

Project Details

ROSES ID: NNH17ZDA001N

Selection Year: 2017

Program Element: Focused Science Topic

Topic: Toward a Systems Approach to Energetic Particle Acceleration and Transport on the Sun and in the Heliosphere

Project Title:

Understanding the Connection Between Solar Energetic Particle Events and CME Dynamics in the Low Corona by Combining Observations from Mauna Loa Solar Observatory and Spacebased Coronagraphs

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Project Member(s):

- Fry, Dan James;Collaborator;NASA Johnson Space Center
- Richardson, Ian G;Co-I;University of Maryland, College Park

Summary:

SCIENCE GOALS: This proposal addresses LWS TR&T 2017 Focus Science Topic (FST) #2. This is primarily an observational investigation comparing the characteristics of solar energetic particles (SEPs) with spacebased and groundbased coronagraph observations of the associated coronal mass ejections (CMEs). The work will provide new insights into the production of energetic particles in the low corona.

Studies based on spacebased coronagraph measurements in the middle corona indicate that CME dynamics provide information about the characteristics of the resulting SEP event. For example, the peak SEP intensity at a given location in space is dependent on the CME speed and direction [e.g., Kahler, 2001; Richardson et al., 2014] and correlated with the CME brightness [Kahler & Vourlidas, 2005]. Furthermore, the SEP spectral hardness appears to be related to the initial CME acceleration [Gopalswamy et al. (2015, 2017)], but this conclusion is based on proxies for the acceleration below the field of view of spacebased coronagraphs. By combining spacebased coronagraph observations with groundbased observations of the low corona, we will eliminate the need for proxies and measure CME formation and initial acceleration directly.

METHODOLOGY: We will study SEPs associated with CMEs detected since 1980 by coronameters at the Mauna Loa Solar Observatory that can measure directly the formation and initial accelerations of CMEs low in the corona (i.e.,

RELEVANCE: Our investigation will provide direct measurements of CME formation and evolution low in the corona, where SEP acceleration is believed to occur. This investigation will likely be relevant to determining the spectral (and other) characteristics of SEPs. Both of these are solicited as types of investigations appropriate for this focused topic. The proposed work addresses the goal of the LWS program to provide a scientific understanding of the entire Sun-Earth system, almost to the point of predictability. It is also responsive to NASAs mission to protect human and robotic space explorers by improving timely forecasts of SEP events and their properties through CME observations.

CONTRIBUTIONS: We will provide direct measurements of CME formation and evolution low in the corona which are likely relevant to determining the spectral (and other) characteristics of SEPs. We will also provide such observations for case studies that are identified with other members of the FST. The PI and Co-I will provide analytical tools and interpretation of coronagraph and SEP measurements. All data used is publicly available including archival coronagraph data from MLSO, SMM, Solwind, SOHO, and STEREO, and SEP observations from IMP 8, Helios, WIND, ACE, SOHO, and STEREO.

METRICS: We will participate in regular telecons and face-to-face meetings with the other FS team members; we will present progress reports at relevant scientific meetings; and we will submit annual reports to HQ. We will discuss our progress and that of the FS team routinely with Collaborator Fry (NASA/SRAG).

Publication References:

no references