Contribution ID: **283**

Type: **Oral**

Influence of the Scrape Off Layer on RF Actuator Performance

Friday, 21 October 2016 08:50 (20 minutes)

Experimental and modeling results from Alcator C-Mod and NSTX show that details of the scrape off layer (SOL) can significantly impact the effectiveness of radio frequency (RF) heating and current drive actuators. C-Mod experiments show that cold, dense conditions in the SOL lead to significant collisional absorption of lower hybrid (LH) waves outside the last closed flux surface (LCFS), reducing lower hybrid current drive (LHCD) efficiency in the multi-pass regime common in high density diverted experiments to date. Measurements of the fast electron tail are in close agreement with ray tracing/Fokker-Planck modeling including a realistic 2-point SOL model [S. Shiraiwa, AIP Conf Proc, 1689, 030016 (2015)]. On NSTX, high-harmonic fast-wave power is trapped in the SOL by the righthand cutoff [N. Bertelli, Nuc Fus 54, 083004 (2014)] and thought to be dissipated in divertor RF sheaths [R.J. Perkins, Phys Plas 22, 042506 (2015)].
This paper will present new measurements from a unique suite of diagnostics that show how LH wave power is absorbed in the SOL on C-Mod. While LHCD is a leading method for driving non-inductive current off-axis, there is a so-called "density limit"for efficient current drive observed in experiments on limited tokamaks. A more restrictive density limit was later discovered in diverted topologies. Recovering high current drive efficiency at densities in excess of 10^20 m-3 is critical for steady state tokamak reactors, and is a primary research thrust of C-Mod.
Recent LH power modulation experiments on C-Mod show that the LH waves are absorbed near the LCFS at high density [I.C. Faust, submitted to Phys Plas (2016)]. Power flux diagnostics looking at the edge show a prompt response to LH power modulation, ruling out absorption of the LH waves in the confined plasma. The toroidally symmetric nature of the edge response indicates that the LH wave absorption is distributed around the torus outside the LCFS due to ray stochasticity in the multi-pass regime. Ray tracing/Fokker-Planck simulations including a realistic SOL model improve agreement with experimental fast electron measurements. The cold, dense regions of the SOL near the divertors strongly absorb rays through collisional absorption according to the model.
Work supported by DoE Contract No. DE-FC02-99ER54512 on Alcator C-Mod, a Department of Energy Office of Science user facility.

Paper Number

EX/7-1

Country or International Organization

United States of America

Primary author: Dr WALLACE, Gregory (MIT Plasma Science and Fusion Center)

Co-authors: Dr TAYLOR, Gary (PPPL); Mr FAUST, Ian (MIT PSFC); Dr WILSON, James Randall (PPPL); Dr HOSEA, Joel (PPPL); Dr BERTELLI, Nicola (Princeton Plasma Physics Laboratory); Dr BONOLI, Paul (Massachusetts Institute of Technology); Dr MUMGAARD, Robert (MIT PSFC); Dr PARKER, Ronald (MIT PSFC); PERKINS, Rory (Princeton Plasma Physics Laboratory); Dr BAEK, Seung Gyou (MIT PSFC); Dr SCOTT, Stephen (PPPL); WUKITCH, Stephen (MIT PSFC); Dr SHIRAIWA, Syun'ichi (PSFC, MIT); Dr SHINYA, Takahiro (University of Tokyo)

Presenter: Dr WALLACE, Gregory (MIT Plasma Science and Fusion Center)

Session Classification: RF & SOL Physics

Track Classification: EXD - Magnetic Confinement Experiments: Plasma–material interactions; divertors; limiters; scrape-off layer (SOL)