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High frequency gyrokinetic (HFGK) particle simulation of ion heating in the cyclotron frequency range. R.A. KOLESNIKOV, W.W. LEE, H. QIN, E. STARTSEV, PPPL — The linear gyrokinetic formulation for $\rho/L_B \ll 1$ can be generalized to describe the arbitrary frequency and wavelength dynamics, where ρ is the ion gyroradius and L_B is the scale length of the ambient magnetic field [H. Qin, W. M. Tang, W. W. Lee and G. Rewoldt, Phys. Plasmas **6**, 1575 (1999)]. We developed a high frequency gyrokinetic (HFGK) algorithm, which utilizes the separation of the ion gyromotion from its gyrocenter motion, and it is equivalent to the original Lorentz-force description for $\rho/L_B \ll 1$. We performed a nonlinear δf gyrokinetic particle-in-cell simulation of the HFGK model to demonstrate its ability to study arbitrary frequency dynamics [R. A. Kolesnikov, W. W. Lee, Sherwood meeting (2006)]. The algorithm allows self- consistency and first principle based simulation of nonlinear heating dynamics. Separation of motions allows us to take advantage of the difference between finer timescales associated with the propagation of rf waves and larger timescales due to slower gyrocenter motion, which produces finite particle orbits as well as turbulence and radial heat transport. We present some simulation results of simple 2D electrostatic system to study the absorption of cyclotron waves and their effect on gyrocenter motion as well as development of non-Maxwellian tail in ion distribution function. The effects of this non- Maxwellian distribution function on the turbulence resulting from the drift wave instability will be presented.

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