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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.

This work was supported by U.S. DOE GRANT and the ITER-CN under Grants No. 2013GB111004.

PACS numbers:

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