

Towards a predictive model of power loss from parametric decay instability of ICRF waves*

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Both theoretical¹ and experimental² investigations of parametric decay instability (PDI) in tokamak fusion plasmas point to PDI as a possible edge power loss mechanism in ICRF (including HHFW and IBW) experiments. What is lacking at present, on both the theoretical and experimental sides, is a quantitative evaluation of the net power loss from PDI processes. (Ref. 2 has presented some bounds for HHFW power losses on experiments in NSTX.) In this paper, we consider the extension of previous theoretical models¹ to enable the description of pump depletion and power loss due to PDI. A set of nonlinear coupled equations for a long-wavelength “dipole” pump and short-wavelength daughter modes will be presented. The equations are intended to describe parametric decay and pump depletion in weakly inhomogeneous plasmas. By writing the nonlinear coupling coefficients in terms of a spectral basis, the work will target a nonlocal description of PDI in the 1D-AORSA³ full wave code.

[1] M. Porkolab, *Fus. Eng. Design* **12**, 93 (1990); and refs. therein.

[2] J.R. Wilson, et al., *AIP Conf. Proc.* **787**, 66 (2005); and refs. therein.

[3] E.F. Jaeger, L.A. Berry, et al., *Phys. Plasmas* **13**, 056101 (2006).

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