

§ 58. Additional ECRH Effect on Energetic Ions in NBI-Sustained Plasma on LHD

Notake, T. (Dep. Ene. Eng. and Sci., Nagoya Univ.), Osakabe, M., Kubo, S., Shimozuma, T., Idei, H., Yoshimura, Y., Ohkubo, K., Takita, Y., Kobayashi, S., Itoh, S., Mizuno, Y., Ozaki, T., Ida, K., Takeiri, Y., Tsumori, K., Oka, Y., Ikeda, K., Kaneko, O.

Electron Cyclotron Resonance Heating (ECRH) is very useful tool for plasma production, electron heating and current drive. On LHD, a high electron temperature of more than 10keV is achieved [1] and electron internal transport barrier is formed [2] by strongly focused ECRH. The enhancement of electron temperature, generation of nonthermal electron, transition of radial electric field and so on are caused by ECRH. Thus, ECRH plays very important roles on the transport of electrons. On that of ions on helical devices, the confinement of energetic ions is one of the most important themes from the view point of fusion devices. To comprehend the ECRH effects for confinement of energetic ions is very important.

It is theoretically predicted that a loss-cone could be created for ions whose pitch angle is almost perpendicular to the magnetic field line by negative radial electric field formation due to the cancellation of $E \times B$ drift and grad-B drift. Since this loss-cone has the energy dependence, so it is often called as a 'resonant loss-cone'.

Experimentally, the generation and annihilation of the resonant loss-cone have been observed in the helical systems such as Heliotron-E [3] and Compact Helical System (CHS) [4]. These effects are investigated by additional ECRH on NBI sustained plasma in LHD at the 6th campaign. The neutral particle flux before/during ECRH pulse are measured by Time-of-Flight Neutral Particle Analyzer (TOF-NPA) [5] for various pitch angles and energies.

Fig.1(a) shows the neutral particle flux below 10keV for various pitch angles of NBI sustained plasma. Here, the pitch angle is an angle between magnetic field line in a 3.9m magnetic axis and direction of the ion motion. In this timing, negative electric field is created by NBI and the resonant loss-cone is produced around 5keV with 78 degree pitch angle. As shown in Fig.1(b), the annihilation of loss-cone is observed during ECRH. The neutral flux under the 7keV considerably

increases all over pitch angles. These experimental results suggest that ion confinement is improved through combined effects of positive potential formation and annihilation of resonant loss-cone due to ECRH effects.

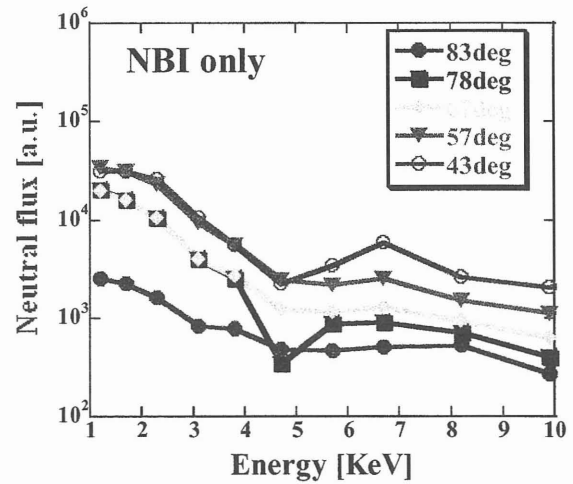


Figure 1(a) Neutral particle fluxes of only NBI phase

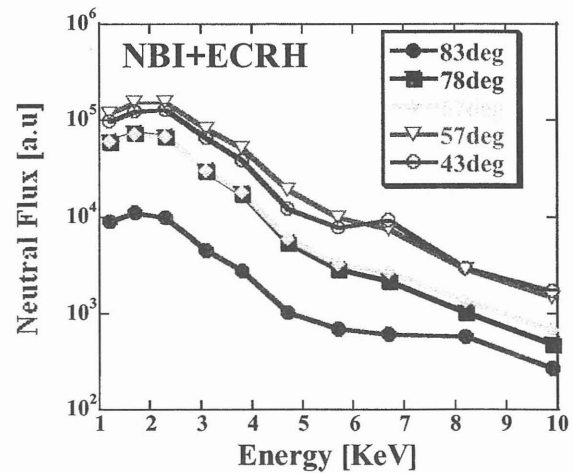


Figure 1(b) Neutral particle fluxes of NBI+ECRH phase

References

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