Characterization of Edge Current Density, Pressure Gradient, and Instabilities Using the Improved MSE System and a Radial Sweeping Technique\textsuperscript{1} L.L. LAO, J.R. FERRON, V.S. CHAN, R.J. GROEBNER, R.J. LA HAYE, R.L. MILLER, T.H. OSBORNE, E.J. STRAIT, A.D. TURNBULL, T.S. TAYLOR, General Atomics, B.W. RICE, Lawrence Livermore National Laboratory — Edge instabilities with moderate toroidal mode numbers $n = 2$–5 typically terminate the ELM-free phase of DIII–D high performance discharges with a fast growth time $\gamma^{-1} \approx 20$–$150$ $\mu s$. These moderate $n$ magnetic precursors were also observed, although less frequently, in the ELMing phase. Ideal stability calculations of the experimental equilibria are consistent with many observed features of the instabilities and indicate a complex interaction between edge current density $J_{\text{edge}}$ and pressure gradient $P'_{\text{edge}}$ which drive ballooning/kink/peeling modes at moderate $n$. As these instabilities are sensitive to $P'_{\text{edge}}$ and $J_{\text{edge}}$, for a more definite comparison with theory, new experiments were performed using the improved 35-channel MSE system and a radial sweeping technique to better characterize both the plasma edge gradients and the instabilities.

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