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OV/2-5: Progress of Long Pulse and H-mode Experiments on EAST

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Significant experimental progress has been made since last IAEA FEC towards improved confinement and high plasma performance regimes under long pulse conditions. In particular, the following key results have been achieved with a combination of RF and LHCD under a very low recycling wall condition: 1MA plasma current, fully steady long pulse diverted plasma entirely driven by LHCD over 100 s, and a new type of stationary H-mode discharges lasted much longer than several ten times the energy confinement time. Experiments have been performed to identify the key role that zonal flows play in mediating the L-H transition and sustaining H-mode confinement. This leads to many new advances in H-mode physics, including the observations of a new limit-cycle oscillation preceding the L-H transition at marginal input power and the kinetic energy transfer between shear flows and ambient turbulences, as well as modulations of a high-frequency broad-band turbulence by oscillating zonal flows in a new small-ELM regime, etc. In addition, clear current filaments have been observed only in the far SOL where the voltage difference of plasma sheath between two divertor plates connected by a filament is large. Furthermore, an initial acceleration of the central toroidal rotation has been observed before the L-H transition, with rotation breaking over a longer time scale, accompanied by momentum loss, at the edge during every type III ELM event. Detailed analysis shows that the magnitude of the edge NTV torque that is needed for rotation breaking is roughly in accord with the experimental observations. This paper presents these recent advances and characteristics of and means to control different H-modes. New advances and issues with enhanced capabilities in present campaign that may arise will also be presented.

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