7) Physics of stochastic edge plasmas with respect to error fields, locked modes, and resistive wall modes

Effects of Externally Produced Static Magnetic Island on Edge MHD Modes in the Large Helical Device

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In the Large Helical Device (LHD), MHD instabilities with low mode numbers such as m/n = 1/1, 2/3 and 1/2 (m, n: poloidal and toroidal mode numbers) which are thought to be resistive interchange modes excited in magnetic hill region are strongly excited in the edge region of high beta plasmas and/or plasmas with edge transport barrier (ETB) [1, 2]. At the low toroidal magnetic field ($B_t \leq 1.5$ T), these edge MHD modes exhibit bursting behaviors and modulate H_α emission appreciably. These bursting edge MHD modes appreciably affect plasma transport in the edge and plasma performance. In LHD, static magnetic island was externally generated in the plasma edge using the perturbation field coils called LID (local island divertor) coil in order to study the effects of static magnetic island on these edge MHD modes. Radial structures of these edge MHD modes are measured with seven sets of 20-channel soft X-ray (SX)/ absolute extreme ultraviolet (AXUV) detector arrays arranged in the toroidal direction. Island structure is monitored with multi-channel Thomson scattering system having more than 140 channel spatial positions.

On a certain experimental condition, the formation of the static edge magnetic island (EMI) with m/n = 1/1 has clearly changed unstable mode spectra and radial structures. This fact will be explained by modification of the edge pressure profile around EMI, which may destabilize another edge MHD mode whose rational surface resides slightly outside the $\iota/2\pi = 1$ rational surface.

[1] K. Toi *et al*., Phys. P lasmas **12**, 020701-1 (2005).

[2] F. Watanabe *et al*., Plasma Phys. Control. Fusion **48**, A201 (2006).