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Role of stable modes in zonal flow regulated ITG turbulence KIRIT MAKWANA, PAUL TERRY, Department of Physics, University of Wisconsin-Madison, DAVID HATCH, Max-Planck-Institut für Plasmaphysik, Garching, M.J. PUESCHEL, Department of Physics, University of Wisconsin-Madison — Stable modes are studied in zonal flow regulated ITG turbulence using the gyrokinetic code GENE. Proper orthogonal decomposition (POD) modes are employed to investigate the eigenmode space of the distribution function. Both the unstable and stable POD modes show strong nonlinear energy transfer via three wave interactions that include zonal modes. The zonal mode itself absorbs a small fraction of the energy injected by the unstable mode. The remaining energy is deposited in the stable modes of non-zonal wavenumbers that are involved in the three wave coupling. These stable modes lie mostly within the wavenumber range of the instability. This indicates that zonal flows mediate energy transfer from unstable to stable modes, leading to saturation. The amplitude attenuation rate (AAR) of POD modes shows an equipartition across a large range of stable modes. This rate is balanced by three wave correlations of the POD modes and their time dependent amplitudes. These correlations are large if they involve zonal modes and they also show an equipartition for higher mode numbers. A similar analysis using linear eigenmodes also shows rough equipartition among the linear modes. Thus, AAR provides a handle to collectively describe the multitude of stable modes in a gyrokinetic simulation.

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