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Nonlinear dynamics of charged particle motion in Alfvén waves ZEHUA GUO, CHRIS CRABTREE, LIU CHEN, Department of Physics and Astronomy, University of California, Irvine — The nonlinear dynamics of charged particle motion in a uniform background magnetic field and obliquely propagating shear Alfvén wave is investigated both numerically and analytically. Using Lie perturbation theory in the wave frame a resonance condition is found. In the lowest order one recovers the well-known linear resonance condition, when the particle completes n full gyroperiods during it's traversal of the wavelength. That is, $n\Omega + v_z k_z = 0$, where v_z is the particle's velocity along the background field in the wave frame, k_z is the parallel wave vector, and Ω is the gyrofrequency. In the second order, however, the resonance condition becomes $n\Omega + 2v_z k_z = 0$. The analytical theory produces a resonance Hamiltonian which is directly compared to numerically computed Poincare surfaces of section. Detailed predictions on the location of fixed points, width of resonance, and resonance overlap criterion will be presented.

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