Scaling of ELM Crash Parameters

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In the pedestal region, which is characterized by steep pressure gradients, mode structures are observed during crashes of edge localized modes (ELMs) and in the phase between them. Recent observations showed that the crash phases are dominated by low toroidal mode numbers ($n = 1$–7) on the ASDEX Upgrade tokamak, which fits to comparisons to the nonlinear magnetohydrodynamic code JOREK [1]. In order to understand the dominant physical mechanisms, the comparison of modeling and experiment for cases with a significant variation of critical parameters is essential.

A parameter scaling conducted on ASDEX Upgrade shows that the toroidal mode numbers of ELM crashes increase with decreasing the edge safety factor q_{95}, see figure 1. Other peeling-ballooning relevant parameters such as bootstrap current, normalized pressure gradient or triangularity do not show a clear trend. In addition to that it is shown that the ELM duration and intensity also varies with q_{95}, which is in line with previous studies on different machines [2, 3].

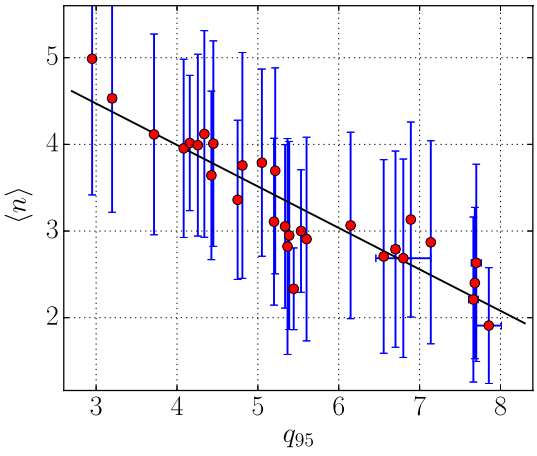

Figure 1: *Average toroidal mode numbers $\langle n \rangle$ of mode structures during the ELM crashes of 30 ASDEX Upgrade H-mode discharges against the edge safety factor q_{95}.*

Starting from the results of the ASDEX Upgrade parameter scaling an intuitive geometric model is presented that can explain the q_{95} scaling of the toroidal structure by the dominance of one poloidal structure. Furthermore, experimental scalings are compared to modelling results from advanced JOREK simulations [4].

References

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