Contribution ID: **375**

Type: **Poster**

Investigations of radial high-Z transport mechanisms in ICRF-heated Alcator C-Mod H-mode plasmas

Wednesday 19 October 2016 08:30 (4 hours)

Recent Alcator C-Mod research investigates mechanisms by which ion cyclotron range of frequency (ICRF) heating can effectively mitigate on-axis accumulation of high-Z impurities and explores new techniques to study their interaction with edge transport barriers (ETB). In C-Mod EDA H-modes using D(H) minority heating, modifying the minority concentration and the major radius of the minority resonance layer results in substantive changes in core high-Z impurity transport. Raising the minority fraction is linked to enhanced core peaking of tungsten injected via laser ablation. When the minority resonance layer is moved off-axis to the low-field side (LFS), bridging the q=1 surface, core accumulation is avoided similar to when heating on-axis. In contrast, off-axis heating on the high field side (HFS) at similar minor radii resulted in tungsten accumulation, uncontrolled radiation rise and core electron temperature collapse. These observations differ from recent JET results showing a weak difference in tungsten-driven soft x-ray peaking between LFS and HFS heating. Diffusive and convective transport of high-Z impurities in C-Mod are constrained by STRAHL simulations. Using TORIC in TRANSP to model the minority species and NEO and GKW to model the neoclassical and turbulent transport, a range mechanisms are investigated by which minority heating can impact the core radial impurity transport. While minority heating may modify the core peaking, volume averaged impurity content is controlled by radial flux at the ETB. Modeling suggests that for opaque scrape-off layers as expected in ITER, kinetic profiles will combine to result in outward neoclassical impurity flux between edge localized modes (ELMs). This important result stands in contrast to the widely observed behavior of quasi-stationary impurity flux between ELMs or in ELM-free H-modes to be directed inward, building up core impurity content. Experimental results from Alcator C-Mod suggest that this condition of outward impurity flux may be transiently accessed following a transition from I-mode to ELM-free H-mode. By tracking the time evolution impurities introduced prior to the H-mode transition, the direction of the impurity flux can be estimated from time-evolving STRAHL simulations of impurity spectroscopy. Initial results using this novel pedestal transport analysis technique are presented.

Paper Number

EX/P3-3

Country or International Organization

U.S. A.

Author: Dr REINKE, Matthew (ORNL)

Co-authors: Dr LOARTE, Alberto (ITER Organization); Dr HUBBARD, Amanda (Massachusetts Institute of Technology, Plasma Science and Fusion Center); Dr CASSON, Francsi (CCFE); Dr HUGHES, Jerry (MIT PSFC); Dr RICE, John (MIT PSFC); Mr CHILENSKI, Mark (MIT PSFC); Dr HOWARD, Nathan (MIT - PSFC); Dr WUKITCH, Stephen (MIT PSFC); Dr WOLFE, Steve (MIT PSFC)

Presenter: Dr REINKE, Matthew (ORNL)

Session Classification: Poster 3

Track Classification: EXS - Magnetic Confinement Experiments: Stability