Abstract Submitted
for the DPP08 Meeting of
The American Physical Society

Nonlinear cyclotron harmonic absorption JAECHUN SEOL, National Fusion Research Institute, C.C. HEGNA, J.D. CALLEN, University of Wisconsin-Madison — Nonlinear oscillations of a particle's energy occur when a particle stays in an electron cyclotron resonance zone. In this work, we found that collisionless heating of particles occurs when they oscillate primarily within the microwave beam at first, second, and third harmonic resonances. It is found that the net energy gain of particles from the microwaves is inversely proportional to the wave frequency. It is also found that the net energy gain is dependent on the microwave beam width. The nonlinear energy gain of particles from a single pass through a resonance zone has been formulated analytically. A numerical calculation has been performed and the results are in good agreement with the analytic calculation. Both analytic and numerical calculations show a strong frequency-dependence and a beam-width-dependence of nonlinear cyclotron resonance heating. The range of applicability of the nonlinear resonance and resultant heating can be limited by de-correlation effects such as Coulomb collisions, 3D drifts or other effects.

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Date submitted: 22 Jul 2008 Electronic form version 1.4