§15. Non-local Interaction of Ion Thermal Transport between Core and Edge Triggered by ECRH on the LHD Plasma

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The edge-core-related dynamics of the ion thermal transport during the spontaneous formation of ion ITB has been studied in the LHD [1]. Recently non-local interaction of ion thermal transport caused by ECRH was observed.

Figure 1 shows the time evolution of (a) the port-through power of NBI and ECRH, (b), (c) the gradient of T_e and T_i at the normalized minor radius of r_{eff}/a_{99} = 0.31 and 0.98, and the radial profiles of (d) T_e and (e) T_i before (4.14 s) and during ECRH superposition (4.74 s, P_{ECRH} = 5.1 MW). The target was high T_i plasma accompanied with the ion ITB and was produced using high power NBI with the total port-through power of ~25 MW under the magnetic configuration of R_{ax} = 3.6 m/ B_t = 2.85 T. On-axis ECRH was superposed in stepwise up to 5.1 MW and the ray trace calculation showed that more than 90% of ECRH absorption power was deposited inside r_{eff}/a_{99} = 0.2 at 4.74 s. Both in the plasma core and the edge, T_e and the gradient increased with increase of ECRH power. Especially the improvement of the electron thermal transport was significant in the plasma core region due to the formation of the electron ITB. On the other hand, the gradient of T_i was degraded in the plasma core with increase of the ECRH power leading to the flat T_i structure in the plasma core region. On the other hand, the T_i gradient was improved at the plasma edge. The normalized ion thermal diffusivity $\chi_i/T_i^{1.5}$ at r_{eff}/a_{99} = 0.98 reduced by 60% compared with that before the ECRH superposition. The improvement of the ion thermal transport at the edge led to increase of T_i in whole plasma region even the core transport was degraded.

The PCI measurement is one of the most effective diagnostics to investigate the turbulence behavior because of the wide measurable region and to the high time resolution. We have already obtained the preliminary results of the PCI measurement that showed the low-frequency turbulence in the plasma edge was suppressed by ECRH. In the future work, the behavior of the core turbulence will be also evaluated and the relation between the ion thermal transport and the turbulence will be clarified.

1) K. Ida *et al*., *Nucl. Fusion* **50** (2010) 064007.

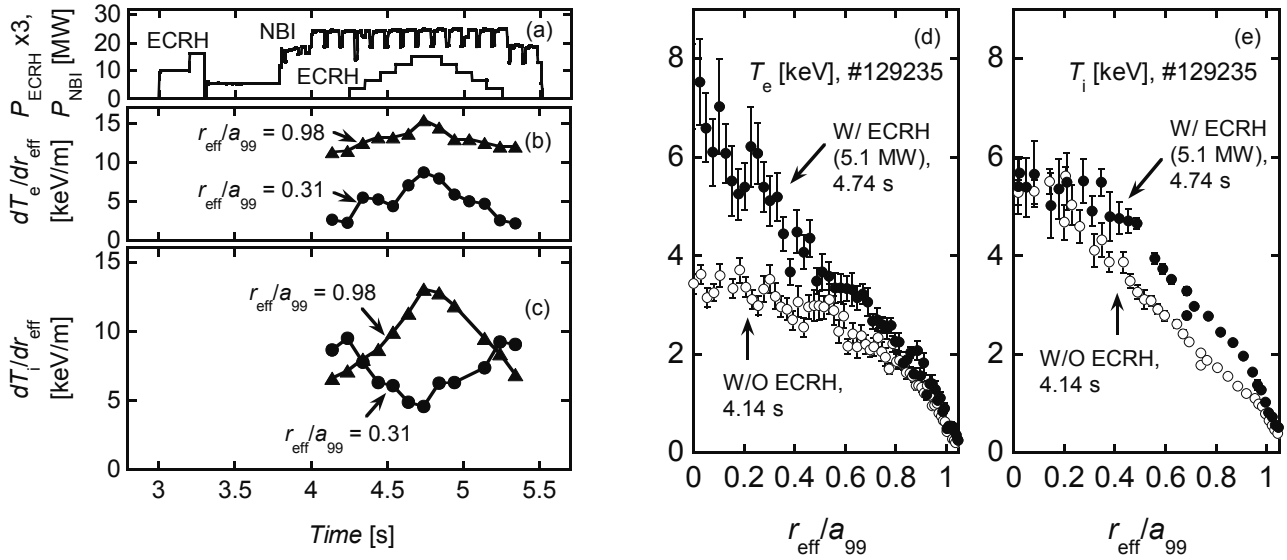

Figure 1. The time evolution of (a) NBI and ECRH power, (b), (c) the gradient of T_e and T_i at r_{eff}/a_{99} = 0.31 and 0.98, and the radial profiles of (d) T_e and (e) T_i before and during ECRH superposition.