30D17P

PANTA における分光による揺動スペクトル観測
Observation of turbulent fluctuation of light emissions in PANTA

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Turbulence plays an important role on structure formation of magnetically confined plasmas. Thus the understanding of plasma turbulence is strongly required for realization of fusion reactors. In PANTA in Kyushu University [1], a spectroscopic system is being made to aim at two-dimensional measurement of turbulence, and the system will be extended for tomographic reconstruction of turbulence images. This poster presents initial results from a test of the system on spectral analysis of the line-integrated light emission, and future experimental plans.

PANTA is a cylindrical linear plasma device with the diameter of ~0.1 m and axial length of 4 m. Plasma is generated by helicon wave (7 MHz, 3 kW). The magnetic field is fixed at 0.09 T in the present experiment.

The spectroscopic system consists of 132 (33 rows x 4 columns) channels and can measure different lights in wavelength using four kinds of optical filters ; infrared (900±20 nm), red (696.5±30 nm), blue (476.5±30 nm), and UV (294±20 nm). The 33 channels in a set are aligned in the vertical direction with the intervals of 5 mm. The filtered light signals, integrated along the horizontal line-of-sight across the plasma, are transferred to photo-diode detectors through optical fibers. The present measurement is performed for selected 16 channels for obtaining radial profiles of fluctuations. The significant fluctuation signals in blue light are obtained for argon plasmas, and for red light in a neon plasma. Fast Fourier Transform (FFT) was applied to the observed signals to obtain fluctuation spectra with the frequency resolution of ~50 Hz. Figure 1 (a) and (b) shows an examples of power spectra of emission intensity fluctuations along the central chord (including r = 0 mm) and deviated chord from the center (including r = 20 mm) in the blue light (ArII) in an argon plasma, respectively. As is shown in Fig. 1, we can find several spectral peaks in low frequencies, for example at ~5 kHz, significantly above the noise level, suggesting a possibility to infer the radial position where such coherent modes are located.

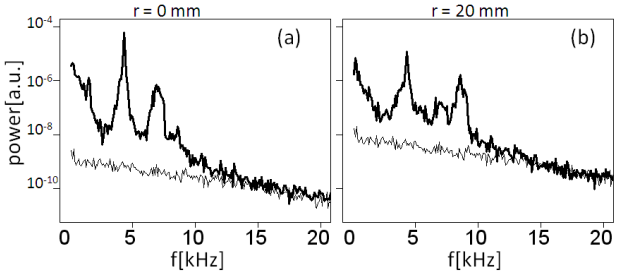

Fig.1. Bold lines of (a) and (b) indicate power spectra of emission intensity (blue) along the central line-of-sight (including r = 0 mm) and deviated line from the center (including r = 20 mm) in argon plasma, respectively. Thin lines indicates noise level.

This work is supported by a grant-in-aid for scientific research from JSPS(23246162, 21224014, 23360414, 23360409) and by the collaboration programs of NIFS (NIFS10KOAP023) and of the RIAM of Kyushu University.

References

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