§39. Identification of MHD Mode Structure Using ECE Measurement

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It is well known that the edge resonant low-order modes have some effects on the radial structures such as local flattening in density or temperature profiles which masy cause degradation of plasma performance. Therefore ,it is quite important issue to obtain the data of magnetic fluctuations and instability mode structure, which are basic data for MHD instability study and its control [1]. In this study, the result of the measurement of mode structure used by ECE (Electron Cyclotron Emission) [2] is reported.

Usually, MHD or high-beta experiment are conducted in the condition of low magnetic filed $B_t \leq 1.0$T in order to clear the effect on the magnetic field. In that condition, ECE measurement cannot be used because of the cutoff in LHD. Instead, SXR emission measurement is a helpful tool for fluctuation studies. However it is not adequate to identification of mode structure, in principle, since the obtained SXR emission intensity is included the integral effect along the line-of-sight. If the result of identification of mode structure used by SXR is supported by the ECE measurement, this study helps the confinement study of the low filed discharge.

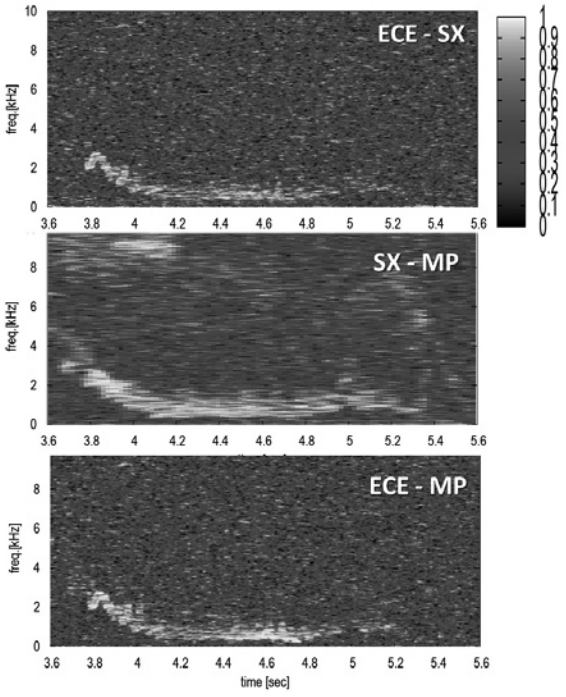

Fig. 1: Coherence evolution among ECE measurement, SXR measurement and Magnetic Probe.

The experiment is conducted using ECE measurement in the condition of $R_{ax} = 3.6$m, $B_t = 1.5$T, which is suitable for ECE to measure in $0.1 < \rho < 1$. The MHD fluctuation of low-order mode which is seem to be m/n = 1/1 are observed by SXR, magnetic probe (MP) and ECE. Fig.1 shows the coherence among fluctuations of ECE, SX and MP. Measurement area of Channels of ECE and SX in fig.1 is around $\rho = 0.85$, which corresponds to the area of $\iota = 1$. We can see the significant coherence of 0.7-2.5kHz. So it is considered that these fluctuations are oriented from a same instability. Fig.2 a) shows the coherent profile based on the fluctuation data at $\rho = 0.85$. It is found that the fluctuation at $\rho = 0.85$ propagate to the area of $\rho \sim 0.6$. To clarify the mode structure, we calculated the displacement amplitude ξ. The ξ is defined as $\xi = \frac{-\delta f}{df/d\rho}$. Fig.2 b) is a comparison of the the displacement amplitude profile using the ECE and SX fluctuation data. When SX signal can not show the structure clearly, we can see the mode structure around $\rho \sim 0.9$ using ECE data, which is local measurement tool.

1) S.Masamune, 23rd IAEA Fusion Energy Conference, Daejon, Republic of Korea, EXS/P5-11

2) H. Tsuchiya *et.al.* Plasma Fusion Research Special Issue, to be published

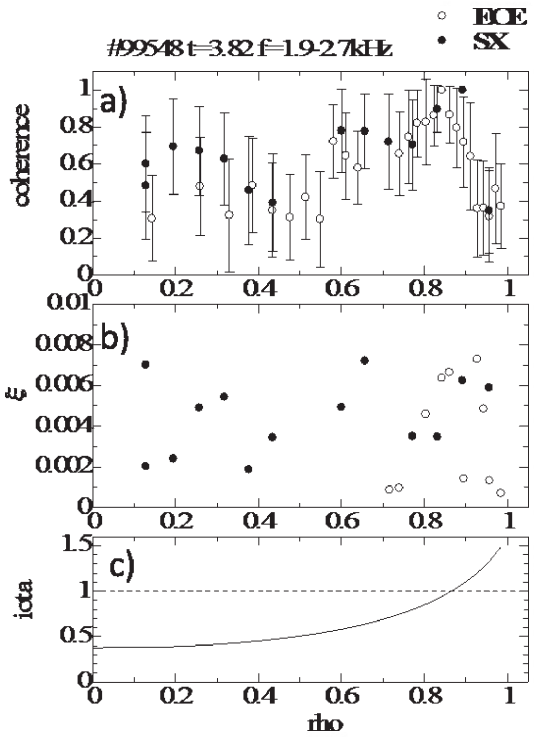

Fig. 2: a) Coherence profile of ECE and SX. b) *xi* profile c) iota profile of LHD