Cross field transport of cosmic rays: Test particle simulation studies

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We study cross-field transport of charged particles in a two
dimensional space by performing test particle simulations. The time stationary,power-law magnetic field turbulence is given perpendicular
to the simulation plane. Qualitatively distinct diffusion processes are observed depending on the ratio of particle Larmor radius to the field fluctuation correlation length. We compare the calculated diffusion coefficients to that obtained by the quasi-linear theory, and further attempt to relate statistics of the field turbulence to that of the
particle transport, making use of the percolation theory.

Fermi acceleration is important in shock acceleration of cosmic rays.

For quasi-perpendicular geometry, in order that the process is operative, it is essential that particles can travel across the magnetic field lines so that they can repeatedly be accelerated at the shock. Here we study cross-field transport of charged particles in a two dimensional space by performing test particle simulations. The time stationary, power-law magnetic field turbulence is given perpendicular to the simulation plane. Qualitatively distinct diffusion processes are observed depending on the ratio of particle Larmor radius to the field fluctuation correlation length. We compare the calculated diffusion coefficients to that obtained by the quasi-linear theory, and further attempt to relate statistics of the field turbulence to that of the particle transport, making use of the percolation theory.