Project Title:
Interplanetary Shock Prediction Using Real Time Energetic Particle Observations

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Project Information:
Interplanetary (IP) shocks driven by coronal mass ejections (CMEs) continuously accelerate ions to higher energies as such shocks propagate through the heliosphere. These ions can be hazardous to humans and technological systems in space. In particular, ions accelerated locally at the traveling shocks, the so-called energetic storm particle (ESP) events, can have intensities at energies >30 MeV that increase by several orders of magnitude. Although the basic physics underlying the shock acceleration process is well understood, no study has attempted to use observed ESP events to predict the arrival of the associated IP shock. The current shock prediction models, which are based on metric Type II radio emission use only the H-alpha location and X-ray duration, do not take into account the CME that is ultimately driving the shock. A better shock prediction model is needed to reflect the current understanding of CME/shock/energetic particle relationship. We propose a one-year effort to use the real-time energetic particle data along with solar wind and magnetic field data to examine all IP shocks from November 1997 to December 2000 and produce an empirically predictive tool. Based on this vast data set we will build a statistically based model to predict (a) the arrival time of an incoming IP shock, and (b) the maximum SEP intensity at Earth values measured upstream of the Earth.

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