DPP10-2010-001826

Abstract for an Invited Paper
for the DPP10 Meeting of
the American Physical Society

Modification of divertor heat and particle flux profiles with 3-D fields in NSTX

JOON-WOOK AHN, ORNL

Externally imposed non-axisymmetric magnetic perturbations produce multiple local peaks and valleys in the divertor heat and particle flux profiles [1] in NBI-heated plasmas in the National Spherical Torus Experiment (NSTX) with $B_t = 0.4$T, $I_p = 800$kA, $\beta_t \sim 10\%$. The addition of 3-D fields causes pronounced lobes to form near the separatrix X-point, which leads to the "strike point splitting" [2, 3] and flux striations observed in experiments. ITER may rely on 3–D resonant magnetic perturbation (RMP) fields for ELM suppression, and non-axisymmetric heat and particle deposition and an increase of peak values could pose additional engineering constraints. In NSTX, the radial location and spacing of the divertor striations produced by 3-D fields are reproduced well using vacuum field tracing of the superposition of vacuum 3-D fields and 2-D equilibrium fields [1]. The applied n=3 fields can also trigger ELMs [4]. The ELM heat flux profiles (measured with a new fast IR camera [5]) appear to be phase locked to the n=3 field structure, as also reported in DIII-D experiments [3]. The inclusion of the response of the plasma inside the separatrix (calculated with IPEC [6]) as the base equilibrium for field line tracing did not alter the computed structure of striations significantly compared to the vacuum modeling. This suggests that vacuum field line tracing alone may predict the effect of 3-D fields on divertor profiles even in rapidly rotating, high-β plasmas. This work was supported in part by US DOE, DE-AC05-00OR22725 and DE-AC02-09CH11466.

[1] J-W. Ahn, *et al*, Nucl. Fusion **50** (2010) 045010
[2] T.E. Evans, *et al*, *J. Phy.: Conf. Series* **7** (2005) 174
[3] M.W. Jakubowski, *et al*, Nucl. Fusion **49** (2009) 095013, and references therein
[4] J.M. Canik, *et al*, Phys. Rev. Letts. **104** (2010) 045001
[5] J-W. Ahn, *et al*, Rev. Sci. Intrum. **81** (2010) 023501
[6] J.-K. Park, *et al*, Phys. Plasmas **14** (2007) 052110