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Effect of Resonant Magnetic Perturbations on Low Collisionality Discharges in MAST and a Comparison with ASDEX Upgrade

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The application of Resonant Magnetic Perturbations (RMPs) is foreseen as a mechanism to ameliorate the effects of ELMs on the ITER divertor. Various aspects of RMP operation crucial to ITER have been demonstrated on MAST such as mitigating the first ELM after the L-H transition, sustaining ELM mitigation during both the current ramp-up and in the event of failure of a sub-set of the in-vessel coils and applying a slowly rotating n=3 RMP, which sustains ELM mitigation while rotating the pattern of the strike point splitting. Although ELM suppression has not been observed on MAST, ELM mitigation has been achieved using RMPs with toroidal mode number of n=2, 3, 4 and 6 over a wide region of operational space, with considerable overlap with the regions where suppression of type-I ELMs is observed in other machines. The effect that the choice of toroidal mode number on the effectiveness of the mitigation has been investigated and shows that n=3 or 4 is optimal. The ELM mitigation phase is typically associated with a drop in plasma density and overall stored energy. By carefully adjusting the refuelling, either by gas or pellet fuelling, to counteract the drop in density it has been possible to produce plasmas with mitigated ELMs, reduced peak divertor heat flux and with minimal degradation in pedestal height and confined energy.
Above a threshold value in the applied perturbation field (brres) there is a linear increase in normalised ELM frequency (fELM) with brres. Experimentally it has been found that both the lobes produced near the X-point and the mid-plane corrugations also increase linearly with the size of brres. These deformations to the plasma boundary have been replicated by modelling, which shows that they can strongly influence the peeling-ballooning stability boundary and hence lead to an increase in fELM.
Mitigation of type I ELMs has also been achieved on ASDEX Upgrade at mid-low collisionalities, using RMPs with n=1 and 2. In a large number of cases an increase of fELM with brres is also observed. However, unlike in MAST, there are some cases where this is not the case. This presentation will compare and contrast the results from the two devices with an aim of increasing our understanding and ability to extrapolate to future devices.
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