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AORSA-1D simulation of parametric decay instability (PDI) in tokamak plasmas[1] GUANGYE CHEN, F.E. JAEGER, L.A. BERRY, ORNL , J.R. MYRA, Lodestar — Theory and experiment have suggested that PDI is a possible nonlinear edge loss mechanism. This study simulates the PDI in ICRF heating for the C-MOD and NSTX tokamaks, using an extended 1D full wave spectral code, AORSA [1], where a non-uniform plasma is taken into account. PDI is described by a set of coupled equations for a long-wavelength "dipole" pump and short-wavelength daughter waves. Fixing the pump wave, so that a direct method can be used to find the solution, eliminates possible numerical instability associated with iterative methods. We successfully excite the decay instability into an ion Bernstein wave and an ion cyclotron quasi-mode. Simulation shows the PDI threshold of C-MOD is consistent with the estimate from experiment, and the linear damping is so weak that non-linearly excited waves can propagate into the bulk plasma. NSTX has a much lower PDI threshold, and the narrow distance between harmonics prevents the daughter wave energy from getting into the bulk plasma. Comparison with local dispersion relation calculations shows strong effects of damping and poloidal wave number k_y on the PDI.

[1] E.F. Jaeger, et al., Phys. Plasmas 7, 3319, 2000.

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