Study of EHO-like mode and high-frequency fluctuation in the pedestal of the EAST tokamak

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In the pedestal region of the Experimental Advanced Superconducting Tokamak (EAST) during high confinement mode plasma operations with radio-frequency heating, two distinct fluctuations are observed: high-frequency fluctuations (HFFs) and edge harmonic oscillation-like (EHO-like) modes. The HFFs are characterized by intermittent fluctuations with a broadband frequency range of 1−3 MHz and a poloidal wave number ($k_\theta \geq 0.9$ cm^{-1}). On the other hand, the EHO-like mode exhibits characteristic similar to MHD-like mode with n=1−5 and lower poloidal wave number ($k_\theta \leq 0.12$ cm^{-1}). In the no-ELM period during L-H transition, both of them contribute to outward particle flux toward divertor though it is notably less than that caused by edge coherent modes (ECMs). Meanwhile the core impurity level like tungsten decreases without the sputtering caused by ELMs. During the inter-ELM period, a significant decrease in the D_α baseline is observed whenever the low frequency fluctuation (LFF) weakens and the HFF grows, prior to each large ELM. A possible explanation is that the rapid increase of E×B shear stabilizes the LFF and destabilizes the HFF, which lowers the pedestal transport and enables the further growth of the pedestal until the onset of the ELM. The physics of HFF is also simulated by the gyro-kinetic code, the results are similar with observation on DIII-D tokamak.

Selected Topic 1:"No-ELM and small-ELM regimes & extrapolation to burning plasmas"