Resonance overlap and nonlinear features of the beam-plasma system

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J Plasma Phys **86**, Issue 4 (2020) 845860401; https://doi.org/10.1017/S0022377820000744

Abstract:

The beam–plasma instability can be addressed as a reduced model in several contexts of plasma physics, from space to fusion plasma. In this paper, we review and refine some nonlinear features of this model. Specifically, by analysing the dependence of the nonlinear velocity spread as a function of the linear growth rate, we discuss the effective size of the resonance in view of its role in the spectral overlap at saturation. The relevance of this characterization relies on the necessity of a quantitative determination of the overlap degree to discriminate among different transport regimes of the self-consistent dynamics. The analysis is enriched with a study of the phase-space dynamics by means of the Lagrangian coherent structure technique, in order to define the transport barriers of the system describing the relevant features of the overlap process. Finally, we discuss relevant features related to the mode saturation levels.