Dynamics of Edge Localized Modes in the HL-2A tokamak

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Introduction: In H-mode operation, ELMs (Edge Localized Modes) expel repetitive bursts of heat and particles from the core plasma. Giant ELMs provoke detrimental effects on plasma-facing surfaces in future fusion device, such as ITER. For this reason, much effort is spent worldwide on the understanding, mitigation and control of edge localized modes, so that the largest and most destructive ELMs are avoided, while at the same time some level of particle and pressure control is maintained. In ASDEX, only type-III ELMs exist[1], and the energy loss caused by an ELM was of the order of 5%. In HL-2A, the preliminary results show that Type I and Type III ELMs were observed in the experiment, further study on the dependence of ELM frequency on heating power is in progress in future experiments.

Type I and Type III ELMs: In HL-2A divertor configuration, the ELMy H-mode operation was first achieved[2] in 2009 experiment campaign, by combining the auxiliary heating of NBI (<0.8 MW) and ECRH (<1.2 MW) with 2nd harmonic X-mode, with changes of plasma parameters such as the plasma current, plasma density, toroidal magnetic field and additional heating power. An example of shot11616 plasma parameters are given in Figure 1. From top to bottom are electron density, control signal for SMBI valve, ECRH waveform with 870 kW power from 260 ~ 900 ms, NBI waveform with 690 kW power from 300 ~ 890 ms, central...