The Toroidicity-Induced Alfven Eigenmode Structure in DIII-D: Implications of Soft X-ray and Beam-Ion Loss Data

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ABSTRACT

The internal structure of the toroidicity-induced Alfvén eigenmode (TAE) is studied by comparing soft x-ray profile and beam ion loss data taken during TAE activity in the DIII-D tokamak with predictions from theories based on ideal magnetohydrodynamic (MHD), gyrofluid, and gyrokinetic models. The soft x-ray measurements indicate a centrally peaked eigenfunction, a feature which is closest to the gyrokinetic model's prediction. The beam ion losses are simulated using a guiding center code. In the simulations, the TAE eigenfunction calculated using the ideal MHD model acts as a perturbation to the equilibrium field. The predicted beam ion losses are an order of magnitude less than the observed ~6-8% losses at the peak experimental amplitude of $\delta B_r / B_0 \simeq 2-5\times 10^{-4}$.