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General anisotropy

30 min. invited talk

The role of perpendicular diffusion in explaining observed cosmic ray anisotropies

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We apply a pitch-angle dependent transport model to the propagation of both solar energetic particles (SEPs) near the Sun and galactic and anomalous cosmic rays (CRs) near the heliopause (HP). The importance of the pitch-angle dependence of the perpendicular diffusion coefficient is emphasized by showing how different forms (pitch-angle dependencies) of this quantity can lead to very different results. These results contradict earlier statements that only the magnitude of this quantity is important. We furthermore show that: (i) By incorporating perpendicular diffusion into a SEP transport model, we can explain various recent observations, including the so-called asymmetric nature of the SEP distribution when observed as a function of longitude. (ii) By choosing an appropriate form of the perpendicular diffusion coefficient, we are able to qualitatively reproduce the observed CR anisotropies near the HP. (iii) When perpendicular diffusion is included into the relevant transport equation, causality does not seem to be conserved; a worrying result if true.