Velocities and Transport Barriers in NSTX OH and HHFW Heated H-modes

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Ohmic and RF H-modes are obtained on NSTX without the added input and complication of fast particles and momentum that accompany NBI. This should allow better understanding of the fundamental physics of the L-H transition and H-mode dynamics as well as turbulence simultaneously measured in the core and edge. Mainly ELM free Ohmic H-modes have been studied on NSTX. Ohmic H-modes have been obtained in lower single null (LSN) and double null (DN) divertor configurations. A diverted plasma was necessary for the L-H transition to occur. An edge rotation diagnostic (ERD) is used to measure edge toroidal and poloidal velocities and ion temperature. Measured spin up of the plasma to 10's of km/sec and is consistent with Rice's [Ref.: direct communication] scaling. NBI heated H-modes are dominated by rapid peaking of the edge "ears" on the n_e profile, which makes reflectometry of the core impossible. In contrast, for ELM free ohmic H-modes, the n_e profile is initially peaked in the core. This allows access over tens of milliseconds for correlation reflectometry measurements in the core, results consistent with a factor ≥ 2 decrease in the correlation length across the L-H transition. At the same time, gas puff imaging (GPI) shows significant edge turbulence before the L-H transition as indicated by the "blob" activity, while after the transition the edge becomes quiescent, more so than is found in the edge of NBI heated H-modes. On NSTX, H-mode access is improved by bake-out and aggressive wall and divertor conditioning (boronization, helium discharge conditioning) . The conditions for and characteristics of velocities and transport barriers of the Ohmic and RF H-modes in NSTX will be discussed and compared in detail. Finally, NBI "blips" (10 ms beam pulses) into OH H-modes show that they may be good target plasmas for obtaining combined edge and core transport barriers.