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Time Sequence of Energetic Particle Spectra in Quasi-parallel Shocks

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We have studied the transport properties of energetic particles in the upstream region of parallel shocks considering the possibility of anomalous diffusion where the density decay profile has not an exponential profile but a power-law behavior. The results obtained from hybrid simulation model show that the energetic ions with energy of 50-100 E_0 (E_0 is the shock ram energy) spatial profiles are well fitted by a power law distribution and that the value of $< dx^2 > / t$ increases in time. This implies that particle propagation can be described by a super-diffusion profile even though the power of the magnetic wave is sufficient large to scatter the particles.

Keywords: shock wave, particle acceletaion, diffusion process