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## ヘリオトロンJにおけるビーム放射分光法を用いた密度揺動分布計測

## Density Fluctuation Measurements using Beam Emission Spectroscopy in Heliotron J

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In order to understand the anomalous transport in high temperature plasmas, it is important to know spatial structure of the plasma fluctuations experimentally. Beam Emission Spectroscopy (BES) is a method to measure the density fluctuation at a local position using neutral beam injection (NBI). We have installed the BES system into the Heliotron J device [1]. The BES system has been recently upgraded to estimate the density fluctuation over the entire plasma region ($0<\rho<1$) in one shot.

In the rotational transform profile control experiments by the Electron Cyclotron Current Drive (ECCD), we measured the radial profile of the density fluctuation. As the parallel refractive index $N_{||}$ of injected EC waves was changed from 0.0 to 0.5, toroidal current varied from 0.5 kA (Co) to -1.5 kA (Ctr). Figures 1(a) and 1(b) show the time evolutions of the line-averaged electron density ($\bar{n}_e$) and the power spectrum by BES at $\rho$ = 0.72 in the case of $N_{||}$ = 0.0. Two intense energetic-ion-driven MHD modes were observed at frequency $f$ = 55 and 65 kHz. The frequencies of these modes were insensitive to the line-averaged electron density, where $\bar{n}_e$ was higher than $0.6\times10^{19}$ $m^{-3}$, suggesting that the mode is energetic particle mode. The mode amplitude of BES ($I_{BE}/\langle I_{BE}\rangle$) for the mode, as shown in Fig.1(c), depended on the electron density and had a maximum at $\bar{n}_e$ = $0.7\times10^{19}$ $m^{-3}$. Figure2 shows the radial profiles of the mode amplitude at $\bar{n}_e = 0.8\times10^{19}$ $m^{-3}$ in the case of the $N_{||}$ = 0.0 and 0.4. In the case of $N_{||}$ = 0.4, the mode amplitude became weak in the outer region, which may be due to the change in the rotational transform profile due to ECCD.

The analysis of the radial structure of the density fluctuation is in progress with regard to the dependence of $N_{||}$.

[1]S. Kobayashi, et al., Rev. Sci. Instrum **83** 10D535 (2012).

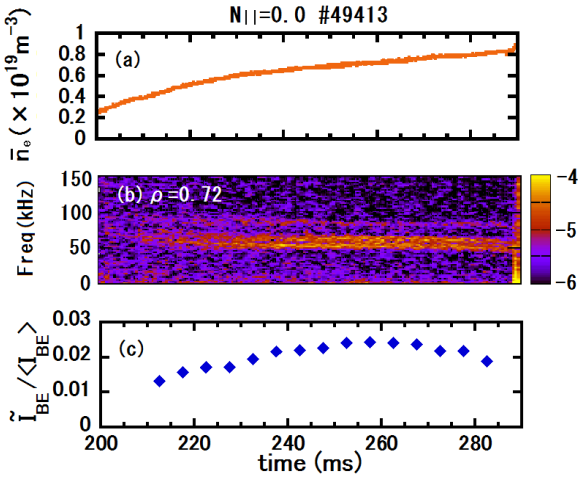


Fig.1. Time evolutions of (a)line-averaged electron density, (b)power spectrum, and (c)mode amplitude ($f$ = 45 – 75 kHz).

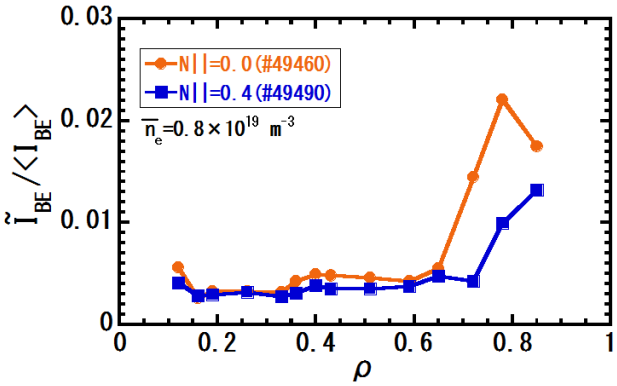


Fig.2. Radial profiles of the mode amplitude $\bar{n}_e = 0.8\times10^{19}$ $m^{-3}$.