Project Details

ROSES ID: NNH05ZDA001N
Selection Year: 2006
Program Element: Focused Science Topic

Topic: Shock acceleration of solar energetic particles by interplanetary CMEs

Project Title:
SELF-CONSISTENT SOLAR-ENERGETIC PARTICLE ACCELERATION AT EVOLVING SHOCKS ASSOCIATED WITH CORONAL MASS EJECTIONS

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Summary:
Under the National Objective to Study the Earth System from space and develop new space-based and related capabilities for this purpose the proposed work is specifically concerned with the NASA objective to Explore the Sun-Earth System and its effects on Earth, the Solar System, and the space environmental conditions that will be experienced by human explorers. The proposal fits in with the Targeted Investigations element of the Living With A Star Targeted Research and Technology (LWST) Program under which it addresses the Focused Science Topic Shock acceleration of solar energetic particles by interplanetary coronal mass ejections (CMEs) . Time-dependent numerical solutions of the equations of fundamental kinetic focused transport and acceleration theory for energetic charged particles, kinetic wave excitation and transport theory, and MHD theory for CME shock evolution will be employed to achieve a fully self-consistent time-dependent model of solar energetic particle (SEP) acceleration at propagating interplanetary CME shocks from the Sun to Mars with the minimum number of simplifying assumptions. A few fully self-consistent SEP models that are based on transport and acceleration theory exist, but are either analytical, or semi-numerical such as the current University of California Riverside (UCR) model. The existing models are subject to a number of assumptions such as near-isotropic particle distributions at and downstream of the CME shock that need further investigation. The SEP model that we propose, which can be viewed as a logical extension of the current UCR model, will be used for this purpose, and for comparison of simulation results with specific SEP events. Thus we expect to achieve an enhanced understanding of the significant complexities of time-dependent SEP acceleration that arises at an evolving CME shock (e.g., self-consistent wave generation by SEPs streaming away from the shock and the role of quasi-perpendicular shocks), and how this relates to the formation of radiation hazards between the Sun and Mars.

Publication References:

Summary: no summary

Reference: Le Roux, J. A.; (2008), Time-dependent Acceleration of Solar Wind Particles at Interplanetary Traveling Shocks, PARTICLE ACCELERATION AND TRANSPORT IN THE HELIOSPHERE AND BEYOND: 7th Annual International Astrophysics Conference. AIP Conference Proceedings, Volume 1039, pp. 258-26, doi: 10.1063/1.2982455