§13. Effect of Magnetic Configuration on Confinement Improvement of CHS Plasmas

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New type of the discharge with improved confinement was found in CHS; both of an edge transport barrier (ETB) of the electron density and an elevated electron temperature (T_e) in the core region are realized simultaneously. The high T_e in the core region that is typical of ITB has been obtained so far in CHS when the electron density was on the order of 10^{18} m^{-3} in the plasma heated with 53 GHz ECH with the maximum power of about 400 kW. The mechanism for the ITB is thought to be due to the increased shearing rate ExB.

The elevated T_e in the new discharge was found when the ETB was obtained under two co-injected NBI heatings with the maximum total power of about 1.4 MW and under rather strong gas puffing. The plasma has the line-averaged electron density of 3-4 x$10^{19}$$m^{-3}$ that is much higher than that of ITB induced with ECH. The mechanism that brings about the increase in T_e should be different from that in the ITB because the density range is much different. The discharge is shown in Fig. 1. The transition of ETB is at about 67 ms that is shown by the drop in the Hα signal. The electron temperature profiles are shown at four timings in Fig.2: 2 ms before the transition, and 3 ms, 8 ms, and 13 ms after the transition. It is seen that the electron temperature is substantially increased at 3 ms after the transition (at 70ms). The

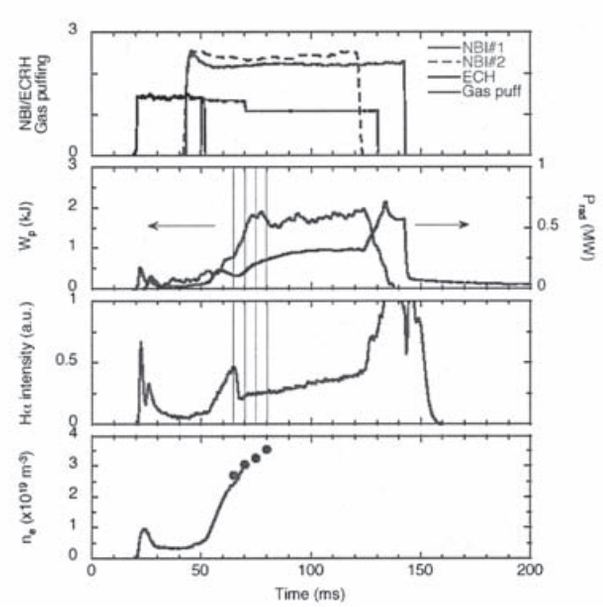

Fig.1. Waveforms of the discharge with new type of improved modes.

electron density profiles are hollow as is shown in Fig.3. The following consideration on the magnetic configuration that is different from the ExB shearing rate is given to this discharge for the mechanism of the elevated T_e. From studies on new helical magnetic field configurations the simultaneous realization of the magnetic well and the stellarator shear is predicted to be favorable to stabilize micro-instabilities induced by trapped particles because of the drift reversal. The magnetic well is formed in the core region only at 70 ms, however, not formed at 65 ms (before the ETB transition) and at 75 and 80ms (after the transition). On the other hand, the stellarator shear is

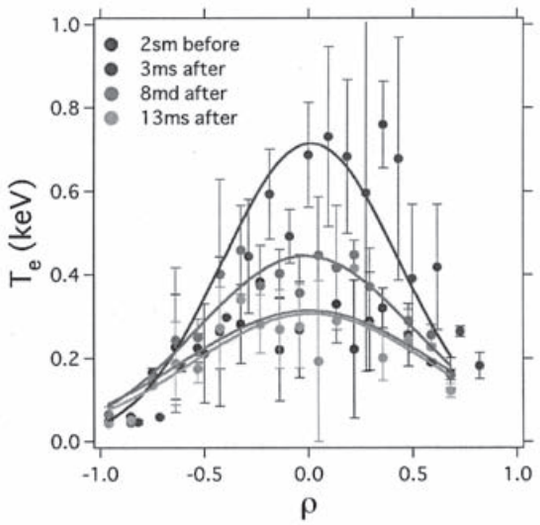

Fig.2. T_e profiles before and after the ETB transition.

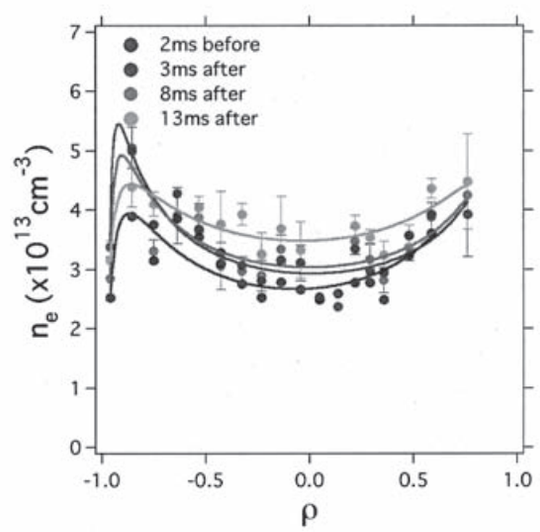

Fig.3. The n_e profiles at four timings.

formed at these timings over the whole plasma region. However, it is difficult to explain why the improved confinement with the elevated T_e has faded out so quickly in a few ms. In summary, the new improved confinement regime was found, however, its mechanism has not been explained.