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Nonlinear Dynamics of Charged Particles Motion in Shear Alfvén Waves[1] ZEHUA GUO, UC, Irvine, CHRIS CRABTREE, MIT, LIU CHEN, UC, Irvine — The nonlinear dynamics of ions in the presence of shear Alfvén waves is a fundamental issue in a wide range of plasma enviroments. In this work, we present analytical as well as numerical studies of the simplest model; a single linearly polarized shear Alfvén wave in a uniform background magnetic field. Analytically, we have carried out, in the wave frame, Lie perturbation analysis to the second order in the wave amplitude parameter, $\epsilon \equiv B_W/B_0$. At the lowest order, the familiar cyclotron resoance, $\omega - k_z v_z + n\Omega = 0$, is recoverd; where n is a non-zero integer. In the second order, however, we not only recover the expected Landau resonance, $\omega = k_z v_z$, due to the finite mirror force; but, more interestingly, the nonlinear subharmonic cyclotron resonance at $\omega = k_z v_z + n\Omega/2$. The predicted phase space structures agree well with those of numerically computed Poincare plots. Detailed dependances of nonlinear dynamics on the wave properties will be presented.

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