

Project Details

ROSES ID: NRA-NNH04ZSS001N

Selection Year: 2005

Program Element: Focused Science Topic

Topic: To relate solar-energetic particles to their origin at the sun and inner heliosphere.

Project Title:

Development and Validation of a Realistic Model of the Acceleration and Transport of Solar Energetic Particles Produced by CME-Driven Shocks

PI Name: Allan J. Tylka

PI Email: atn@g.ucla.edu

Affiliation: Naval Research Laboratory

Project Member(s):

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Summary:

We propose to develop and validate a realistic numerical model of solar energetic particle (SEP) production by CME-driven shocks. Specifically, we will: (1) generalize our present time-dependent non-linear model [Ng, Reames, & Tylka 2003] to include shock-drift and first-order Fermi acceleration at shocks of arbitrary obliquity on arbitrary evolving magnetic flux tubes; (2) combine the model with realistic, 3-D models of CMEs and coronal and heliospheric fields that are selected by the LWS TR&T Program for this purpose; (3) provide data analyses that will guide and constrain the model development; (4) thoroughly validate the model by detailed comparisons with SEP measurements from the whole complement of energetic particle detectors on Wind, ACE, IMP8, SAMPEX, SOHO, and GOES and (in some events) ground-based neutron monitors; and (5) employ the model in testing new ideas on the origin of SEP variability, such as shock geometry, compound seed populations, and time-dependent acceleration. This proposal specifically addresses: (i) the acceleration time-scale; (ii) the location of the SEP acceleration region; (iii) particle distributions and their variability, both event-to-event and temporally within an event; and (iv) the intensity and spectra of ultra-heavy ions in gradual events. The results of this research will be a better understanding of the physics behind SEP variability, as well as numerical tools that can provide a basis for future predictive capabilities. These efforts directly support Goal II, SEC-Theme, RFA (2a).

Publication References:

Summary: no summary

Reference: Tylka, Allan J.; (2005), Energetic Particle from CME-Driven Shocks: Spectra, Composition, and Timing, Coronal and Stellar Mass Ejections, IAU Symposium Proceedings of the International Astronomical Union 226, Held 13-17 September, Beijing, edited by K. Dere, J. Wang, and Y. Yan. Cambridge: Cambridge University Press, 2005., pp.330-331, doi: 10.1017/S1743921305000815