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The Back Transition and Hysteresis Effects in DIII-D¹

D.M. THOMAS, R.J. GROEBNER, K.H. BURRELL, T.H. OSBORNE, T.N. CARLSTROM, General Atomics — The back transition from H-mode to L-mode is being studied on DIII-D as a part of our investigation of the L-H transition power threshold scaling. We are carrying out a complimentary series of parametric scans to determine the scaling of the sustaining power required to remain in H-mode as well as to determine the behavior of local edge parameters before/during the back transition. Such studies have important implications both for ITER operational scenarios and basic edge transport barrier physics understanding. Operation of DIII-D at injection powers slightly above the H-mode threshold can result in multiple forward-backward transitions during a discharge. These oscillatory discharges represent a comparatively simple system for studying various control parameters that may influence the H-<->L state transition. Careful edge power flow analysis gives values for the sustaining power well below the corresponding threshold powers ($P_{HL}/P_{LH}=35-70\%$), indicating substantial hysteresis can be achieved in this parameter. Studies of other control parameter candidates such as edge temperature during the back transitions are less clear: the amount of hysteresis seen in these parameters, if any, is primarily dependent on the nature (ELMing, ELM-free) of the parent H-state.

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