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Overview of Recent Pedestal Studies at ASDEX Upgrade

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Extensive studies have shown that the pedestal Er profile in H-mode and asymmetric density and flow profiles of impurity ions are consistent with neoclassical predictions. While the ions set the background flow profile and their transport properties can be described by neoclassical modelling, the mechanisms which determine the electron density and temperature profiles are more varied.
A detailed study of the density build-up after the L-H transition can be modelled with the reduction in the diffusion coefficient in the ETB to a level of around ~0.04 m2/s, while the question of whether a particle pinch is present has not been resolved. The density level which is reached in H-mode after the L-H transition is directly proportional to the neutral gas level in the divertor just before the L-H transition
The ELM cycle is characterised by different phases of recovery, in which ∇Te and ∇ne recover on different time scales. The final pressure gradient remains saturated until the next ELM occurs. To test the peeling-ballooning (PB) model, with experimental data, high quality edge current density profiles are derived from magnetic equilibrium reconstructions using internal pressure constraints as well as external magnetic and scrape-off layer current measurements. The ideal linear MHD code suite ILSA/MISHKA was used to determine the stability limit in the different phases of the ELM cycle. While the position of the operational point stays constant in pressure gradient-current density space, the stability limit moves closer until the ELM crash occurs, because more poloidal harmonics become unstable in a wider pedestal. However, the final ELM trigger condition cannot be determined by linear MHD stability alone.
The same data has also been used as input for gyrokinetic simulations with GENE in order to determine the dominant type of turbulence. In the phase just before the ELM crash, the gyrokinetic analysis shows robustly unstable MTMs at the top of the pedestal as well as unstable KBMs in the whole pedestal region. The linear behavior of ∇Te vs. Te in real space for a wide data base of pre-ELM pedestals also indicates that a local mode (e.g. the KBM) rather than a global mode limits the Te gradient. Results of velocimetry analysis of ECEI data demonstrate the existence of MTMs at the pedestal top.

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