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Delta-f simulations of electron Bernstein modes NONG XIANG, JOHN R. CARY, DANIEL C. BARNES, University of Colorado, JOHAN CARLSSON, Tech-X Corporation — Full-wave modeling provides an excellent description of wave propagation and absorption in the interior of a toroidal fusion plasma. However, in the coupling region, from the RF launch structure a few centimeters into the plasma, physics neglected by full-wave theory (such as parametric decay) can dominate. In principle, the particle-in-cell (PIC) algorithm provides a complete description of the RF coupling physics. An outstanding problem in PIC simulations of electron Bernstein modes is that particle noise may obscure the physical process being modeled. For instance, in full PIC simulations of the electron Bernstein waves (EBW) the incident wave field is required to be about 10^6 V/m in order for the EBW field not to be noise dominated, even with 400 particles per cell, and this incident field is not only larger than typical wave fields in the experiments, but also gives rise to significant nonlinear effects. Hence, full PIC is not practical for simulating linear Bernstein modes. To overcome these difficulties, we implemented the delta-f method in VORPAL, a massive parallel, hybrid plasma modeling code. Consequently we are able to model much lower values of the incident field, as low as 100 V/m. This makes practical the simulations of linear plasma-wave interactions. The simulation results are in good agreement with the available (small $k_\perp \rho_e$) linear theory. Moreover, with delta-f simulation, the effects of finite electron temperature on the linear mode conversion between the extraordinary (X) and electron Bernstein waves can be explored.

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