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EX/P7-19: L to H-mode Power Threshold and Confinement Characteristics of H-modes in KSTAR

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Since KSTAR has obtained the H-mode in 2010 campaign, H-mode plasmas were routinely obtained with combined heating of NBI with maximum power of 1.5MW and ECRH with maximum power of ˜0.3 MW and ˜0.6 MW for 110 GHz and 170 GHz, respectively. The L- to H-mode power threshold and confinement properties of KSTAR H-modes are investigatged in this work. Firstly, the L- to H-mode power threshold and the power loss to the seperatrix are calculated by power balance analysis for about collected 400 shots. As a result, a trend of roll-over is observed in the power threshold of KSTAR H-mode compared with the multi-machine power threhsold scaling in the low density regime. Dependence of the power threshold on other parameters are also investigated such as the X-point position and shaping parameters like as triangularity and elongation. In addition, the reason of reduction of power threshold in 2011 campaign compared with that in 2010 is addressed. Secondly, the confinement enhancement factors are calculated to evaluate the performance of KSTAR H-modes. The calculated H89-p and H98(y,2) represent that the confinement is enhanced in most KSTAR H-mode discharges. Interestingly, even in L-mode phases, confinement is observed to be enhanced against the multi-machine scalings. Hexp factor is newly introduced to evaluate the amount of confinement improvement in the H-mode phase compared with the L-mode phase in a single discharge. Hexp exhibits that the global energy confinement time of the H-mode phase is improved about 1.3-2.0 times compared with that of the L-mode phase. Finally, interpretive and predictive numerical simulations are carried out using the ASTRA code for typical KSTAR H-mode discharges. The Weiland model and the GLF23 model are employed for calculating the anomalous contributions of both electron and ion heat transport in predictive simulations. For the H-mode phase, the Weiland model reproduces the experiment well. The results presented here are expected to support establishment of ITER H-mode plasmas.

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