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Turbulent Reduction of Drifts for Solar Energetic Particles

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Particle drifts perpendicular to the background magnetic field are proposed by some authors as an explanation for the very efficient perpendicular transport of solar energetic particles (SEPs). This process, however, competes with perpendicular diffusion caused by magnetic turbulence, which will also disrupt the drift patterns and reduce the efficiency of drift effects. The latter phenomenon is well known in cosmic ray studies, but not yet considered in SEP models. Additionally, SEP models which do not include drifts, especially for electrons, use turbulent drift reduction as a justification of this omission, without critically evaluating or testing this assumption. We present the first theoretical step for a theory of drift suppression in SEP transport. This is done by deriving the turbulence-dependent drift reduction function with a pitch-angle dependence, as applicable for anisotropic particle distributions, and by investigating to what extent drifts will be reduced in the inner heliosphere for realistic turbulence conditions and different pitch-angle dependencies of the perpendicular diffusion coefficient.

Keywords

solar energetic particles; drifts; diffusion; turbulence

Collaboration

other Collaboration

Subcategory

Theoretical Results

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