Electron Internal Transport Barriers and Magnetic Topology in the Stellarator TJ-II

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Electron Internal Transport Barriers (e-ITBs) are frequently observed in helical systems. e-ITBs are characterized by an increase in core electron temperature and plasma potential as well as an improvement in core electron heat confinement. A comparative study of transport barriers in different helical devices will be presented by Yokoyama et al at this conference [1].

In most helical systems, and in particular in TJ-II stellarator, the formation of e-ITBs is observed in Electron Cyclotron Heated plasmas with high heating power density [2]. In TJ-II, e-ITBs are also formed in magnetic configurations having a low order rational surface close to the plasma core where the ECH power is deposited [3]. In such configurations the key element to improve heat confinement, i.e. the strong radial electric field, results from a synergistic effect between enhanced electron heat fluxes through the low order rational surface and pump-out mechanisms in the heat deposition zone [4,5].

Recent experiments show a quasi-coherent mode associated with a rational surface that triggers the formation of the e-ITB [6]. This quasi-coherent mode is observed by both ECE and HIBP diagnostics. The mode is found to be localized within the radial range ρ: 0.0 - 0.4, with a maximum amplitude around ρ: 0.25 - 0.35, close to the foot of the e-ITB. The quasi-coherent mode evolves during the formation/annihilation of the e-ITB and vanishes as the barrier is fully developed. These observations indicate that the quasi-coherent modes are modified by the radial electric fields that develop at the transitions, thereby showing the importance of ExB flows in the evolution of MHD instabilities linked to low-order rational surfaces.

Further studies are in progress to investigate the influence of the order of the low rational surfaces (3/2, 5/3,…) in triggering core transitions.

[1] M. Yokoyama, H. Maassberg, T. Estrada et al. This conference
[2] F. Castejón, V. Tribaldos, I. García-Cortes, et al. Nuclear Fusion **42** (2002) 271
[3] T. Estrada, L. Krupnik, N. Dreval et al. Plasma Phys. Control. Fusion **46** (2004) 277
[4] F. Castejón, D. López-Bruna, T. Estrada et al. Nuclear Fusion **44** (2004) 593.
[5] M.A. Ochando and F. Medina Plasma Phys. Control. Fusion **45** (2003) 221.
[6] T. Estrada et al, Submitted to Plasma Phys. Control. Fusion