Identity of the JET M-mode and the ASDEX Upgrade I-phase phenomena

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Abstract:

An H-mode plasma state free of edge-localized mode (ELM), close to the L-H transition with clear density and temperature pedestal has been observed both at the Joint European Torus (JET) and at the ASDEX Upgrade (AUG) tokamaks usually identified by a low frequency (LFO, 1–2 kHz), m= 1, n= 0 oscillation of the magnetics and the modulation of pedestal profiles. The regime at JET is referred to as M-mode while at AUG as intermediate phase or I-phase. This contribution aims at a comparative analysis of these phenomena in terms of the density and temperature pedestal properties, the magnetic oscillations and symmetries. Lithium beam emission spectroscopy (Li-BES) and reflectometer measurements at JET and AUG show that the M-mode and the I-phase modulates the plasma edge density. A high frequency oscillation of the magnetics and the density at the pedestal is also associated with both the M-mode and the I-phase, and its power is modulated with the LFO frequency. The power modulation happens simultaneously in every Mirnov coil signal where it can be detected. The bursts of the magnetic signals and the density at the pedestal region are followed by the flattening of the density profile, and by a radially outward propagating density pulse in the scrape-off layer (SOL). The analysis of the helium line ratio spectroscopy (He-BES) signals at AUG revealed that the electron temperature is modulated in phase with the density, thus the I-phase modulates the pressure profile gradient. This analysis gave opportunity to compare Li-BES and He-BES density profiles at different locations suggesting a toroidal and poloidal symmetry of the density modulation. The presented results indicate that the regimes, the AUG I-phase and the JET M-mode, exhibit similar characteristics, which leads to the conclusion that the regimes are likely the same.