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:
MODELING THE RADIAL DEPENDENCE OF THE SHOCK ACCELERATION OF SOLAR ENERGETIC PARTICLES FROM THE CORONA TO EARTH WITH A TIME-DEPENDENT FOCUSED TRANSPORT MODEL

PI Name: Jakobus A. le Roux
PI Email: jakobus.leroux@ucr.edu
Affiliation:
Project Member(s):
- Webb, Gary M; Co-I; University of Alabama in Huntsville,
- Pogorelov, Nikolai ; Co-I; University of Alabama
- Zank, Gary P; Co-I; University of Alabama

Summary:
The proposal fits in with the Targeted Investigations element of the Living With A Star Targeted Research and Technology Program under which it addresses the Focused Science Topic Use Inner Heliospheric Observations to better constrain Coronal Mass Ejection (CME) and Solar Energetic Particle (SEP) Event models . A current time-dependent focused transport shock acceleration model will be further developed so that it can be used to model SEP events due to CME-driven shocks all the way from the corona to Earth using observations of SEP events between 0.3 and 1 AU by to constrain the simulations. A locally available 3D MHD model will be used to simulate the evolution of CME shocks in the corona and beyond to 1 AU. With the extended focused transport model we are going to investigate from first principles the validity of the remarkably successful diffusive shock acceleration model of Tylka and Lee [2006]. This will be done by revisiting SEP injection and shock acceleration at quasi-perpendicular and quasi-parallel CME shock geometries in the corona because the role of magnetic field-line random walk in SEP anomalous diffusive transport is poorly understood. We plan to include the observed ubiquitous non-Gaussian nature of magnetic field-line random walk in the solar wind in the focused transport model to determine the extent that anomalous perpendicular and parallel diffusion processes might become non classical in response, and thereby modify SEP injection and shock acceleration. In addition, the modification of parallel diffusion, and thus of the shock acceleration of SEPs at quasi-parallel CME shocks due to nonlinear wave-wave interaction effects on the SEP generated enhanced wave intensity spectrum upstream, which has not been studied in much detail, will be investigated.

Publication References:

Summary: no summary

Reference: Vasquez, Bernard J.; Markovskii, Sergei A.; Chandran, Benjamin D. G.; (2014), Three-dimensional Hybrid Simulation Study of Anisotropic Turbulence in the Proton Kinetic Regime, The Astrophysical Journal, Volume 788, Issue 2, article id. 178, 7 pp, doi: 10.