§11. Cross Correlation Measurement between Density and Potential Fluctuations in a Tandem Mirror for the Purpose of Radial Transport Control

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Understanding physical mechanism between ICRF and DC electric field and/or flow shear might lead ICRF driven transport control irrespective of confinement magnetic configuration[1]. As a basic study for this purpose, this report shows correlation measurement between density and potential fluctuations in GAMMA 10 following the previous study[2]. In the HIEI tandem mirror, the mechanism of fluctuations were clarified from informations of relative phase difference between these fluctuations[3].

In the scrape-off layer plasma of GAMMA 10, low frequency fluctuation is observed by application of central cell ICRF. The frequency of the fluctuation is several kilo-hertz, and was identified as an electron drift wave.

Using an azimuthally aligned probe array on the limiter, correlation among signals obtained by the probes was measured. Fig. 1 shows correlation between density fluctuations measured by probes separated with azimuthal angle of 90 degrees. Time evolution of frequencies of high intensity is shown in Fig. 1(a) below a time sequence chart of RF application. There are fluctuations from first to fifth order with their fundamental frequencies of 17 kHz, and those frequencies decline on plug/barrier ECH application. The fundamental frequency is rather higher compared with the previous report as density gradient increases by setting movable limiter at inner position. The relation between frequency and relative phase difference is summarized in Fig. 1(b), showing proportional relation between both values.

Similar measurement was performed about correlation between density fluctuation and floating potential. In Fig. 2(a), time evolution of frequencies of high intensity is shown, and it is similar to that in Fig. 1(a). About the relation between frequency and relative phase difference, however, the results shown in Fig. 2(b) are quite different from that in Fig. 1(b).

According to the linear theory of stability, relative phase difference of fluctuations between density and potential is 0 for electron drift wave. In the present condition, by taking account of locations of probes, the relation between frequency and relative phase difference is expected to be those as Fig. 1(b) Analysis of this gap between theory and experimental results is under way.

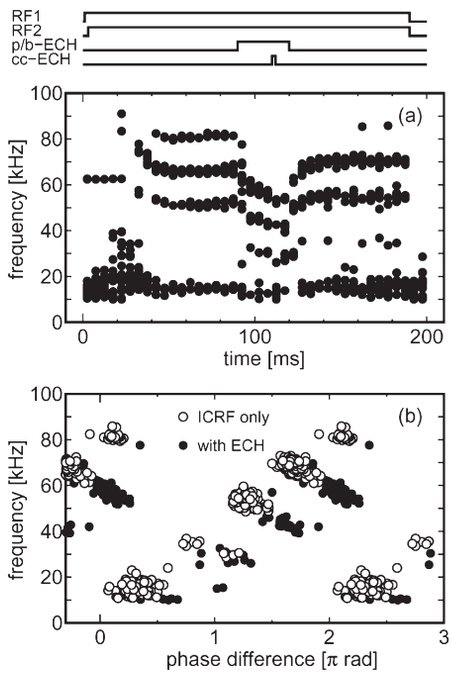

Fig. 1 Samples of correlation between density fluctuations. (a) high intensity frequency versus time and (b) relative phase difference.

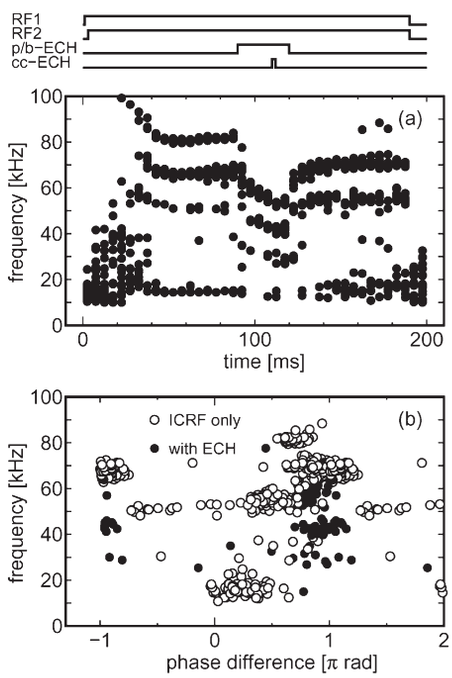

Fig. 2 Samples of correlation between density and potential fluctuations. (a) high intensity frequency versus time and (b) relative phase difference.

Reference
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3) Y. Yasaka, *et al.*, Trans. Fusion Sci. Technol. **43**(1T) (2003) 44.