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Stability of Low Frequency Fast-ion Driven Instabilities in DIII-D

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Although the stability of ellipticity, toroidal and reversed-shear Alfven eigenmodes (EAE, TAE, RSAE) is relatively well understood, less is known about the stability of lower-frequency modes such as the beta-induced Alfven eigenmode (BAE), the beta-induced Alfven-acoustic eigenmode (BAAE), and the energetic-particle geodesic acoustic mode (EGAM). Because they are often unstable in present devices and are implicated in fast-ion transport, understanding their stability is vital. To that end, a database of ˜1000 beam-heated discharges has been assembled. Modes are classified based on electron cyclotron emission, beam emission spectroscopy, magnetics, and interferometer data. The database is limited to the initial two seconds of the discharge, where the evolving q profile facilitates identification of RSAEs and provides an effective scan of the dependence of stability upon q. Preliminary analysis indicates that, during the current ramp, TAEs and RSAEs are unstable more often than BAEs and BAAEs. BAEs are more likely to be unstable when the poloidal beta exceeds 0.5 and for particular values of q. BAAEs with a characteristic "Christmas light" pattern of brief instability as q evolves occur in low beta plasmas with relatively high electron temperature. EGAMs are more common in plasmas in which counter injection and plasma currents between 0.4-0.85 MA cause a significant loss cone. Analysis of representative cases by LIGKA, FAR3D, and GTC is planned. If available, results from a scheduled experiment to determine the relative importance of fast ions and thermal pressure gradients in driving BAE and BAAE instability will also be presented.

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