DPP13-2013-000034

Abstract for an Invited Paper
for the DPP13 Meeting of
the American Physical Society

New insights on boundary plasma turbulence and the Quasi-Coherent Mode in Alcator C-Mod using a Mirror Langmuir Probe[1]

BRIAN LABOMBARD, MIT Plasma Science and Fusion Center

A "Mirror Langmuir Probe" (MLP) diagnostic has been used to interrogate edge plasma profiles and turbulence in Alcator C-Mod with unprecedented detail, yielding fundamental insights on the Quasi-Coherent Mode (QCM) – a mode that regulates plasma density and impurities in EDA H-modes without ELMs. The MLP [1] employs a fast-switching, self-adapting bias scheme, recording density, electron temperature and plasma potential simultaneously at high bandwidth ($\sim$1 MHz) on each of four separate electrodes on a scanning probe. Temporal dynamics are followed in detail; wavenumber-frequency spectra and phase relationships are readily deduced. Poloidal field fluctuations are recorded separately with a two-coil, scanning probe. Results from ohmic L-mode and H-mode plasmas are reported, including key observations of the QCM: The QCM lives in a region of positive radial electric field, with a mode width ($\sim$3 mm) that spans open and closed field line regions. Remarkably large amplitude ($\sim$30%), sinusoidal bursts in density, electron temperature and plasma potential fluctuations are observed that are in phase; potential lags density by at most 10 degrees. Propagation velocity of the mode corresponds to the sum of local ExB and electron diamagnetic drift velocities – quantities that are deduced directly from time-averaged profiles. Poloidal magnetic field fluctuations project to parallel current densities of $\sim$5 amps/cm^2 in the mode layer, with significant parallel electromagnetic induction. Electron force balance is examined, unambiguously identifying the mode type. It is found that fluctuations in parallel electron pressure gradient are roughly balanced by the sum of electrostatic and electromotive forces. Thus the primary mode structure of the QCM is that of a drift-Alfven wave.

[1] B. LaBombard and L. Lyons, Rev. Sci. Instrum. **78** (2007) 073501.

[1]Work supported by US DoE award DE-FC02-99ER54512.