Topic: Origin and Nature of the Slow Solar Wind, Associated Interplanetary Structures, and SEP Transport

Project Title:
Using Impulsive SEP Events as Probes of Solar-Heliospheric Structures and the Coronal Origins of the Slow Solar Wind

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Project Information:
In the quest to understand the origin of the slow solar wind and the evolution of the accompanying magnetic fields and plasma structure in the inner heliosphere, it is critical to have tools which constrain and validate models as well as provide information regarding the source of magnetic fields. Observations of impulsive solar energetic particle (SEP) events are such a tool. Unlike the large SEP events created by shocks driven by coronal mass ejections (CMEs), these events are not accompanied by large scale changes in the heliospheric magnetic field. Additionally, these small events closely trace out the local magnetic field lines connecting the observer to the source region on the Sun. The fact that impulsive events are often observed within a slow solar wind stream [Kocharov et al., 2008], means that their source region may lie in close proximity to the origin of the slow solar wind. Thus, identifying and studying the source regions of the impulsive SEP events will yield important insights into the origin of the slow wind by providing multiday information on the magnetic connection point of the spacecraft to specific active regions on the Sun.

We propose to systematically examine the large and rich ACE dataset, specifically measurements from the ULEIS, EPAM, and SIS sensors, for impulsive SEP events and periods of 3He enrichments occurring within slow solar wind streams. Using a variety of solar observations and magnetic field mapping techniques we will identify the sources of these events. This analysis will then be extended to include data from the STEREO and SDO spacecraft which will permit us to monitor source regions of impulsive SEP events over significantly longer ranges of solar longitude (particularly when the two STEREO spacecraft are substantially distanced from ACE). Our intent is to work closely with other FST team members who will be modeling and observing the solar wind and heliospheric structures to provide concrete tests and constraints on the magnetic field topology and magnetic connection to solar source regions. Such collaborations will also benefit similar efforts in the future that will involve measurements from Solar Probe and Solar Orbiter.

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