§9. Simultaneous Measurement of Fluctuation Correlation for both Azimuthal and Axial Directions in the GAMMA 10 Tandem Mirror

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Suppression of drift instability is significant for an axially well-confined tandem mirror plasma. An ICRF application has a possibility of driving flow shear resulting in suppression of the instability. Following to the previous report[1)], simultaneous measurement of fluctuation correlation for both azimuthal and axial directions in the GAMMA 10 tandem mirror was carried out as a basic study for ICRF driven transport control.

In the central cell of GAMMA 10, axially and azimuthally aligned probe arrays are settled. Signals of ion saturation current or floating potential for each probe can be measured simultaneously. By application of central cell ICRF, fluctuations in the frequency of several kilo-hertz are observed in the scrape-off layer plasma of GAMMA 10. These fluctuations were identified as a drift wave.

Figure 1 shows an example of correlation spectrum of density fluctuation in the azimuthal direction, and three peaked signals (9 kHz, 43 kHz, 55 kHz) are confirmed. Relative phases are analyzed for these peaked signals, and time evolution of them is indicated in Fig. 2. As shown in the figure, relative phase for 9 kHz is almost constant during a shot except the start-up and the end. As for 43 kHz and 55 kHz, however, relative phases vary at random. Although multiple peaked signals were harmonic ones of fundamental one in the previous measurement, they are not in the present case.

The amplitudes of harmonic frequencies of 9 kHz were examined both in the azimuthal direction and in the axial direction. Figure 3 shows relative phase–frequency diagrams for harmonic frequency components of 9 kHz. As for (a), which is for the azimuthal direction, the 2nd and the 3rd components are weakly recognized, but components over the 4th are ambiguous. The 5th and the 6th are completely buried under the uncertain signals found in Figs. 1 and 2. As for (b), which is for the axial direction, not only clearly recognized components of the 2nd to the 4th, but also components over the 7th are also recognized weakly, and relative phases for all components are near 0. This may be the mode observed in the low RF power application in the previous report[2)].

The correlation measurement was also performed concerning to floating potential. The mechanism of fluctuations will be clarified from informations of relative phase difference between density and potential fluctuations as performed in the HIEI tandem mirror[3)].

Reference
1) Takeno, H., *et al.*, Ann. Rep. NIFS April2005-March2006 (2006) 491.
2) Takeno, H., *et al.*, Ann. Rep. NIFS April2004-March2005 (2005) 461.
3) Y. Yasaka, *et al.*, Trans. Fusion Sci. Technol. **43**(1T) (2003) 44.

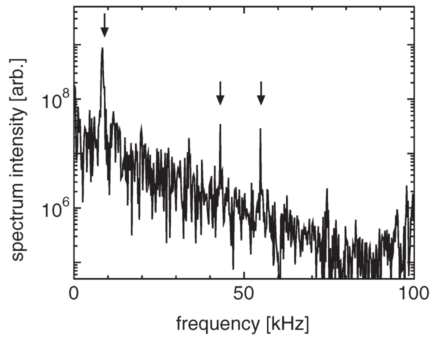

Fig. 1. Example of correlation spectrum of density fluctuation in the azimuthal direction.

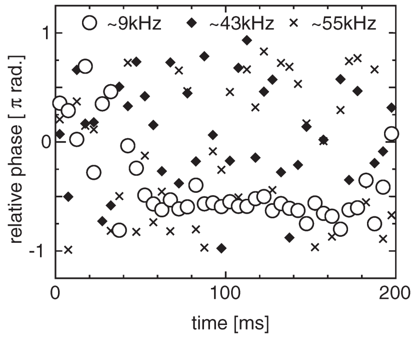

Fig. 2. Time evolution of relative phase between density fluctuations in the azimuthal direction.

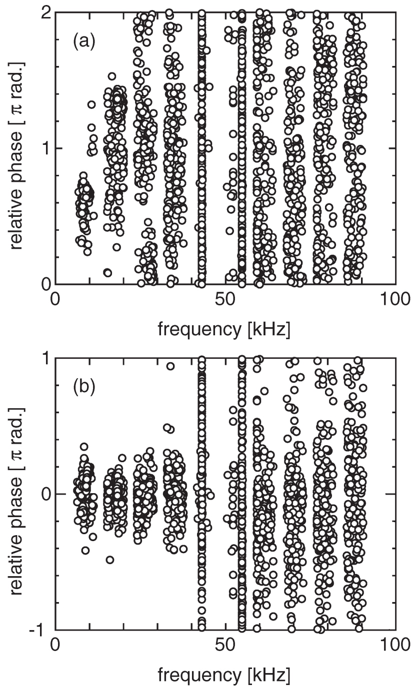

Fig. 3. Relative phase–frequency diagrams for harmonic frequency components of 9 kHz. (a) is for the azimuthal direction, and (b) is for the axial direction.