

Overview of HL-2A Recent Experiments

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Experiments on the HL-2A tokamak have been aimed at physics issues involved in advanced tokamaks and ITER since the last IAEA FEC. In particular, significant progresses have been made in the following areas: techniques and physics of ELM control, energetic-particle physics, MHD, disruption, multi-scale interactions, physics of advanced tokamak scenario, edge turbulence. Regarding to techniques and physics of ELM control, intensive experiments for controlling ELMs have been performed in HL-2A with several tools, including RMP, LHCD, LBO-seeded impurities (Al, Fe, W) and impurity SMBI (Ar, Ne). The observed ELM mitigation with pedestal turbulence enhancement and radial spectral shift due to the pedestal velocity shear reduction can be qualitatively simulated by a turbulent heat transport model. Toroidal Alfvén eigenmodes (TAE) driven by energetic-ion had been observed on HL-2A. Progress has been made in understanding the physics of instabilities that may interact with turbulence causing strong influence on cross-field transport and in developing strategies to control them, including neo-classical tearing modes and core-localized Alfvén eigenmodes. The stabilization of $m/n=1/1$ ion fishbone activities by ECRH were found on HL-2A. The experimental results confirmed the stabilization of $m/n=1/1$ fishbone depends not only on the injected power but also on the radial deposition location of ECRH. Disruption mitigation experiments with a new fast SMBI gas injection system have been recently performed. In HL-2A, advanced tokamak scenario with central q close to 1 was achieved. Auxiliary heating (mainly NBI) during the current rise phase was used, creating ITBs with a weak magnetic shear in the plasma centre. In ITB plasmas with weak magnetic shear, kinetic electromagnetic instabilities were confirmed and investigated. For the study of edge turbulence and flows, a signature of incoherent phase slips was evidenced by the study on the interaction between $E \times B$ shear and cross phase between radial velocity perturbation and poloidal ω -velocity perturbation. In the pedestal region, the dynamics of the plasma flows, turbulence and pedestal formation across the L-I-H transition were studied by Doppler reflectometry. The electromagnetic character of filamentary structure was measured in the scrape off layer of HL-2A for the first time.

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