Nonlinear Simulation of Multiple Energetic Particle Driven Alfvén Eigenmodes with source and sink

J. Lang and G.-Y. Fu
Princeton Plasma Physics Laboratory

The nonlinear behavior of a single toroidicity-induced Alfven eigenmode has been well studied using the kinetic/MHD hybrid code M3D-K [1] in the presence of pitch-angle scattering, source/sink, and the slowing-down process [2]. When multiple Alfven eigenmodes are present, nonlinear mode-coupling effect could play an important role if the resonant regime from each mode is close enough [3]. Our preliminary simulations show that Coulomb collision effect competes with multiple-mode coupling effect in the nonlinear saturation of Alfven waves. At low collision regime, multiple-mode coupling effect changes the mode structure from that of single mode simulation results. Spatial resonance overlapping from different modes is observed during multiple-mode nonlinear saturation. At high collision regime, the nonlinear saturation of multiple modes is determined by pitch angle scattering effect and shows little difference from the single mode results. Detailed dependence of the variation of distribution function and the nonlinear saturation level on multiple-mode coupling effects will be further explored. This work is supported by US DOE SciDAC project Center for Nonlinear Simulation of Energetic Particles in Burning Plasmas (CSEP)

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