

O4.104 The ballooning structure of small edge localized modes on AUG and TCV

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See the full abstract here <http://ocs.ciemat.es/EPS2019ABS/pdf/O4.104.pdf>

In future fusion devices the collisionality $\nu_{e,pedtop}$ proportional to ne/Te^2 at the pedestal top will be very low, i.e. $\nu_{e,pedtop} \sim 0.06$ [1], due to the expected high temperature. On the other hand at the very edge it should be high, $\nu_{e,sep} \sim 12$, because a high separatrix density is necessary for efficient power exhaust. These conditions cannot be reached simultaneously in nowadays machines. ASDEX Upgrade [2] and TCV [3] discharges with high separatrix collisionality, comparable to ITER, exhibit small Edge Localized Modes (ELMs) if the plasmas are highly shaped, i.e. high triangularity and close to double null at high elongation. Stability calculations have shown that these small ELMs are close to the ballooning stability boundary and ballooning modes are therefore promising candidates [4]. This is underlined by experimental observations showing that they are located close to the separatrix, driven by the pressure gradient and stabilized by magnetic shear.

The former is demonstrated by locally changing the pressure gradients via local gas fuelling in contrast to pellet fuelling. The dependence on the magnetic shear is experimentally validated by small changes in the z position, which modifies the shear close to the separatrix and thus, properties of small ELMs. Infinite ballooning calculations performed with the HELENA code are shown to give more evidence for the instability of these plasmas in a narrow region close to the separatrix. It is demonstrated how these small ELMs modify the shape of the pedestal close to the separatrix in such a way that it is stable against large type-I ELMs. Using data from Doppler reflectometry as well as the thermal He beam diagnostics this contribution will also show that the filamentary structure changes significantly in the small ELM phases. The modification of the pedestal profile due to the enhanced transport can therefore be of great importance for the power exhaust in future ITER discharges.

References

- [1] A Loarte et al. 2003 Plasma Phys. Control. Fusion 45 1549
- [2] G.F. Harrer et al. 2018 Nuclear Fusion 58 112001
- [3] B. Labit et al. 2018 IAEA Fusion Energy Conference
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