§4. Behavior of e-ITB Foot Points during ECRH Discharges


A mechanism of e-ITB formation relating with a lower order rational surface has been studied in LHD.\(^1\)\(^2\) Most of the previous e-ITB experiments were carried out using centre-focused ECRH overlapping to NB sustained plasmas. There were always effects of inductive return current against NB driven current on the profile of the rotational transform because the relaxation time of the current against NB driven current on the profile of the plasmas. There were always effects of inductive return current in LHD.

Most of the previous e-ITB experiments were carried out e-ITB experiments by using perpendicularly-injected ECRH alone. It becomes possible to investigate the dynamics of e-ITB formation and the relation between injected ECRH and the foot point of the e-ITB, (f)\(^3\) we obtained the increase of the foot point of the e-ITB moved to outward with increasing \(T_e\) profiles. As can be seen from Fig. 1 (a)-(d), steep gradient of \(T_e\) formed in the vicinity of the rational surface, which was larger than that in the e-ITB region. Fig. 1 (e), (f) shows that \(T_e\) at the core region increased with the foot point moving outward and the e-ITB growing. On the other hand, \(T_e\) just inside the rational surface (at \(r_{eff} = 0.21, 0.24\) \(m\)) gradually decreased as shown in Fig. 1 (g) leading to the increase of \(T_e\) gradient at the core region and to the decrease of that around the rational surface. Finally, the \(T_e\) gradient at the e-ITB region equated with that around the rational surface indicating that (i) the foot point of the e-ITB reached to the position of the rational surface of \(e/2\pi = 0.5\) and (ii) the e-ITB plasma with only one folding point in its \(T_e\) profile was formed. We also observed same \(T_e\) profile behavior in higher density plasmas with \(n_e < 0.73 \times 10^{19} m^{-3}\).


Fig. 1. The time evolution of (a)-(d) \(T_e\), \(n_e\) profile, (e) the radial position of the foot point of the e-ITB, (f) \(T_e\) gradient at \(r_{eff} = 0.078\) \(m\) and (g) \(T_e\) slightly inside the rational surface of \(e/2\pi = 0.5\).