Radial structure of Alfvén eigenmodes in the DIII-D tokamak through electron cyclotron emission measurements

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Abstract

The spatial structure of toroidal Alfvén eigenmodes (TAEs) and reversed shear Alfvén eigenmodes (RSAEs) in DIII-D is obtained from electron cyclotron emission (ECE) measurements. Peak measured temperature perturbations are of similar magnitude for both TAEs and RSAEs and found to be < 7 eV, corresponding to $\delta T_e/T_e \approx 0.5\%$. Simultaneous measurements of density fluctuations using beam emission spectroscopy (BES) indicate $\delta n_e/n_e \approx 0.25\%$. For these modes, predictions of the measured temperature and density perturbation profiles from the ideal magnetohydrodynamic (MHD) code NOVA, which includes the effects of adiabatic compression, are in close agreement with experiment. Additionally, MHD calculations confirm the relative magnitude of density to temperature fluctuations measured using multiple diagnostics. These results are directly relevant to "real-time" MHD spectroscopy in future burning plasma experiments where a reliable means for identifying Alfvén eigenmodes from core fluctuation measurements will be required.

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