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EX/11-3: Visualization of ELM Dynamics and its Response from External Perturbations via 2D Electron Cyclotron Emission Imaging in KSTAR

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The nature of the Edge Localized Mode (ELM) in the H-mode regime in toroidal plasmas is complex and therefore requires advanced diagnostic tools in order to enhance the understanding of the physical dynamics. It is particularly important to find a comprehensive way to eliminate or suppress this instability which is a critical issue for H-mode operation in ITER and DEMO. There have been numerous studies on the nature of this instability as well as its control by external means whereas the control attempts have thus far been largely empirical. A high resolution (spatial and temporal) 2-D ECEI system [1] successfully characterized the real time dynamics of the entire evolution of the ELM [2] in KSTAR campaigns (2010 and 2011). This includes the growth, saturation and bursting process of this instability. In the 2011 KSTAR campaign, the external actuators such as Resonant Magnetic Perturbation (RMP) coils with an $n=1$ structure, Supersonic Molecular Beam Injection (SMBI) and Electron Cyclotron Heating/Current Drive (ECH/ECCD) were introduced and the detailed temporal and spatial responses of the ELMs to the actuators were visualized. In RMP experiment, the mode number was changed from high to low m/n numbers with the increase in size and intensity before complete suppression. During SMBI experiment, the mode number was changed from low to high m/n numbers with the decrease in size and intensity. When ECH/ECCD power was applied to the edge, there was no clear response.

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