§22. Edge Plasma Measurement in CHS H-mode with a Lithium Beam Probe

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Very rapid L-H transition within 0.1 msec was observed in deuterium plasmas, heated by co-injected neutral beams. The simultaneous measurement of radial profiles of the electron density and its fluctuations was performed with a thermal neutral lithium beam probe to investigate edge plasma behavior in the L-H transition.

The lithium beam probe is suitable for the transition measurement, since it can provide the time evolution of profiles of the edge electron density and its fluctuations simultaneously with good time and spatial resolution in one shot.

Fig.1 shows the temporal evolution of the local electron density n_e at z = 12.7 cm where the position of the last closed flux surface (LCFS) is estimated to be located around. Here z is the distance between a measuring point and the equatorial plane along the lithium beam. It is found that edge density fluctuations were suppressed after the L-H transition at t =100.7 msec, as shown in Fig.1. This phenomenon is similar to that of tokamak L-H transition.

To obtain more information about the fluctuations, power spectra taken at z = 12.7 cm are calculated with the fast Fourier transform algorithm, using time series data from t = 95 msec to 97.6 msec in the L-mode and from t = 101 msec to 102.6 msec in the H-mode, as shown in Fig.2 (a). The broadband turbulent fluctuations are observed in the L-mode. After the L-H transition at t =100.7 msec, the fluctuations are found to be suppressed in almost all the frequency range. Furthermore we calculated the correlation of two radially adjacent fluctuation signals, because the correlation may be closely related to the radial particle transport. Figures 2 (b) and (c) are the coherences between the fluctuations at z = 11.3 cm and z = 12.7 cm, which are calculated from the cross power spectrum. In the H-mode, the coherence is found to decrease, especially in the frequency range lower than 30 kHz.

Further study is required to clarify the role of density fluctuations in the transition phenomena.

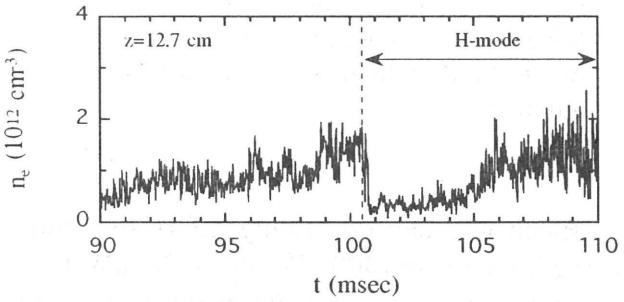

Fig.1 The temporal evolution of n_e at z = 12.7 cm near LCFS.

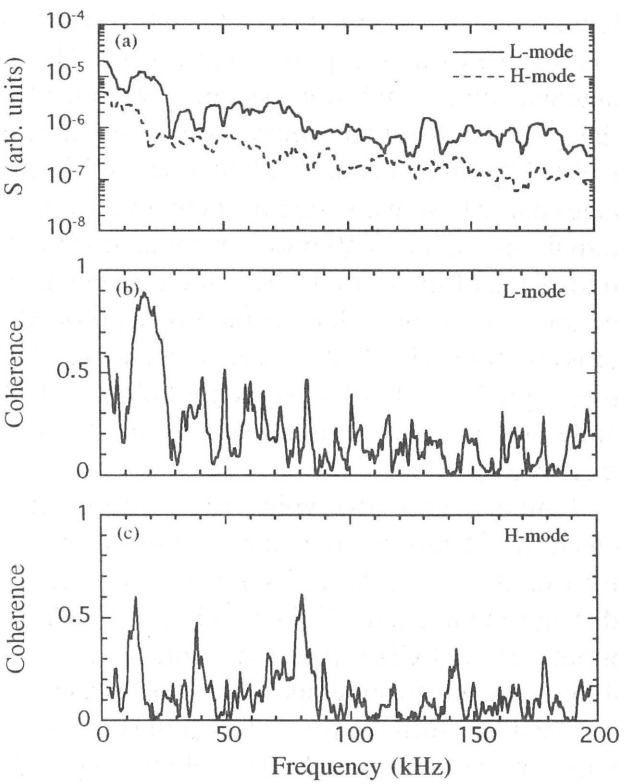

Fig.2 (a) Power spectra S of $\tilde{n}_e$ at z = 12.7 cm and the coherences between $\tilde{n}_e$ at z = 11.3 cm and z =12.7 cm in (b) L-mode and (c) H-mode.

References

1) Toi, K., et al., in Plasma Physics and Controlled Nuclear Fusion Research 1994 (Proc. 15th Int.Conf. Seville, 1994), IAEA-CN-60/A6/C-P-3.