

Internal use only

Abstract number: S5-33

Fundamental Processes

15 min. contributed talk

Aspects of nonlinear cosmic-ray modulation

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The heliospheric diffusion tensor is a key element in the study of the modulation of cosmic rays. As such, the diffusion coefficients depend on the power spectrum of the turbulence throughout the heliosphere. In the present study, a transport model for turbulence throughout the heliosphere is solved, and utilized to model the omnidirectional power spectra for both slab and 2D turbulence. These spectra are used as inputs to calculate cosmic ray mean free paths from the quasilinear and nonlinear guiding centre theories, which are then utilized in the study of the modulation of galactic cosmic ray protons via a 3D steady-state cosmic ray modulation code. The effects of turbulence on the reduction of cosmic ray drifts are also investigated, by means of ultrascales and correlation lengths calculated from the computed turbulence power spectra.