Abstract Submitted
for the DPP08 Meeting of
The American Physical Society

Diffusion of Charged Particles in Chaotic Magnetic Fields[1] A.K. RAM, PSFC-MIT, B. DASGUPTA, IGPP-UC, Riverside — Diffusion of charged particles across magnetic field lines is routinely observed in laboratory and space plasmas. For example, there are well documented observations on cross-field diffusion of solar cosmic rays. In theoretical studies on cross-field transport, an irregular component, prescribed in an *ad hoc* fashion, is added to the background magnetic field to induce spatial diffusion. In contrast, we determine the magnetic fields from prescribed regular current configurations. We consider asymmetric, spatially nonlinear, three-dimensional steady state magnetic fields generated by currents flowing in circular loops and straight lines. The magnetic fields are completely deterministic and, for certain range of parameters, chaotic. The motion of charged particles in these magnetic fields is determined using the Lorentz equation. We find that a chaotic magnetic field does not necessarily imply chaotic particle motion. In fact, the particle motion can be quasiperiodic with no associated cross-field transport. However, a particle moving in a deterministic, spatially nonlinear magnetic field superposed on a uniform background magnetic field can undergo spatial transport. Hence, fields generated by simple current configurations can lead to cross-field diffusion. An analysis of magnetic field lines and particle diffusion will be presented.

[1]Work supported by DoE and NASA.

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Date submitted: 21 Jul 2008 Electronic form version 1.4