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Constraining the Cross-field Diffusion of Jovian Electrons

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Jupiter is a quasi-stationary point source of energetic electrons, which are observed at Earth to display a thirteen month periodicity caused by the varying magnetic connection between Earth and the Jovian magnetosphere. The observation of Jovian electrons at Earth during times when Earth is not well magnetically connected to Jupiter implies that the electrons must have propagated across the background magnetic field. Particle drifts are not expected to be important for these energies, therefore perpendicular diffusion must be responsible. Unfortunately, the exact pitch-angle and energy dependences of the perpendicular diffusion coefficient are currently uncertain. We present a new stochastic differential equation model for both the isotropic and focussed transport of energetic electrons in the inner heliosphere. Comparing the computed spectra of Jovian electrons during best and worst magnetic connectivity at Earth with spacecraft observations, we constrain the amount of pitch-angle scattering and cross-field diffusion in the inner heliosphere for realistic turbulence conditions. We investigate two different theories of perpendicular diffusion, each predicting different spatial, energy, and pitch-angle dependencies.

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Yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

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