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TOPIC: Influence of stochatisation on barrier/ELM mitigation

Radial Structure of Edge Transport Barrier Formed in Three-Dimensional Divertor Configuration on the Large Helical Device

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In a helical divertor configuration of the Large Helical Device (LHD), edge transport barrier (ETB) is formed through low to high confinement (L-H) transition. In the case that both the averaged beta value $<\beta_{dia}>$ (derived from diamagnetic measurement) and line-averaged electron density $<n_e>$ at the transition are relatively high as $<\beta_{dia}>\geq 1.5\%$ and $<n_e>\geq 2x10^{19}m^{-3}$, the increase in the stored energy (or $<\beta_{dia}>$) just after the transition is hampered by rapid growth of bursting edge MHD modes and/or small ELM-like Hα fluctuations. On the other hand, the transition at lower $<n_e>$ and $<\beta_{dia}>$ leads to a continuous increase in the stored energy with a time scale longer than the global energy confinement time, without suffering from these MHD activities near the edge. In LHD, radial structure of ETB is measured by various diagnostic systems such as multi-channel Thomson scattering system, FIR/CO_2 laser interferometers, charge-exchange-recombination spectrometer and others installed at different toroidal locations. The ETB formed in electron density profile obviously extends into ergodic field layer outside the last closed flux surface defined in the vacuum field. The width of ETB is almost independent of the toroidal field strength from 0.5T to 1.5T and is much larger than the poloidal ion gyro-radius. Moreover, the width does not seem to depend on the presence of bursting edge MHD modes.

When resonant helical field perturbations were externally applied to expand a magnetic island size at the rational surface of the rotational transform $\iota/2\pi=1$ near the edge, the L-H transition was triggered at lower electron density compared with the case without the sizable edge magnetic island. In this case, ETB observed in electron temperature profile developed just outside the separatrix of the island. This island generation also lead to suppression of edge MHD modes and ELM like Hα fluctuations.