Coupling of global toroidal Alfvén eigenmodes and reversed shear Alfvén eigenmodes in DIII-D

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Abstract

Reversed shear Alfvén eigenmodes (RSAEs) are typically thought of as being localized near minima in the magnetic safety factor profile, however, their spatial coupling to global toroidal Alfvén eigenmodes (TAEs) has been observed in DIII-D discharges. For a decreasing minimum magnetic safety factor, the RSAE frequency chirps up through that of stable and unstable TAEs. Coupling creates a small gap at the frequency degeneracy point forming two distinct global modes. The core-localized RSAE mode structure changes and becomes temporarily global. Similarly, near the mode frequency crossing point, the global TAE extends deeper into the plasma core. The frequency splitting and spatial structure of the two modes throughout the various coupling stages, as measured by an array of internal fluctuation diagnostics, are in close agreement with linear ideal MHD calculations using the NOVA code. The implications of this coupling for eigenmode stability is also investigated and marked changes are noted throughout the coupling process.

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