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EX/P7-21: Evolution of the Turbulence Radial Wavenumber Spectrum near the L-H Transition in NSTX Ohmic Discharges

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The measurement of radially extended meso-scale structures such as zonal flows and streamers, as well as the underlying microinstabilities driving them, is critical for understanding turbulence-driven transport in plasma devices [1]. In particular, the shape and evolution of the radial wavenumber spectrum indicate details of the nonlinear spectral energy transfer [2], the spreading of turbulence [3], as well as the formation of transport barriers [4]. In the National Spherical Torus Experiment (NSTX), the FMCW backscattering diagnostic [5] is used to probe the turbulence radial wavenumber spectrum ($k_r = 0-22 \text{ cm}^{-1}$) across the outboard minor radius near the L- to H-mode transition in Ohmic discharges. During the L-mode phase, a broad spectral component ($k_r \sim 2-10 \text{ cm}^{-1}$) extends over a significant portion of the edge-core from $R=120$ to 155 cm ($\rho=0.4-0.95$). At the L-H transition, turbulence is quenched across the measurable k_r range at the ETB location, where the radial correlation length drops from ~ 1.5 to 0.5 cm . The k_r spectrum away from the ETB location is modified on a time scale of tens of microseconds, indicating that nonlocal turbulence dynamics are playing a strong role. Close to the L-H transition, oscillations in the density gradient and edge turbulence quenching become highly correlated. These oscillations are also present in Ohmic discharges without an L-H transition, but are far less frequent. Similar behavior is also seen near the L-H transition in NB-heated discharges.

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