27pA09

ストキャスティック磁場領域におけるイオンの熱と運動量の輸送
Ion Heat and Momentum Transport in the region with stochastic magnetic field

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A stochastization of the magnetic flux surfaces has been considered to be important, because the partial stochastization of the magnetic flux surfaces due to perturbation fields can contribute the mitigation of Edge-Localized-Modes (ELMs). Bifurcation phenomena in the radial propagation of heat pulse driven by modulated electron cyclotron heating (MECH) are observed in the Large Helical Device (LHD). There are two patterns of heat pulse propagation observed in the flat temperature region. One is a bi-directional slow heat pulse propagation observed in the fast magnetic shear drop, and the other is a fast heat pulse propagation observed in the slow magnetic shear drop. This bifurcation in the heat pulse propagation suggests the topology bifurcation of a magnetic flux surface in the plasma.

When the neutral beam direction is reversed from co-injection to counter-injection the magnetic shear gradually decreases in time and the stochastization of the magnetic flux surfaces take places. Figure 1 shows the radial profiles of electron temperature, ion temperature and toroidal rotation velocity before the magnetic shear drop (nesting magnetic flux) and after the magnetic shear drop (stochastic magnetic flux). After the stochastization of the magnetic flux surfaces, the electron profiles show the flattening in the core region, where the collisionality is low enough. In this condition, the flattening region of the electron temperature profile is considered to be the stochastic region of magnetic flux surface, which has been confirmed by the previous heat pulse propagation experiments.

The flattening region in the ion temperature profile is somewhat narrower than the stochastic region of magnetic flux surface (T_e flattening region). The toroidal rotation is very peaked at the plasma magnetic axis before the stochastization and the central rotation velocity is significantly reduced after the stochastization. This reduction of the velocity is due to the change of magnetic topology (not due to the increase of toroidal parallel viscosity), because the toroidal viscosity is almost unchanged by the stochastization.

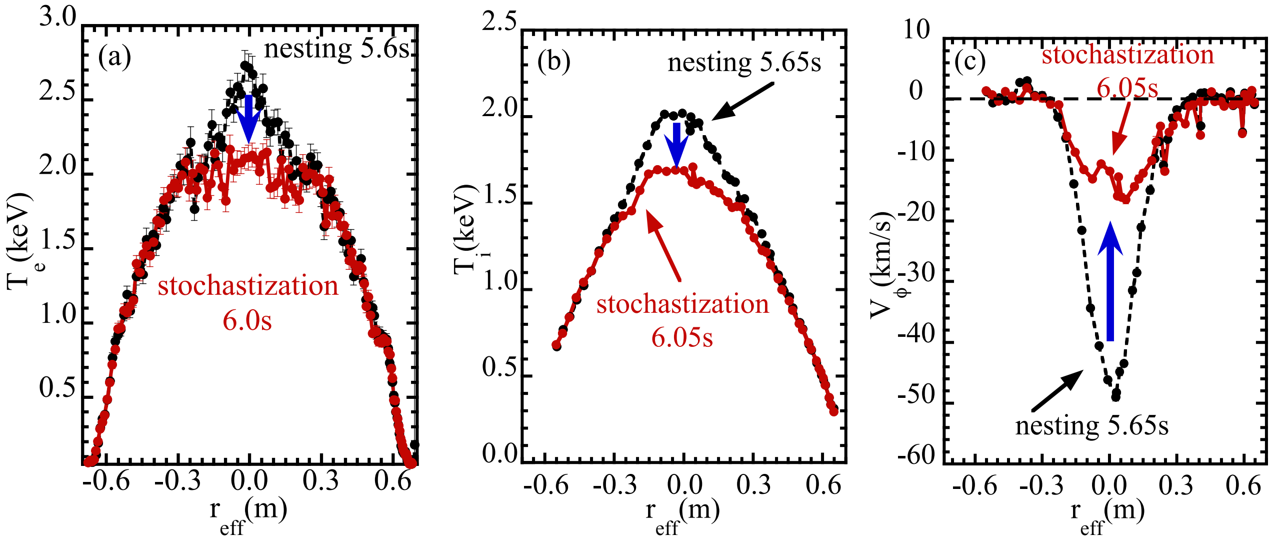

Fig.1(a) Radial profiles of (a) electron temperature (b) ion temperature (c) toroidal rotation velocity before the magnetic shear drop (nesting magnetic flux) and after the magnetic shear drop (stochastic magnetic flux).