§26. Characteristics of Edge Fluctuation Measured by Langmuir Probe Array on CHS

Ohkuni, K.
(Dep. Energy Eng. Science, Nagoya Univ.)
Toi, K. and CHS Group

In the edge plasma region, particle and energy fluxes are induced by fluctuations of plasma parameters. In the several tokamaks, the total particle flux due to electrostatic fluctuations is measured in the edge plasma region, by using Langmuir probes.[1] In order to study edge plasma fluctuations and transport induced by them in a helical device, a Langmuir probe array is installed on CHS.[2]

The Langmuir probe array consists of 16 electrodes, and divided into 4 sets which are arranged radially with about 6mm separation (Fig. 1). Each set which consists of 4 electrodes works as a standard triple probe, where floating potentials at two positions separated by 4.5 mm in the poloidal direction are simultaneously measured. Fluctuations of poloidal electric field are estimated by these two signals of floating potential.

Edge fluctuations were measured in NBI heated plasmas, where the magnetic axis position R_{ax} ~ 92 cm, the toroidal magnetic field B_t ~ 1.4 T, line-averaged density n_e ~ 1.5×10^{19} m^{-3}, and the central electron temperature T_e ~ 0.5 keV.
In the plasmas, edge plasma parameters were measured with the Langmuir probe array. The electron temperature and density near the edge are varied from 10 to 25 eV and from 0.1 to $0.4\times10^{19}m^{-3}$, respectively.

The particle flux in the radial direction induced by electrostatic fluctuations is expressed by $\Gamma = \langle\tilde{E}_{pol}\,\tilde{n}_e\rangle/B_t$, where $\tilde{E}_{pol}$ and $\tilde{n}_e$ are fluctuations of poloidal electric field and electron density, respectively. Figure 2 shows radial profiles of $\tilde{n}_e$, $\tilde{E}_{pol}$ and Γ. The direction of particle flux around r/<a> ~ 0.94 is inward, and in the other regions, it is outward. In Fig. 2, the total flux on r/<a> ~ 0.92 and 0.98 are about 4.5 and 2.5×10^{19} $m^{-2}s^{-1}$, respectively. The frequency dependence of the flux at these positions is shown in Fig. 3. In the inner position, components of higher frequency (50 < f < 80 kHz) contribute to the total flux. The contribution of lower frequency components (f < 20 kHz) is dominant in the outer position. Detailed studies of these edge fluctuations are now being performed.

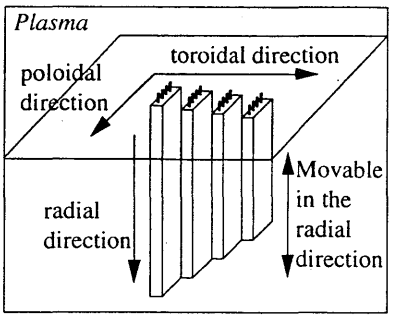

Fig. 1. Schematic drawing of the Langmuir probe array

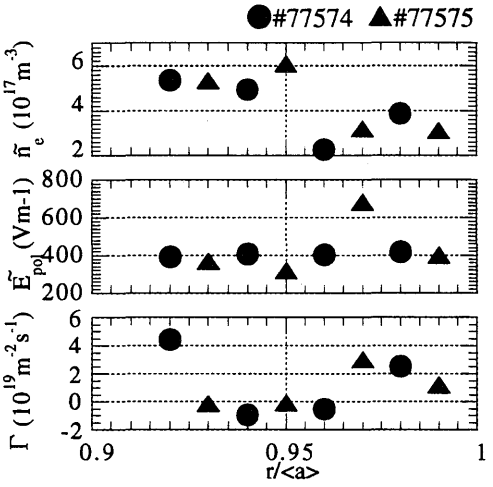

Fig. 2. Radial profiles of fluctuations of electron density and poloidal electric field, and particle flux induced by electrostatic fluctuations

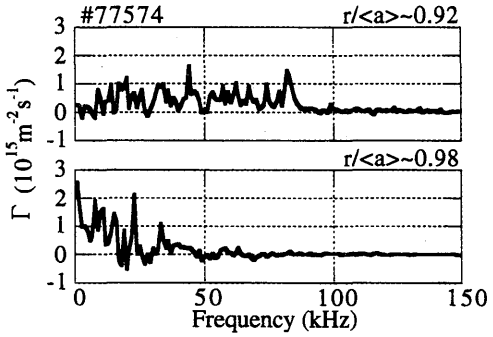

Fig. 3. Frequency dependence of the particle flux at r/<a> ~ 0.92 and 0.98

Reference
1) Ch. P. Ritz, et al. , Phys. Rev. Lett. **62**, 1844 (1989)
2) K. Ohkuni, et al. , Rev. Sci. Instrum. **70**, 419 (1999)