DPP12-2012-000233

Abstract for an Invited Paper
for the DPP12 Meeting of
the American Physical Society

Observation of improved and degraded confinement with driven flow on the LAPD

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External continuous control over azimuthal flow and flow shear has been achieved in a linear plasma device for the first time allowing for a careful study of the effect of flow shear on pressure-gradient-driven turbulence and transport in the edge of the Large Plasma Device (LAPD). The flow is controlled using biasable iris-like limiters situated axially between the cathode source and main plasma chamber. LAPD rotates spontaneously in the ion diamagnetic direction (IDD); positive limiter bias first reduces, then minimizes (producing a near-zero shear state), and finally reverses the flow into the electron diamagnetic direction (EDD). Degradation of particle confinement is observed in the minimum shearing state and reduction in turbulent particle flux is observed with increasing shearing in both flow directions. Near-complete suppression of turbulent particle flux is observed for shearing rates comparable to the turbulent autocorrelation rate measured in the minimum shear state. Turbulent flux suppression is dominated by amplitude reduction in low-frequency (> 10kHz) density fluctuations and a reduction in the radial correlation length. An increase in fluctuations for the highest shearing states is observed with the emergence of a coherent mode which does not lead to net particle transport. Magnetic field is varied in order to explore whether and how field effects transport modification. Calculations of transport equations are used to predict density profiles given source and temperature profiles and can show the level of transport predicted to be necessary in order to produce the experimental density profiles observed. Finally, the variations of density fluctuations and radial correlation length are fit well with power-laws and compare favorably to simple models of shear suppression of transport.