

Impact of 3-D magnetic field topology on divertor heat flux under ITER-like RMP configurations

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The in-vessel, 3-row resonant magnetic perturbation (RMP) coils in KSTAR, just like in the planned ITER-RMP configurations, provides an ideal testbed to study the impact of 3-D magnetic field topology in ITER. Indeed, in support of ITER, KSTAR has been conducting a series of 3-D physics experiments whose RMP configurations might not be easily realized in other devices equipped with 2-row RMPs. Specifically, a variety of ‘intentionally misaligned’ RMP configurations have been systematically studied, while their compatibility with detached plasmas has been also explored. Taking full advantage of robustly reproducible full ELM suppression with either $n=1$ or $n=2$ RMPs, we have succeeded in measuring divertor heat flux striation patterns using static and rotating RMPs, whenever feasible. Unlike successfully diffused divertor heat flux during RMP-ELM mitigation [1], preliminary experimental analysis suggests that divertor heat fluxes were rarely dispersed by the previously effective misaligned configuration, once RMP-driven ELM suppression becomes dominant. This may be consistent with the classification that RMP-driven, ELM suppression would belong to a bifurcated state, while the ELM mitigation would be primarily governed by the linear plasma response to RMP [2]. However, another type of misaligned configuration, whose plasma response is dominantly enhanced by kink influence, appears quite promising in effectively lowering the peak of divertor heat flux, as well as in broadening the non-axisymmetric lobes. We will report the detailed analysis results of each RMP configuration impact, as well as discuss key physics parameters that might have contributed to ELM suppression in lieu of ELM mitigation.

[1] Y. In *et al*, Nucl. Fusion **57** (2017) 116054

[2] Y. In, “*Tamed stability and transport using controlled non-axisymmetric fields in KSTAR*”, APS-DPP invited talk GI2.03 (2017); <http://meetings.aps.org/Meeting/DPP17/Session/GI2.3>