Session: ??

Studies of Edge Turbulence in Wide Pedestal QH-modes using Phase Contrast Imaging*

J.C. Rost,[1] E.M. Davis,[1] A. Marinoni,[1] M. Porkolab,[1] and K.H. Burrell[2]

[1]Plasma Science and Fusion Center, MIT, Cambridge, Massachusetts, USA
[2]General Atomics, San Diego, California, USA

Turbulence measurements with the Phase Contrast Imaging (PCI) in the recently developed wide-pedestal QH-mode reveal multi-mode spectra similar to those seen during ELM-free H-mode while scans in input torque demonstrate the dependence of the turbulent modes on plasma rotation and E_r well depth. Recent low-torque experiments have developed a new regime of Quiescent H-mode (QH-mode) characterized by good performance, a high, wide pedestal, and the absence of the coherent Edge Harmonic Oscillation (EHO).[1] The PCI, which images line-integrated fluctuations on a linear detector array with good spatial and frequency response, has previously studied the medium wavelength, high frequency turbulence generated in the highly-sheared plasma in the E_r well at the edge of QH-mode and H-mode plasmas.[2]

The edge turbulence in wide-pedestal QH-mode separates into two bands of ion-scale fluctuations, a medium frequency range ($100 < f < 500$ kHz) and a high frequency range (500 kHz $< f < 2$ MHz). As the torque applied to a QH-mode plasma is ramped down, the plasma parameters may jump abruptly at the transition to the wide-pedestal regime. Comparing the timing of changes in turbulence parameters to changes in plasma parameters indicates which parameters control the instabilities present. The medium frequency turbulence is driven by toroidal plasma rotation, with faster poloidal propagation and larger amplitude as the applied torque and hence rotation increase. The high frequency band of turbulence is tied to the bottom of the E_r well, propagating near the fastest velocity. This turbulence is driven only in the E_r well of an H-mode, but becomes weaker as the shear due to the E_r well increases, completely disappearing in high torque QH-modes. This work will lead to identification of the instabilities present in the high-gradient region of the H-mode-like edge, key to understanding their role in the thresholds and formation of these high-performance regimes as well as developing numerical models valid in this region of the plasma.

[1] Burrell *et al,* "Discovery of stationary operation of quiescent H-mode plasmas with Net-Zero NBI torque and high energy confinement on DIII-D," submitted to Phys. Plasmas.

[2] Rost *et al*, Phys. Plasmas **21** (2014) 062306.

*Work supported in part by the US Department of Energy under DE-FG02-94ER54235 and DE-FC02-04ER54698

Please select _____X Poster or _____Oral

Topical Area High performance scenarii_____