Characterization of the electron density profile dynamics and magnetic fluctuations during oscillations close to the L-H threshold at COMPASS

D. I. Réfy1, S. Zoletnik1, J. Seidl2, O. Grover4, M. Hron2, D. Dunai1, G. Anda1, A. Bencze1, P. Hacek2,3, J. Krbec2,4, and the COMPASS Team

1 Wigner RCP, Budapest, Hungary, 2: Institute of Plasma Physics of the CAS, Prague, Czech Republic, 3: Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic, 4: Faculty of Nuclear Sciences and Physical Engineering, CTU, Prague, Czech Republic

A new confinement regime is being investigated as a candidate for a limit cycle oscillation (cLCO) at COMPASS[1] tokamak, appearing near the L-H transition, and identified by a low frequency (~1-5 kHz), magnetic oscillation. Similar phenomena were observed at the JET [2] and ASDEX Upgrade (AUG) [3] tokamaks, those were identified as ELM-free H-mode confinement regimes with clear density pedestal. This contribution aims at adding the COMPASS results to a previous study [4] that addressed the JET and AUG phenomena in terms of density pedestal dynamics and magnetic oscillation studies.

Lithium beam emission spectroscopy (Li-BES) at COMPASS shows that the above phenomenon modulates the plasma edge density. The investigation of the density profile dynamics during these phenomena became possible with the Li-BES as the diagnostic is capable of density profile measurements from the SOL to deep inside the pedestal with ~1cm spatial and 10µs temporal resolution.

The typical frequency of the oscillations is in the 2-5kHz range and has a ~3kHz FWHM. The divertor D-alpha oscillates with the cLCO frequency that indicates radial transport in the SOL due to the cLCO. The Li-BES results confirm that the density at the pedestal and the SOL is influenced by the phenomenon, and the modulation is in correlation with the D-alpha signal. Further, a high frequency band (HFB, 50-200 kHz) magnetic and density oscillation will be characterised, its amplitude is modulated with the cLCO frequency, and the appearance of the modulation is correlated with the appearance of the cLCO. The relation between these and the pedestal modulation will be shown. The COMPASS system has a signal to noise ratio in the range of 100, thus the direct observation of the HFB oscillation is possible in contrast to the JET and AUG systems, where statistical approach was needed.

This might enable us to get insights of the trigger mechanism of the oscillations. Our results indicate that these phenomena at the three experiments might be very closely related.