Landau Resonant Modification of Multiple Kink Mode Contributions to Three-dimensional Tokamak Equilibria

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Abstract. Detailed measurements of the plasma's response to applied magnetic perturbations provide experimental evidence that the form of three-dimensional (3D) tokamak equilibria, with toroidal mode number $n = 1$, is determined by multiple stable kink modes at high-pressure. For pressures greater than the ideal magnetohydrodynamic (MHD) stability limit, as calculated without a stabilizing wall, the 3D structure transitions in a way that is qualitatively predicted by an extended MHD model that includes kinetic wave-particle interactions. These changes in poloidal mode structure are correlated with the proximity of rotation profiles to thermal ion bounce and the precession drift frequencies suggesting that these kinetic resonances are modifying the relative amplitudes of the stable modes. These results imply that each kink may eventually be independently controlled.

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