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EX/P7-03: Characteristics of Microturbulence in H-mode Plasma of LHD

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In LHD, an H-mode transition was achieved after ELM suppression. The main plasma of LHD is surrounded by a thick ergodic layer, of width around 30 percent of the minor radius. This ergodic layer consists of m/n=10/10 and m/n=20/22 magnetic islands. This three dimensional structure of the edge magnetic field is similar to resonant magnetic perturbations (RMP) in tokamaks, so these results may be relevant to ELM suppressed RMP experiments in tokamaks. H-mode transition was found with constant heating (5MW NBI) and fueling. This outwardly shifted configuration has R_axis=3.9m, Bt=0.9T. Small ELMs were visible, then dithering took place, and finally, dithering disappeared and the H-mode transition occurred.

After transition, both electron and ion temperature profiles were almost unchanged, while density profile changed significantly. This indicates that confinement improvement occurs only for particles. Density profiles before and after H mode transition are hollow, but in H phase the edge density gradient increased and the highest density points shifts from r/a=0.7 in L phase to r/a=0.9 in H phase, implying that a transport barrier was formed at r/a >0.9. Turbulence was measured by two dimensional phase contrast imaging (2D-PCI) with frequencies of 20–500kHz and wavenumbers of 0.1- 1mmˆ-1. The fluctuation amplitude dropped suddenly at the transition timing suggesting that the reduction of turbulence is linked to the improvement of particle transport. 2D-PCI showed the fluctuation velocity had two propagation components. One moves in the electron diamagnetic (e-dia.) direction in the lab. frame at r/a<1.2, the other moves in the ion diamagnetic (i-dia.) direction in lab. frame at r/a=1.3. After the transition, fluctuation amplitudes dropped for r/a=0.5-1.0, in addition, the fluctuation's spatial structure changed significantly. After the transition, the e-dia. component at r/a<1.2 splits into two parts and the phase velocity of fluctuation at r/a=0.9 increased from 3km/s in L phase to 7km/s in H phase resulting in the formation of velocity shear around transport barrier. Simultaneous measurements of ExB poloidal rotation velocity did not show clear change, thus, the phase velocity is due to the change of fluctuation phase velocity. The formation of velocity shear around the transport barrier can play important role in particle confinement improvement.

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