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Particle diffusion and energization in Arnold-Beltrami-Childress force-free helical magnetic fields[1] B. DASGUPTA, CSPAR, Alabama, F. HOLGUIN, A.K. RAM, PSFC - MIT, D. MITRA, Nordita, Stockholm, Sweden — It has long been considered that the cosmic magnetic fields in regions of low plasma pressure and large currents, such as in interstellar space and gaseous nebulae, are force-free in the sense that the Lorentz force vanishes. The Arnold-Beltrami-Childress (ABC) field is an example of a force-free helical magnetic field. The ABC magnetic field lines exhibit a complex and varied structure and can be chaotic. The motion of charged particles in regions of spatially chaotic ABC magnetic field lines displays a variety of dynamical behavior depending on the particle's energy and its initial direction of motion with respect to the local magnetic field vector. Particles started on chaotic magnetic field lines do not necessarily follow chaotic orbits [1]. A class of particles executes periodic motion. For steady-state ABC fields the particles diffuse in space. For time-dependent ABC fields the particles gain energy for extended time periods–the mean kinetic energy has a power-law behavior in time. We present results on the dynamics of particles, and on their spatial diffusion and velocity space energization in ABC fields.

[1] A. K. Ram and B. Dasgupta, *Phys. Plasmas* **17**, 122104 (2010).

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