Project Details

ROSES ID: NNH06ZDA001N
Selection Year: 2007
Program Element: Focused Science Topic

Topic: Understand how Flares Accelerate Particles near the Sun (i.e., through Shocks and/or Reconnection) and how they Contribute to Large SEP Events

Project Title:
Understanding Propagation Characteristics of Heavy Ions to Assess the Contribution of Solar Flares to Large SEP Events

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Summary:
Solar Energetic Particle (SEP) events are the most powerful explosions in the solar system, able to create high radiation levels at Earth with little warning. In the large events, particles are known to be accelerated both in the solar flare itself and by the shock driven by the associated Coronal Mass-Ejection (CME). The flare SEPs are known to have a distinct compositional signature including enhancements in electrons, the rare isotope 3He, and the relative abundance of Fe compared to O. Recent observations have shown that these energetic particle signatures of flare particles are often present in events with powerful CMEs along with shock-accelerated particles. This raises the question what are the basic mechanisms responsible for the most intense SEP events? For example: are the SEPs from the flare directly? or are they pre-accelerated at the flare and further energized by the shock? or are remnant suprathermals from previous flares supplying a critical component of the seed population?

The investigation proposed here probes these questions using the heavy ion signature of flare material, namely enhanced Fe/O ratios and their variation with time and energy. We have recently found new evidence that interplanetary scattering plays a critical role in a majority of large western hemisphere SEP events. We describe how to use these observations to provide an observational basis for developing our theoretical understanding of the important role played by particle scattering during large SEP events. Specifically, the observations along with detailed modeling will enable us to place limits on the contributions of particle transport processes to the observed timing and composition in large SEP events. Our proposed study will therefore provide a sound framework for other modelers and TR&T teams to better understand the primary causes of the variability and the temporal evolution of the heavy ion abundances, such as the Fe/O ratio. This, in turn, will allow us to assess the relative contributions of flare particles (either indirectly in the form of seed particles or directly in the form of high-energy particles) to large gradual SEP events observed at 1 AU.

Publication References:

no references