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P5.1022 Pedestal instabilities in between ELMs at ASDEX Upgrade

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The High confinement mode (H-mode) edge pedestal, a narrow region (~1.5 cm width) with steep pressure gradient just inside the last closed flux surface, is prone to various instabilities. Instabilities include intermittently occurring Edge Localised Modes (ELMs) but also other more continuous modes that occur in between ELM crashes. With imaging of the electron cyclotron emission (ECE-I) we identify and diagnose an instability in the low-frequency part of the spectrum, that occurs before the ELM crash [1, 2]. The radial resolution of ECE allows for its localisation near the pedestal top [1]. The poloidal propagation of the mode, as measured by ECE-I, correlates with the plasma rotation at the location of the mode. The radial electric field, calculated from charge exchange recombination spectroscopy (CXRS) measurements using the radial force balance is such that the observed mode propagates with respect to the E_r = 0 reference frame in the electron diamagnetic direction with no measurable phase velocity. A database has been assembled to investigate dependencies on plasma parameters [2]. Within this database, the frequency of detected instability decreases with increase in Neutral Beam Injection (NBI) heating power. We attribute this trend to the increase in the toroidal rotation with NBI. Simultaneously, an increase in heating power leads to an increase of global β_p which leads to an increase in the pedestal pressure. In the literature (as shown in [3]) the pedestal width Δ scales as Δ~sqrt(β_p,ped). Therefore, if the pedestal widens with β_p,ped in our cases, instabilities may move radially inward towards lower E_r. Hence, their frequency decreases. The two contributions appear combined within the examined database. In order to confirm the contribution from the toroidal rotation, we first examine the behaviour of mode frequency with NBI heating power from the upcoming reverse I_p/B_t campaign at ASDEX Upgrade. In this configuration, the mode frequency should increase with the increase in NBI heating. Second, to disentangle the contribution from the core rotation due to the NBI heating and contribution from the β_p,ped we analyse discharges heated with the ECRH power only. The frequency and mode numbers are then compared with plasma parameters and correlated with the pedestal width.

[1] B. Vanovac et al 2018 Nucl. Fusion 58 112011
[2] B. Vanovac 2019 PhD Thesis, Chapter 8, TU/e
[3] M. N. A. Beurskens et al 2011 Physics of Plasmas 18 056120

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