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Investigation of the heating characteristics of Electron Bernstein wave via slow X-B mode conversion in LHD

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The electron Bernstein wave (EBW) [1] is an electrostatic mode in magnetized plasmas. The EBW has no limitation of electron density on propagation and the power is absorbed at the electron cyclotron resonance layer. The EBW can also drive plasma current because the wavenumber parallel to the magnetic field $k_{\parallel}$ can be large. The mode conversion process is essential to excite the EBW at the upper hybrid resonance (UHR) layer. A new antenna system was installed in the Large Helical Device (LHD) to inject 77 GHz ECH perpendicularly to the magnetic field from the outboard side of the vacuum vessel. In some magnetic configurations of the LHD, the ECH can be injected from the high field side (HFS) using this new system. The ECH injection from HFS in two polarization settings exciting O-mode or X-mode selectively was conducted to investigate the heating characteristics of the EBW via slow X-B conversion by comparing the X-mode injection with the O-mode injection. The clear differences in the variation of the electron temperature and plasma stored energy were not observed because the relatively low electron density was needed to set the UHR layer in front of the new antenna. On the other hand, the large variation of the plasma current was confirmed during the X-mode wave injection in spite of $k_{\parallel} \sim 0$ (Figure 1). The strong emission implying the occurrence of the parametric decay instability was also observed (Figure 2). These results show signs of EBW excitation.

References

[1] I. B. Bernstein, Phys. Rev. **109**, 10-21 (1958)

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