Gyrokinetic projection of the divertor heat-flux width from present tokamaks to ITER

Wednesday, 19 October 2016 11:25 (20 minutes)

The edge gyrokinetic code XGC1 shows that the divertor heat flux width $\lambda_q$ in between ELMs of Type I ELMy H-modes in two representative types of present tokamaks (DIII-D type for conventional aspect ratio and NSTX type for tight aspect ratio) is set mostly by the ion neoclassical orbit spread, which is proportional to $1/Ip$, while the blobby turbulent spread plays a minor role. This explains the $1/Ip$ scaling of the heat flux width observed in present tokamaks. On the other hand, the XGC1 studies for ITER H-mode like plasmas show that $\lambda_q$ is mostly set by the blobby turbulent spread, with the heat flux width being about 5X wider than that extrapolated from the $1/Ip$ scaling. This result suggests that the achievement of cold divertor plasmas and partial detachment required for power load and W impurity source control may be more readily achieved and be of simpler control issue than predicted on the basis of the $1/Ip$ scaling. A systematic ongoing validation study of the XGC1 results on various existing tokamaks will also be presented, including JET that is the closest existing device to ITER. [This work is supported by US DOE, and computing resources supported by OLCF at ONRL.]

Country or International Organization

USA

Paper Number

TH/2-1

Primary author: Dr CHANG, Choong-Seock (Princeton Plasma Physics Laboratory)

Co-authors: Dr LOARTE, Alberto (ITER Organization); Dr KOECHL, Florian (Vienna University of Technology, Institute of Atomic and Subatomic Physics); Dr ROMANELLI, Michele (CCFE); Dr MAINGI, Rajesh (Princeton Plasma Physics Laboratory); Dr KU, Seung-Hoe (Princeton Plasma Physics Laboratory); Dr PARAIL, Vassili (CCFE)

Presenter: Dr CHANG, Choong-Seock (Princeton Plasma Physics Laboratory)

Session Classification: Divertor & SOL Physics 1

Track Classification: THD - Magnetic Confinement Theory and Modelling: Plasma–material interactions; divertors, limiters, SOL