

Observation of electrostatic potential fluctuation of Alfvén eigen mode and geodesic acoustic mode in Large Helical Device

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A coherent mode with a frequency of a few tens kHz is observed during current drive by using neutral beam injection (NBI) [1] or electron cyclotron (EC) wave [2,3] in Large Helical Device (LHD). The frequency range of the mode and its temperature dependence are similar to those of the Geodesic-Acoustic-Mode (GAM) [4][5]. It has magnetic and electrostatic components, and the magnetic probe array shows that it is uniform in the toroidal direction.

The fluctuation with the GAM frequency is observed only in plasmas with reversed magnetic shear, and it is accompanied with reversed-shear induced Alfvén eigen mode (RSAE). The tangential NBI is necessary for the excitation of the fluctuation. The mode with the GAM frequency is probably a RSAE with the lowest frequency which is determined by the finite pressure of the plasma and the geodesic curvature [6].

The characteristics of the GAM are investigated directly by using a heavy ion beam probe (HIBP). The amplitude of the potential fluctuation of the GAM is a few 100 V. The spatial distribution is also observed, and the GAM is localized near the magnetic axis, where the safety factor (rotational transform) is high (low), and the position is different from the position where RSAE is excited.

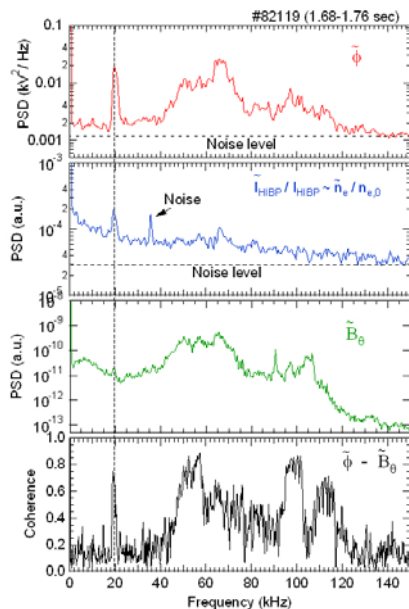


Fig : Frequency spectra of (a) electrostatic potential fluctuation, (b) normalized density fluctuation, (c) poloidal magnetic field fluctuation. The dotted vertical line indicates the geodesic acoustic mode frequency. (d) Coherence between electrostatic potential fluctuation and poloidal magnetic field one.

- [1] K. Toi, et al, 22nd IAEA Fusion Energy Conference, Geneva, 2008
(http://www-pub.iaea.org/MTCD/Meetings/FEC2008/ex_p8-4.pdf)
- [2] T. Ido, et al., Rev. Sci. Instrum., **79**, 10F318 (2008)
- [3] T. Ido, et al., Plasma Sci. Tech., **11**, 460 (2009)
- [4] H. Sugama, T.H. Watanabe, Phys. Plasmas **13**, 012501 (2006)
- [5] S. Satake, et al., Nucl. Fusion, **47**, 1258 (2007)
- [6] B.N. Breizman, et al., Phys. Plasmas, **12**, 112506 (2005)