Acceleration and Transport of Solar Energetic Particles: Modeling CME Driven Shocks

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Abstract

Solar energetic particles (SEPs) in large gradual SEP events are thought to be accelerated at shocks driven by coronal mass ejections (CMEs). An important feature of CME driven shocks is that the field configuration (both the shock strength and geometry) may undergo remarkable variation as the CME evolves.

A numerical code has been developed in Arizona to solve the Fokker-Planck equation including convection, focusing, adiabatic cooling and acceleration, and pitch angle scattering of charged energetic particles moving along magnetic field lines. The Fokker-Planck equation is first cast in a form that is suitable for incorporating time-dependent magnetic fields. We use coordinates co-moving with the field line carried outward by the solar wind. Acceleration at parallel and perpendicular shocks will be discussed.

The present work combines this SEP code with the CME simulations developed in Michigan. These simulations indicate that the shock is likely to be more perpendicular than parallel. We use the magnetic field data of the Michigan simulations as input to the SEP code. We present preliminary results of our numerical simulations and discuss their physical implications.

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