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Role of stable modes in zonal flow regulated ITG turbulence K.D. MAKWANA, P.W. TERRY, J.-H. KIM, University of Wisconsin-Madison — Stable modes are a ubiquitous mechanism for saturation of plasma turbulence. ITG turbulence is well known to be regulated by zonal flows. This work looks at the role of stable modes in ITG turbulence. First, a fluid model is investigated. By analyzing the energy dynamics in a simulation it is shown that the linear instability is saturated by nonlinear coupling with stable modes and zonal flows. It is shown that the zonal flow acts as a facilitator for energy transfer from unstable to stable modes. Three wave phase mixing is studied for triads involving different combinations of unstable, stable and zonal modes. It is found that triads involving one unstable, one stable and one zonal mode show the maximum phase matching. This explains the dominance of zonal modes ($k_y = 0$ modes) in the nonlinear coupling. Amongst zonal modes, the dominance of zonal flows can be explained by looking at the strength of the nonlinear coupling coefficients. Gyrokinetic simulation results showing the nonlinear transfer of energy involving zonal flows will also be presented.

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