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On the Effects of Dissipation Range Turbulence on the Perpendicular Diffusion Coefficients of Cosmic Ray Electrons

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The perpendicular diffusion coefficient (DC) plays a crucial role in the transport of low-energy cosmic ray electrons, which include a proportion of solar energetic particles, electrons originating in the Jovian magnetosphere, and electrons of galactic origin. In turn, various properties of heliospheric magnetic field turbulence have a strong influence on perpendicular DC expressions derived from theory. Deriving such expressions for realistic forms for turbulence power spectra is, however, difficult, as this involves dealing with relatively intractable integrals. This study presents such expressions, derived from the random ballistic decorrelation interpretation of nonlinear guiding center theory and assuming a 2D turbulence power spectrum that includes a dissipation range. These novel results will be compared with previously published perpendicular DCs derived from this theory which do not include the effects of turbulent dissipation, and will be used to ascertain the potential effects of dissipation range quantities on the perpendicular transport of low-energy electrons in the heliosphere.

Apply to be
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   award (Yes / No)?

Yes

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

Hons

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