

## §8. Ion Transport Improvement in Core Electron Root Confinement (CERC) Plasmas Heated with NBI and ECRH

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When the centrally focused ECRH is applied on the NBI plasma, the ion temperature is observed to rise, accompanied by a positive radial electric field in the core region. This  $T_i$  increase should be ascribed to the ion transport improvement with the transition to the neoclassical electron root. The core electron root confinement (CERC) [1] is the specific feature in the helical system including LHD, and the electron transport improvement was confirmed in the CERC plasmas [2]. Here, the ion transport has been investigated in the CERC plasmas heated with both NBI and ECRH.

Figure 1 shows the  $T_i$  profiles and the estimated ion thermal diffusivities normalized by the gyro-Bohm factor of  $T_i^{3/2}$  for both the ECRH-superposed NBI plasma and the NBI-only plasma.

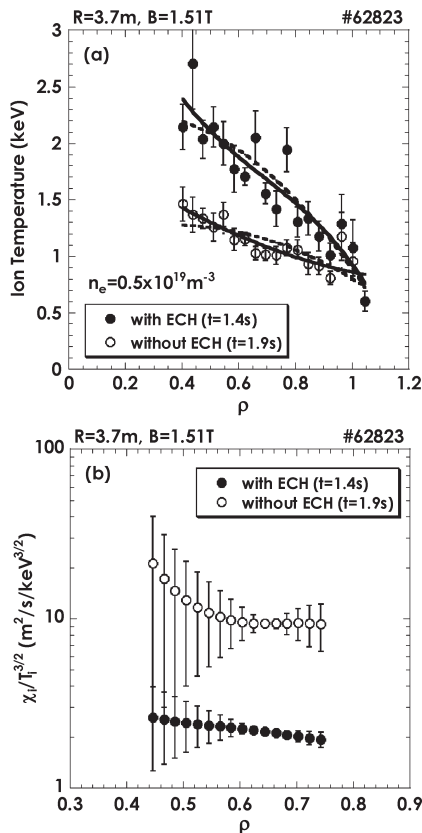


Fig. 1. (a)  $T_i$  profiles measured with the CXRS of the NBI+ECRH plasma ( $t=1.4\text{s}$ ) and the NBI-only plasma ( $t=1.9\text{s}$ ), and (b) the ion thermal diffusivities normalized by the  $T_i^{3/2}$  for the corresponding plasmas shown in (a). Error bars in (b) denote the variation of the estimated thermal diffusivities by two kinds of the  $T_i$ -fitting curve in (a).

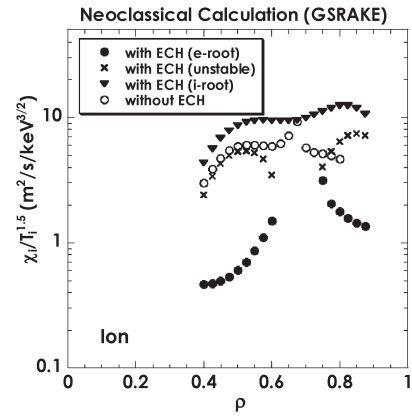


Fig. 2. Neoclassical calculation results of the  $\chi_i/T_i^{3/2}$  for the plasmas shown in Fig. 1.

As shown in Fig. 1, it is found that the ion transport is improved with the superposition of the ECRH on the NBI plasma. In the NBI+ECRH plasma shown in Fig. 1, the transition to the neoclassical electron root with the positive radial electric field is recognized with the central  $T_e$  rise.

Figure 2 shows the results of the neoclassical calculation using the GSRAGE code for the plasmas in Fig. 1. In the case of the electron root, the ion thermal diffusivities are reduced with the superposition of the ECRH, compared with the NBI-only plasma.

As shown in Fig. 3, an increase in the toroidal rotation velocity is observed, accompanied by the  $T_i$  rise, with the addition of the ECRH to the NBI plasma. This suggests the correlation of the toroidal rotation with the core transport.

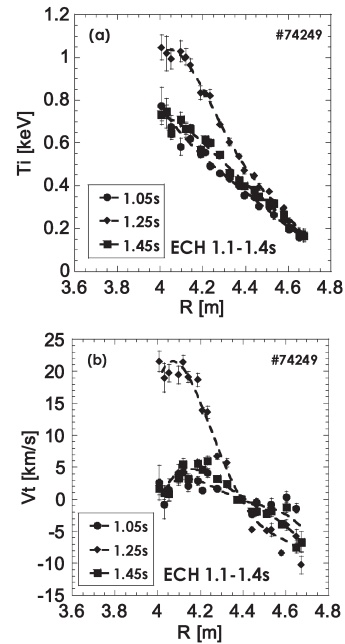


Fig. 3. Profiles of (a) the  $T_i$  and (b) the toroidal rotation velocities in the NBI plasmas with and without the superposition of the ECRH.

### References

- [1] M. Yokoyama *et al*, Fusion Sci. Technol. **50** (2006) 327.
- [2] Y. Takeiri *et al*, Phys. Plasmas **10** (2003) 1788.