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Eigenmode Analyses of Nonlinear Gyrokinetic Simulations D. HATCH, P. TERRY, U. W. Madison, W. NEVINS, LLNL, F. JENKO, F. MERZ, IPP Garching — The excitation of damped eigenmodes is shown to be the dominant saturation mechanism for gyrokinetic ITG turbulence. Stable eigenmodes are excited to significant amplitude even at linearly unstable wavenumbers, revealing the collisionless gyrokinetic plasma to be a lossy medium, quite different from the conventional, nearly conservative medium requiring a cascade to short wavelengths for energy dissipation. This observation comes from eigenmode analyses of gyrokinetic simulations using the complete linear spectrum of the numerically discretized gyrokinetic operator. A projection procedure allows for explicit observation of the importance of each eigenmode with regard to transport, energy dissipation and energy content of the turbulence. This procedure has been applied to ITG driven turbulence where it is found that a series of stable eigenmodes are strongly excited, playing a vital role in energy balance and saturation. Comparisons with simulations for which zonal modes have been artificially suppressed indicate that zonal modes facilitate energy transfer to damped eigenmodes.

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