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Recent Progress in Studies of MHD activities and their Control on HL-2A tokamak

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Abstract. In the recent 2016-2017 campaigns, HL-2A has made a detailed experimental exploration of the control of MHD activities, aided by substantial developments to plasma control, diagnostics and heating systems. For the first time, an neoclassical tearing modes (NTMs) driven by the transient perturbation of local electron temperature during the non-local thermal transport events have been observed [1].Additionally, observation of the effect of the naturally occurring 2/1 island on the poloidal flow and turbulence level was achieved [2], which advanced our physics understanding of the interplay between magnetic islands and plasma flows. In the effort of MHD control, real-time feedback control/suppression of tearing modes with electron cyclotron current drive (ECCD) has been demonstrated [3]. Furthermore, the long-lasting runaway current caused by argon injection with massive gas injection (MGI) was successfully suppressed by supersonic molecular beam injection (SMBI) with a number of injected light gas atoms of about 1.0×10^{21}[4], which are more efficient in increasing the density. Moreover, the edge localized mode (ELM) mitigation by applying Resonant Magnetic Perturbation fields (RMPs) with toroidal mode number n=1 was successfully demonstrated in the H-mode plasma on HL-2A. On the modelling side, extensive efforts of the plasma response to the resonant magnetic perturbation fields, utilized for controlling ELM, help to identify the edge-peeling response as a key factor, which correlates to the observed ELM mitigation in HL-2A tokamak device [5]. The recently observed edge safety factor window for ELM mitigation in HL-2A experiments is explained in terms of the edge-peeling response.

References:

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