§3. Excitation of Electrostatic Fluctuations with Long-Distance Correlation in L-H Transition Plasmas on the Compact Helical System

Takeuchi, M., Toi, K., Nagaoka, K., Suzuki, C., Minami, T., Akiyama, T., Isobe, M., Yoshimura, Y., Nishimura, S., Shimizu, A., Takahashi, C., Matsuoka, K., Okamura, S., CHS Experimental Group

Zonal flows (ZFs) are considered to contribute to reduction of turbulent transport. The clarification of a role of ZFs in L-H transition is one of interesting and important issues. It is necessary to identify ZFs whether or not electrostatic fluctuations, in particular, potential fluctuations have long-distant correlation in both poloidal and toroidal directions.

In L-H transition plasmas of the Compact Helical System (CHS), floating potential fluctuations were measured by using two Langmuir probes separated by ~130 degrees toroidally. Toroidal, poloidal and radial distributions of the fluctuations were measured simultaneously in the region of $0.94 < \rho < 1.05$. As shown in Fig. 1, two quasi-coherent fluctuations having ~10 kHz and ~17 kHz have clearly been detected in the floating potential signals in the rapid density-rise phase just after the L-H transition (+1 ms to +10 ms). The time of t1 is the H_α emission drop and the time of t2 is the end of the density-rise phase. These two coherent potential fluctuations clearly grow till the end of the density rise-phase after ~10 ms (t_2) from the transition, and quickly decay in the saturated density phase in the H-phase. The frequency of the geodesic acoustic mode (GAM) is estimated to be 10-20 kHz in the edge plasma of the ETB plasma ($f_{GAM} = 2^{1/2}Cs / 2\pi R$ where Cs is an ion acoustic velocity and Te = Ti, R = 0.92 m is used). The toroidal correlation between two floating potential fluctuation signals is enhanced to very high value of ~ 0.9 in the density-rise phase. The toroidal mode number indicated the small value of $n < 1$. These quasi-coherent modes are thought to be GAM. The turbulent driven particle flux (Γ) evaluated from the fluctuations of the electron density and poloidal electric field decreases from the time of t1. After the +2 ms from t1, Γ is vanished and then is changed to inward. Time evolutions of Γ below and above 20 kHz are shown in Fig. 2. The flux Γ above 20 kHz clearly decreases, while the Γ below 20 kHz does not so much decrease and then increase. These quasi-coherent modes of ~10 and ~17 kHz may contribute to the reduction of Γ above 20 kHz. It is necessary to analyze the envelope of Γ or the bispectral analysis of the fluctuations of floating potentials and higher frequency Γ in order to clarify the relation the quasi-coherent potential fluctuations and turbulent transport. From temporal evolution of these GAM like fluctuations, they may not link to the L-H transition directly, but facilitate the development of ETB formation.

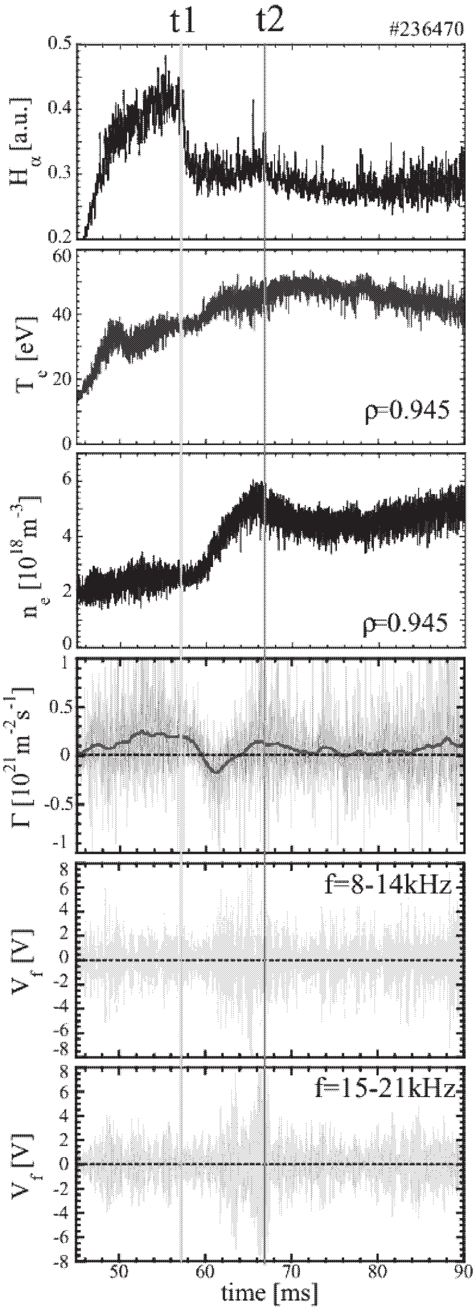

Fig. 1 Time evolutions of the H_α emission, Te, ne, turbulent driven particle flux (Γ), Vf in 8-14 kHz and Vf in 15-21 kHz.

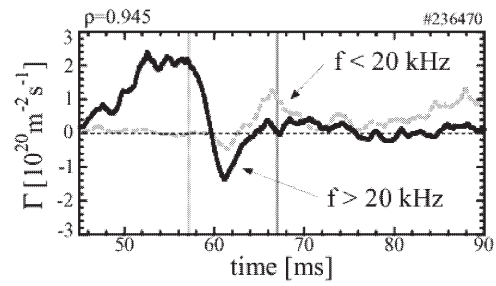

Fig. 2 Time evolutions of turbulent driven particle flux below and above 20 kHz.