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Nonlinear Dynamics of Disruptive Modes

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The dynamic, nonlinear evolution of tearing instabilities on DIII-D reveals a coupling of multiple rotating magnetic island chains that enhances momentum transport. Islands of different toroidal mode number that exert no linear JxB force on one another couple nonlinearly to phase-lock, flattening the toroidal rotation profile. This behavior has been described by a model for 3-wave mixing similar to that evoked for the so-called 'slinky' mode observed in reversed field pinch devices, but as the edge safety factor is reduced toward values relevant to the ITER baseline, or 15 MA scenario, additional momentum transport and forces not encompassed by single fluid resistive MHD become dominant. These data are troubling in their implications for controlling rotation to optimize confinement and to reduce disruptivity in ITER, and they reveal critical shortcomings in our capability to model island-induced modifications of the neoclassical toroidal viscosity. However, the empirical results of this work are also encouraging in that they suggest new methods for the early detection of disruptive modes, such as real-time monitoring of the local effective Prandtl number. Microwave imaging diagnostics play a central role in executing these experiments and guiding the analysis that can lead to a deeper appreciation of the underlying physics

Friday, February 12th @ 10am

CIPS Stern Conference Room, Gamow Tower F931

Refreshments 9:45 Room F935