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P2.1040 Non-axisymmetric heat flux patterns on tokamak divertor tiles

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Non-axisymmetric heat flux patterns on a tokamak divertor can result for several reasons. Here we focus on the two most common causes. First, the plasma equilibrium itself can be nonaxisymmetric, either from applied or intrinsic 3D perturbation fields, and second, the plasma facing components (PFCs) may be toroidally asymmetric. For perturbed plasmas, a heat flux model based on guiding center ion drift in vacuum fields [A. Wingen et al., PoP 21, 012509 (2014)] is reintroduced. Divertor footprints, assuming an idealized axisymmetric wall, are simulated for multiple ion kinetic energies and combined based on their respective contribution to the ion's Maxwellian distribution. Recently, the model was extended to include E B drift effects. It is found that the E B flow reduces the edge stochastization and strike point splitting, as observed in MHD simulations. The modeled divertor heat flux patterns are compared to infrared camera measurements in DIII-D.
On NSTX-U it has been proposed to use a sawtooth-like profile in the toroidal direction for divertor tiles to shadow leading edges of neighboring tiles from incident heat flux. A new toolset was developed to model the effect of 3D shaped PFCs; a first result is shown in Figure 1. The tool uses a CAD model of the inner wall with all gaps, Figure 1: Simulated incident heat flux on NSTX-U and traces heat flux from an axisymmetric lower outer divertor for discharge 116313 at 851 ms. EFIT equilibrium to the wall, assuming an The white areas are holes in the wall's CAD model. Eich scaling [Eich et al., PRL 107, 215001 Swall is distance from HFS midplane, ccw along wall. (2011)] of the heat flux layer width. The figure shows the shaped tiles which shadow adjacent tiles for Swall > 1.8. The drift model will be added to the new toolset in the future. The tool will also be combined with a recently developed code that computes surface heat flux from measurements of sub-surface thermocouples, using machine learning. The work is supported by US DoE under DE-AC05-00OR22725, DE-AC02-09CH11466 and DE-FC02-04ER54698.

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