Characterization of Pedestal Burst Instabilities during I-mode to H-mode Transition in the EAST Tokamak

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I-mode, featuring high energy confinement comparable to H-mode and moderate particle confinement comparable to L-mode, can be a potential candidate for future fusion devices. In EAST, the stationary I-mode regime has been identified [1]. However, it could be found that I-mode could transit to H-mode with the increase of the auxiliary heating power. Quasi-periodic pedestal burst instabilities (PBIs), which features alternative turbulence suppression and bursts, have been clearly observed by various edge diagnostics during I-H transition. The radial distribution of the phase perturbation caused by PBI shows that PBI is localized in the pedestal. Prior to each PBI, a significant increase of density gradient close to the pedestal top can be clearly distinguished, then the turbulence burst is generated, accompanied by the relaxation of the density profile, and then induces an outward particle flux. The relative density perturbation caused by PBIs is about 6 - 8%. Statistics analysis show that the pedestal normalized density gradient R/L_n triggering the first PBI has a threshold value, mostly in the range of 22-24, suggesting that a PBI triggering instability could be driven by the density gradient. These results suggest that PBIs and the density gradient prompt increase prior to PBIs can be considered as the precursor for controlling I-H transition.

Key Words: EAST, I-H transition, pedestal burst instabilities, density gradient

Reference：

[1] A. D. Liu et al, Experimental Identification of Edge Temperature Ring Oscillation and Turbulence Transition near the Pedestal Top for Sustaining Stationary I-mode, Nuclear Fusion 2020,60,126016