Contribution ID: **628** Type: **Poster**

Shielding and amplification of non-axisymmetric divertor heat flux by plasma response to applied 3-D fields in NSTX and KSTAR

Wednesday, 19 October 2016 14:00 (4h 45m)

Understanding of underlying physics processes that determine non-axisymmetric divertor footprints is crucial for ITER's long pulse operation scenario in the presence of 3-D fields, as they will cause asymmetric erosion and re-deposition of divertor material. It has been recently found that plasma response plays a key role in the formation of 3-D lobe structure and divertor footprints by the applied 3-D fields in NSTX and KSTAR.

Work in NSTX showed that ideal plasma response from the IPEC modeling can significantly shield or amplify vacuum footprints from field line tracing. Comparison of footprint measurements by visible and IR cameras to the data from field line tracing reveals that n=1 magnetic perturbations are significantly amplified while n=3 perturbations are shielded. The mechanism of amplification and shielding is determined by the competition between shielding of resonant components and excitation of non-resonant components of applied 3-D fields, demonstrated in the poloidal field spectrum when including plasma response in the modeling. Connection length (Lc) profile from the IPEC modeling for n=1 case shows that Lc rapidly begins to decrease in a significantly deeper region, compared to the vacuum case where it only drops near the very plasma edge, corresponding to a dramatic amplification of vacuum footprint splitting.

Shielding and amplification of applied 3-D fields have been also observed in KSTAR by IPEC plasma response modeling. A full phase shift scan was conducted for n=1 perturbations, while two distinctive phases (90 deg for resonant and 0 deg for non-resonant coil configuration) were closely examined for n=2 perturbations. As in NSTX, non-resonant components of applied fields are amplified due to kink excitation while resonant components are strongly shielded, which produces net amplification (shielding) effect of applied fields that strengthens (weakens) footprint splitting, depending on which action is more dominant for a specific phase shift. Radial location of lobes in the measured heat flux profile shows better agreement with that from the field line tracing when plasma response is taken into account for calculation.

This work was supported by the US Department of Energy, contract numbers DE-AC05-00OR22725 (ORNL), DE-AC02-09CH11466 (PPPL), DE-FC02-04ER54698 (GA), and DE-AC52-07NA27344 (LLNL), and DE-SC0013911 (UW).

Paper Number

EX/P4-30

Country or International Organization

USA

Primary author: Dr AHN, Joon-Wook (Oak Ridge National Laboratory)

Co-authors: Dr MCLEAN, Adam (Lawrence Livermore National Laboratory); Dr LOARTE, Alberto (ITER Organization); Dr BRIESEMEISTER, Alexis (ORNL); Dr KANG, Chan Soo (National Fusion Research Institute); Mr SCOTTI, Filippo (LLNL); Dr CANAL, Gustavo (General Atomics); Dr LEE, Hyung Ho (National Fusion Research Institute); Dr KIM, Jaehyun (National Fusion Research Institute); Dr LORE, Jeremy (ORNL); CANIK, John (Oak Ridge National Laboratory); Dr PARK, Jong-Kyu (Princeton Plasma Physics Laboratory); Dr KIM, Kimin (Korea Advanced Institute of Science and Technology); Dr SCHMITZ, Oliver (University of Wisconsin - Madison, Department of Engineering Physics); Dr MAINGI, Rajesh (Princeton Plasma Physics Laboratory); Dr PITTS, Richard (ITER Organization); Dr YOON, Si-Woo (National Fusion Research Institute); Dr GRAY, Travis (Oak Ridge National Laboratory); Dr KO, Won Ha (Korea, Republic of); Dr IN, Yongkyoon (National Fusion Research Institute); Dr JEON, YoungMu (National Fusion Research Institute)

Presenter: Dr AHN, Joon-Wook (Oak Ridge National Laboratory)

Session Classification: Poster 4

Track Classification: EXW - Magnetic Confinement Experiments: Wave–plasma interactions; current drive; heating; energetic particles