Theory of Nonlinear Cascadings of Trapped-electron Mode Turbulence in Toroidal Plasmas

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Trapped-electron Mode (TEM) turbulence has been extensively studied due to its significant role in anomalous transports of thermal plasmas. Previous nonlinear studies are, however, limited to either TEM-Zonal flow interactions and/or simplified slab geometries. In this study, we analyze the nonlinear mode-mode coupling processes in realistic tokamak geometries, by employing the nonlinear gyrokinetic equations and ballooning-mode representation.

Specifically, the spectrum transfer rate in toroidal mode numbers due to nonlinear induced scattering off low-mode-number quasi-modes is calculated including contributions from both ions and trapped-electrons. Details of the analytical derivations as well as the dependences of the cascading direction and rate on mode structures and plasma parameters will be presented.

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