Harmonic Generation in EBW Injection into Plasmas

Nong Xiang [1] and John R. Cary[1,2]

[1]University of Colorado at Boulder, Colorado 80309
[2]Tech-X Corporation, 5621 Arapahoe Avenue, Suite A,
Boulder, CO 80303

Experiments on MST and NSTX are using or proposing to use electron Bernstein waves (EBWs) for heating and current drive, as these modes can couple into the overdense, high-beta plasmas. To study the propagation and power deposition of EBWs, we have developed both linear and nonlinear ξf PIC methods, which make no assumption about the ratio of gyroradius to wavelength. These methods make use of an implicit electromagnetic advance that gets around the usual need to over-resolve time in order to avoid grid heating. Our numerical results indicate that nonlinear effects can lead to the generation of a second harmonic mode with amplitude that can exceed the of the fundamental wave if the field of the fundamental EBW is sufficiently strong, no more than a small fraction of the plasma thermal energies and within the range of experiments. As a result, the power deposition of the injection EBW could be significantly changed. for instance, the power may be deposited at the cyclotron resonance at half-harmonics frequencies. With a high incident power, the generation of the non-propagation third and fourth harmonic modes is also observed