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Nonlinear excitation and damping of Zonal Flows using a renormalized polarization response FRED HINTON, PATRICK DIAMOND, University of California, San Diego, La Jolla, CA 92093-0424 USA — The nonlinear interaction of drift-wave turbulence and zonal flows is considered using an analogy with dressed test-particles in a stable plasma. The incoherent mode coupling potentials from the drift waves are treated as a source of noise driving the zonal flows. The coherent mode coupling potentials are included in a renormalized nonlinear polarization response to this noise source, analogous to the shielding of test-particles. The nonlinear damping of zonal flows and the conditions for a steady turbulent state are determined from the nonlinear polarizability. This calculation attempts to systematically address the effects of fluctuations and turbulence on the otherwise 'neoclassical' zonal flow polarization response. Thus it offers the possibility of identifying new nonlinear, kinetic 'channels' for the coupling of zonal flow energy to dissipation. The implications for zonal flow saturation will be discussed. This work was supported by DoE Grant No. DE-FG02-04ER54738.

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