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EX/P6-02: Internal Amplitude, Structure and Identification of CAEs and GAEs in NSTX

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Fast-ions (e.g. fusion alphas and neutral beam ions) will excite a wide range of instabilities in ITER or a Fusion Nuclear Science Facility device. Among the possible instabilities are high frequency Alfvén eigenmodes (AE) excited through Doppler-shifted cyclotron resonance with beam ions [1]. High frequency AEs cause fast-ion transport [2,3,4], correlate with electron thermal transport [5] and are postulated to contribute to ion heating [6]. These high frequency modes have historically been identified variously as compressional (CAE) or global (GAE) Alfvén eigenmodes, but the identification has not proven conclusive. Identification is essential to understanding the extent of their effect, since the two types of modes have very different effects on resonant particle orbits. The effect on plasma performance of high frequency AEs is investigated in NSTX. This is facilitated by a recently upgraded array of 16 fixed-frequency quadrature reflectometers. Detailed measurements of high frequency AE amplitude and eigenmode structure were obtained in a high power (6 MW), beam-heated H-mode plasma (shot 141398) [7] very similar to those discussed in Ref. [5]. These measurements, which extend from the plasma edge to deep in the core, can be used in modeling the effects of the modes on electron thermal transport. The observed modes are identified by comparison of their frequency and measured toroidal mode numbers with local Alfvén dispersion relations [7]. The modes identified as CAEs have higher frequencies and smaller toroidal mode numbers than the GAEs. Also, they are strongly core localized, in contrast with the GAEs, which also peak toward the plasma center but have much broader radial extent.

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