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Nonlinear electron dynamics in large-amplitude whistlers[1] M. LAMPE, A.V. STRELTSOV, G. GANGULI, Naval Research Lab, W.M. MANHEIMER, SFA, G. JOYCE, K. PAPADOPOULOS, Univ. Maryland — The nonlinear evolution of whistlers in the radiation belt depends on trapping and phase bunching of resonant electrons in the wave field B_w, and is sensitive to spatial variation of the geomagnetic field B_0 (z) along a field line and to the finite spatial extent of a wave packet. The scale length L for these inhomogeneities is 10^2 to 10^3 times longer than the wavelength λ, making nonlinear evolution a global problem which strains computational resources. Our particle simulation code HEMPIC partially addresses this problem by eliminating the plasma frequency and the speed-of-light timescales, thereby permitting gyrofrequency time steps. Here we use the small parameters λ/L and B_w/B_0 to integrate the electron trajectories with >100 times longer time steps that characterize either the trapping frequency or the time for an electron to traverse the inhomogeneities. We use this approach analytically to elucidate electron phase trapping by a wave packet in the presence of a varying magnetic field, and numerically to elucidate the phase bunching that initiates secondary waves.

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