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Dominant Energy Transfer Channels in Toroidal and Slab ITG Branches[1] TAWEESAK JITSUK, PAUL W. TERRY, Department of Physics, University of Wisconsin-Madison — Evidence from simulations of ITG turbulence in tokamaks, RFPs, and stellarators suggests that both the slab and the toroidal ITG branches are saturated by three-wave coupling to stable modes, through different intermediaries. In the former the intermediary is a marginally stable mode, while in the latter it is a zonal flow. In a fluid model, this difference is consistent with the elimination of parallel flow physics by strong ballooning, which removes the marginal branch, leaving zonal flows as the best channel for maximizing the triplet correlation time. However, zonal flows and marginal modes coexist in both the slab and toroidal limits in the more general 3-field model that includes parallel flows. We study general saturation physics in this model via parameter orderings that access both limits and allow analytic expressions for the complex mode frequencies and eigenfunctions. This enables a determination of the relative roles played by triplet correlation time and eigenmode overlap in selecting the dominant saturation channel and the role of subdominant instabilities. These results are applied to simulations in MST and quasi-symmetric stellarator configurations to establish an understanding of the physics of dominant energy-transfer channels.

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