Internal amplitude, structure and identification of CAEs and GAEs in NSTX* **EX-W**

N. A. Crocker, E. D. Fredrickson[1], N. N. Gorelenkov[1], W. A. Peebles, S. Kubota, R. E. Bell[1], B. P. LeBlanc[1], J. E. Menard[1], M. Podestà[1], K. Tritz[2] and H. Yuh[3]

Univ. of California, Los Angeles, CA 90095
[1]*Princeton Plasma Physics Laboratory, Princeton New Jersey 08543*
[2]*The Johns Hopkins University, Baltimore, MD 21218, USA*
[3]*Nova Photonics, Princeton, NJ 08543*

Email contact of main author: ncrocker@physics.ucla.edu

Fast-ions (e.g. fusion alphas and neutral beam ions) will excite a wide range of instabilities in ITER. Among the possible instabilities are high frequency compressional (CAE) and global (GAE) Alfvén eigenmodes excited through Doppler-shifted cyclotron resonance with beam ions [1]. Modes identified as GAEs have previously been demonstrated to cause fast-ion transport [2,3] and to potentially play a role in electron thermal transport [4]. Modes identified as CAEs have been postulated to contribute to ion heating [5]. The impact on plasma performance of CAEs and GAEs is investigated in NSTX. This is facilitated by a recently upgraded array of 16 fixed-frequency quadrature reflectometers. Detailed measurements of CAE and GAE amplitude and eigenmode structure were obtained in a high power (6 MW), beam-heated H-mode plasma (shot 141398) [6] (Fig. 1) very similar to those discussed in Ref. [4]. 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 [6] (Fig. 2). The modes identified as CAEs have higher frequencies and smaller toroidal mode numbers (i.e. smaller $|n|$) 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. Identification of the modes can aid in predicting their impact on fast-ion and electron transport, as well as ion heating, since CAEs and GAEs are expected to have very different effects on particle orbits.

[1] W.W. Heidbrink, *et al.*, *Nucl. Fusion* **46**, 324 (2006).

[2] E. D. Fredrickson, *et al.*, *Europhys. Conf. Abstracts* **35G**, P2.119 (2011).

[3] E. D. Fredrickson, *et al*., Proc. of the 23rd IAEA Fusion Energy Conf., Daejon, Korea Rep. of, 11-16 October 2010, EXW/P7-06-1–8 (2011).

[4] Stutman D, *et al.*, *Phys. Rev. Lett.* **102**, 115002 (2009).

[5] D. Gates, R. White, and N. Gorelenkov, *Phys. Rev. Lett.* **87**, 205003 (2001).

[6] N. A. Crocker, *et al.*, *Plasma Phys. Controll. Fusion* **15**, 105001 (2011).