Earth-directed geo-eective CMEs;

Develop polarimetric localization tool

{ Use simulations to identify optimal background subtraction for accurate polarization analysis;

{ Compare polarimetric localization results to geometric localization results and other 3D-reconstruction techniques;

Analyze CME internal structure using polarization analysis;

Document combined geometric and polarimetric localization tools and deliver programs to the IDL SolarSoft library.

These projects, which have compelling space weather and scienti c impact, address LWS TR&T Focused Science Topic B. The proposal also addresses NASA Strategic Goal 3, Subgoal 3B, and Research Objective 3B.3.

Publication References:

no references