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Multi-Scale Interaction of a Tearing Mode with Drift Wave Turbulence: A Minimal Self-Consistent Model[1] C.J. MCDEVITT, P.H. DIAMOND, CASS and Physics, UCSD — A minimal self-consistent model of the multi-scale interaction of a tearing mode with drift wave turbulence is presented. We first consider the problem of a tearing instability in a cylindrical plasma interacting with electrostatic drift waves. Wave kinetics and adiabatic theory are used to treat the feedback of tearing mode flows on the drift waves via shearing and radial advection. The stresses exerted by the self-consistently evolved drift wave population density on the tearing mode are calculated by mean field methods. The principal effect of the drift waves is to pump the resonant low-m mode via a negative viscosity, consistent with the classical notion of an inverse cascade in quasi-D turbulence. This mechanism is similar to that by which drift wave turbulence drives zonal flows. The magnitude of the turbulent stresses is consistent with a gyro-Bohm diffusivity, and thus exceeds the magnitude of the inertia term for the tearing mode. We study, two types of low-m, resonant structures. The first is a localized, electrostatic vortex mode and the second is like a usual tearing mode, which matches the visco-resistive layer (with negative viscosity) to an MHD exterior. Outgoing wave boundary conditions are imposed in order to effect the match. Extensions to the Rutherford regime and inclusion of turbulence spreading effects will be discussed.

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