STUDYING THE INTERACTIONS BETWEEN MICROTURBULENCE AND THE TEARING MODE VIA SELF-CONSISTENT SIMULATIONS

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The effects of microturbulence are known to be important in the evolution of magnetohydrodynamic (MHD) instabilities and, conversely, MHD instabilities can have an important impact on the dynamics of the turbulent fields. Due to extremely dissimilar temporal and spatial scales, self-consistently capturing the evolution of both the slowly evolving MHD instabilities and the rapidly evolving microturbulence is a challenging numerical problem. In this work, we self-consistently capture the evolution of the nonlinear tearing mode and drift-wave turbulence by coupling Ohm's law to an extended Hasegawa-Wakatani model. We have developed a new code, TURBO, to simulate this system that includes turbulent drives and prescribed resistive MHD stability properties. Analytic reductions for a turbulent resistivity and viscosity are represented as integrals over the wave spectrum and compared with simulations. Results are presented which indicate that the presence of a magnetic island localizes the turbulence and drives lower wave numbers. This gives rise to a turbulent resistivity that is also localized and oscillates with respect to the island. We discuss how these results provide an understanding for the self-consistent evolution of the coupled turbulence and island system and how to extend this work to include the ion temperature gradient (ITG) mode with a 5-field model.

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