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§8. Electrode Biasing Experiments in CHS

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In Compact Helical System, we carried out the electrode biasing experiments under the electrode current control and observed a transition to high confinement mode with rapid increase of a plasma electric resistance.

Figure 1 shows the typical time evolution of plasma parameters. The plasma was produced by 2.45 GHz ECH. The head of the electrode made of LaB_6 was located at ρ = 0.6. We controlled the electrode current by using current control power supply. The electrode current was swept from 0 A to -12 A. This corresponds to active control of poloidal-flow driving force of $\boldsymbol{J}_r \times \boldsymbol{B}_t$. The energy confinement time in Fig. 1 (g) was evaluated under the assumption that the absorption efficiency of ECH has linear dependence on the electron density. In the phase surrounded by broken lines, rapid increase of the plasma electric resistance can be confirmed. After the increase of the plasma resistance, nonlinear behavior of the electrode current, in which increases after decrease for constant voltage, was observed. At the time of the bifurcation of the electrode current, (i) improvement of the line-averaged electron density and the electron stored energy, (ii) the suppression of the fluctuation level, (iii) the formation of the steep gradient of the electron density at the plasma edge, can be confirmed. After the transition, 15-percent improvement of the energy confinement time was observed.

Figure 2 shows the radial profiles of the fluctuation-driven radial particle flux Γ_{ano} at t = 125 ms (without biasing), 160 ms (before transition) and 185 ms (after transition). Γ_{ano} can be estimated from both fluctuation signals of the electron density and the poloidal electric field[1]. For ease in the analysis, we assumed that there are no phase differences between them in all frequency of the Fourier spectrum. Then Γ_{ano} in Fig. 2 correspond to the maximum value of radial flux driven by the fluctuations. As can be seen in Fig. 2, Γ_{ano} increased by the electrode biasing, however after transition, those were suppressed in whole plasma region. These results imply the improvement of the particle confinement time.

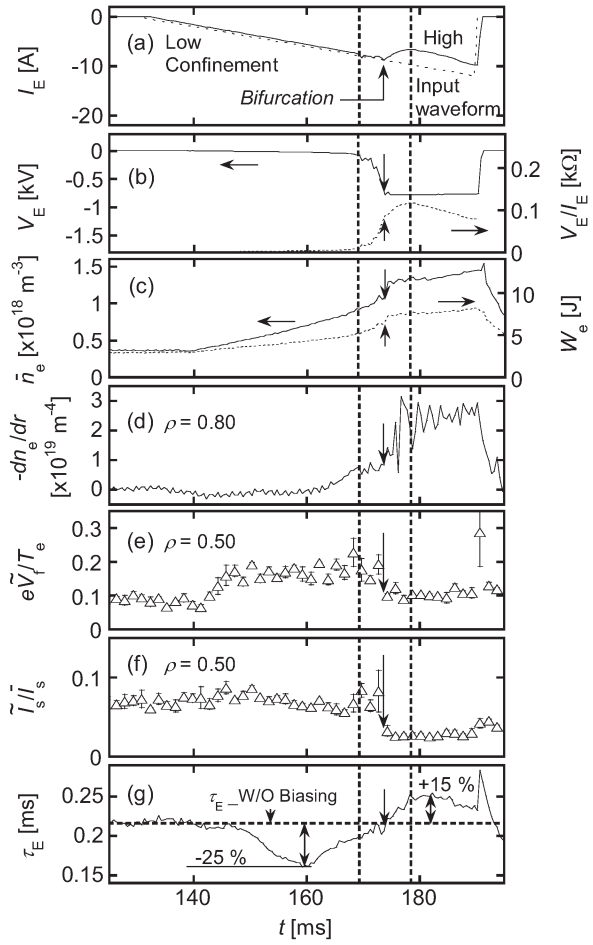

Fig. 1. Typical time evolution of plasma parameters during electrode biasing.

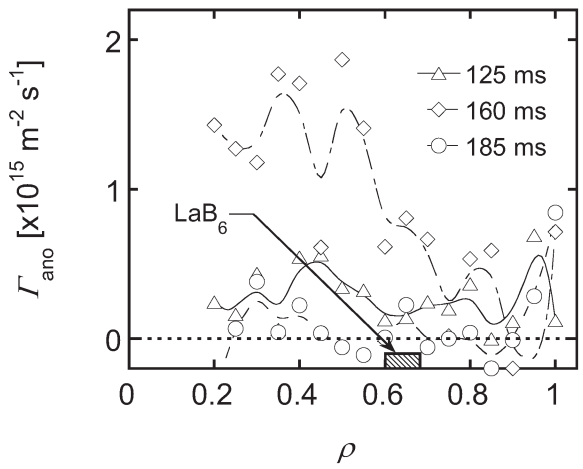

Fig. 2. Radial profiles of the fluctuation-driven radial particle flux.

1) Powers, E. J., Nucl. Fusion **14**, (1974) 749