

Project Details

ROSES ID: NNH08ZDA001N

Selection Year: 2009

Program Element: Focused Science Topic

Topic: Use Inner Heliospheric Observations to better constrain Coronal Mass Ejection (CME) and Solar Energetic Particle (SEP) Event models.

Project Title:

Shock Acceleration and Transport of Solar Energetic Particles from the Corona to > 1 AU

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Summary:

This proposal addresses Focused Science Topic 3(b): Use Inner Heliospheric Observations to better constrain Coronal Mass Ejection (CME) and Solar Energetic Particle (SEP) Event Models. We will develop a model to study in detail the interplanetary transport and acceleration of multi-species solar energetic particles (SEPs) at a CME-driven shock that propagates from the solar corona to > 1 AU. The non-linear time-dependent model will include self-consistent interaction between SEPs and Alfvén waves, using a pitch-angle dependent resonance condition. For SEPs, the model will include focusing, convection, adiabatic deceleration, pitch-angle scattering, and momentum diffusion. Treatment of Alfvén waves will include propagation, SEP-driven growth/damping, shock transmission, and cascading.

We will analyze observations of multi-species energetic ions in shock-associated SEP and energetic storm particle (ESP) events by the ACE, GOES, Wind, and STEREO spacecraft to test and constrain the model. The analysis will include time and energy variations of SEP intensities, elemental abundances, and anisotropies. Concurrent observations of SEPs, plasma and magnetic field on multiple spacecraft as well as electromagnetic solar emissions will be used with the model to address issues regarding the importance of evolving shock-normal (BN) angle, shock speed, Alfvén speed, and other shock and plasma parameters, particle scattering, wave amplification, and heavy-ion suprathermal remnants from previous SEP events.

Publication References:

Summary: no summary

Reference:

Tan, Lun C.; Malandraki, Olga E.; Reames, Donald V.; Ng, Chee K.; Wang, Linghua; Patsou, Ioanna; Papaioannou, Athanasios; (2013), Comparison between Path Lengths Traveled by Solar Electrons and Ions in Ground-Level Enhancement Events, The Astrophysical Journal, Volume 768, Issue 1, article id. 68, 15 pp, doi: 10.1088/0004-637X/768/1/68

Summary: no summary

Reference: Tylka, Allan J.; Malandraki, Olga E.; Dorrian, Gareth; Ko, Yuan-

Kuen; Marsden, Richard G.; Ng, Chee K.; Tranquille, Cecil; (2013), Initial Fe/O Enhancements in Large, Gradual, Solar Energetic Particle Events: Observations from Wind and Ulysses, Solar Physics, Volume 285, Issue 1-2, pp. 251-267, doi: 10.1007/s11207-012-0064-z