§12. Modification and Control of Edge Plasma Fluctuations using Electrostatic Probes

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In a toroidal plasma, plasma fluctuations are thought to be an essential cause dominating plasma particle and energy transport. Therefore, it is important to clarify the characteristics of plasma fluctuations and suppress them through various control methods. Although feedback control of plasma fluctuations is interesting and seems to be promising, so far any reliable schemes to control plasma fluctuations are not yet established in a toroidal turbulent plasma. It is required to establish a feedback control basis. So far, an experiment was carried out in the Texas Experimental Tokamak (TEXT) to investigate a possibility whether edge fluctuations in a toroidal plasma could be controlled by inserted electrodes connected with a feedback control circuit and be effectively suppressed.

In CHS, this type of experiment is being proceeded, using a driver probe which consists of three poloidally arranged electrodes (Fig.1).

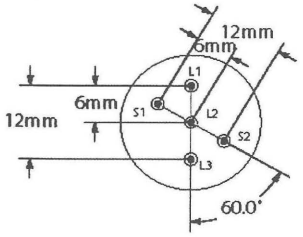

Fig.1 Configuration of a driver probe installed in CHS. Three electrodes L1, L2 and L3 for excitation of fluctuations are arranged in the poloidal direction. Two electrodes S1 and S2 are employed to detect fluctuations near the driver electrodes.

Two sets of sensor probes to detect edge electrostatic fluctuations are installed in CHS, as shown in Fig.2. One is placed on the driver probe, and the other called "far sensor probe" is placed by ~160 degrees toroidally away from the driver probe. The driver probe is in operation as a single Langmuir probe to induce fluctuations of floating potential and ion saturation current.

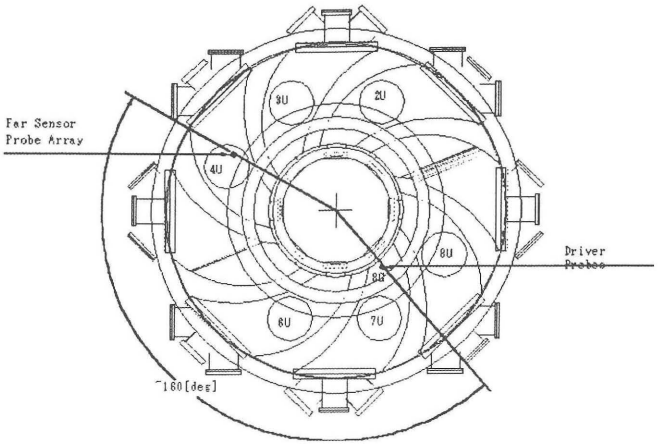

Fig.2 Toroidal arrangement of a driver probe and sensor probes.

As a first step of this experiment, the bias voltage of 5kHz or 10kHz was applied in phase to all three electrodes of the driver probe. As seen from Fig.3, the floating potential signals obtained with the sensor probe away from the driver probe were clearly modulated, but the ion saturation current signals were hardly modulated. Therefore, a method of modulating edge floating potential may be most promising in future feedback control experiments.

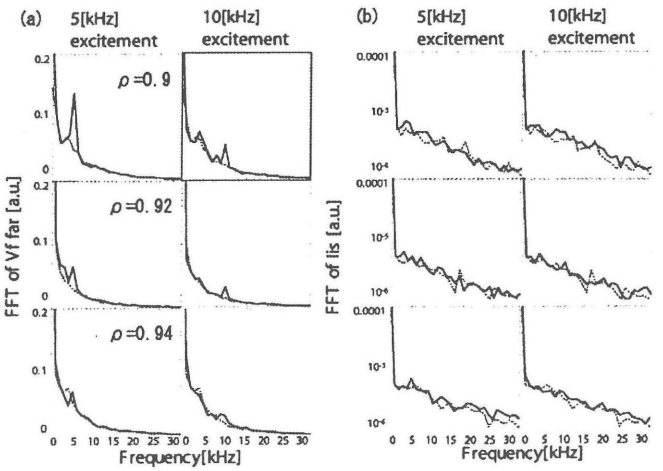

Fig.3 Signals of floating potential (a) and ion saturation current (b) measured with the "far sensor probe" when AC bias voltage of 5kHz or 10kHz was applied to the driver probe. Solid and dotted curves correspond to the signals with and without AC bias voltage, respectively.

Reference

1) B.RICHARDS, Phy. Plasmas 1 (1994) 1606.