TTF 2011
Session: Consider oral, (B) Edge WG

The Dynamics of Turbulence, Zonal Flows and the Reynolds Stress Approaching the L-H Transition*

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Comprehensive 2D turbulence and turbulent flow measurements have been obtained before, during, and after the L-H transition during an ion gyro-radius scan in DIII-D. This experiment was motivated by a previously observed dependence of the turbulence-zonal flow coupling observed in the CSDX linear plasma experiment, and the potential role this phenomenon may have in explaining the toroidal field dependence of the L-H transition. Other non-dimensional parameters (ν^*, q_{95}, β) were kept nearly constant at the pedestal top. Electrostatic Reynolds stress was measured with a multi-point reciprocating Langmuir probe array near the outboard midplane of DIII-D plasma. Long wavelength density fluctuation amplitudes were measured with 2D (8×8) BES array and found to scale with ρ^*. The magnetic geometry was smoothly varied from ion ∇B drift pointing away from (high P_{LH}) to towards (low P_{LH}) the X-point at constant input power: the turbulence poloidal flow at the separatrix is found to reverse, increasing the local shear flow, just prior to the L-H transition during this scan. Detailed analysis of the turbulence characteristics, nonlinear features, zonal flows and GAMs, as well as their dependence on ρ^*, will be presented, along with their possible roles in triggering the L-H transition.

*This work supported in part by the U.S. Department of Energy under DE-FG02-89ER53296, DE-FG02-08ER54999, DE-FG02-07ER54917, DE-FC02-04ER54698 and DE-FG02-08ER54984.