Project Details

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Program Element: Focused Science Topic

Topic: Shock acceleration of solar energetic particles by interplanetary CMEs

Project Title:
Study of SEP Events and Shocks in the Inner Heliosphere

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Summary:
We propose a number of observational studies that will address goals of the LWS Focused Science Topic Shock acceleration of solar energetic particles by interplanetary CMEs . Although a number of shock acceleration models of increasing sophistication exist, they must be driven by, and tested against, observations. Our studies will use an extensive database of energetic particle observations from current and previous missions that extends over more than three solar cycles. In particular, the Helios 1 and 2 spacecraft provide crucial information about SEP events and shocks within heliocentric distances of 0.3 1 AU. One goal of the studies will be to characterize intensity-time profiles of SEP events as a function of radial distance and azimuth relative to the related solar event. We will also investigate the global properties of the related shocks using in-situ solar wind plasma and field data from multiple spacecraft, and determine the relationship between shock parameters and properties of the SEP events. In addition, the speeds of shocks moving out through the inner heliosphere will be investigated by tracking the frequency drifts of the radio emissions that they produce. A particular aim is to better characterize the speeds of CME-driven shocks near the Sun since, at present, various assumptions are made by modelers of this important parameter. We will also investigate the properties of the earliest-arriving particles in order to understand more fully the production of the highest energy particles that are seen early in such events, and the influence of factors such as magnetic connection to the solar event, solar wind structures, and interplanetary particle scattering. In the process, we will investigate whether or not all the particles in so-called gradual events are indeed accelerated at CME-driven shocks. These studies will build on previous work using more limited 1 AU observations in which we have determined the large-scale structure of interplanetary shocks and how they evolve as they propagate out from the Sun.

Publication References:

no references