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Theory and Modeling of ELMs and Constraints on the H-Mode Pedestal[1] P.B. SNYDER, J.R. FERRON, L.L. LAO, A.W. LEONARD, T.H. OSBORNE, A.D. TURNBULL, General Atomics, H.R. WILSON, A.J. WEBSTER, Culham, X.Q. XU, LLNL, D. MOSSESSIAN, MIT, M. MURAKAMI, ORNL — We present a theory of edge localized modes (ELMs) and constraints on the H-mode pedestal, based on the stability of intermediate wavelength peeling-ballooning modes driven by the strong pressure gradient and resulting bootstrap current in the pedestal region. Detailed studies of ideal MHD pedestal stability bounds are presented using the ELITE code, and are compared to data from multiple tokamaks. Observed ELM onset times and characteristics, as well as variation in pedestal behavior with discharge shape and collisionality, are studied. In addition, the impact of diamagnetic stabilization and rotation shear are assessed, and progress on dynamic modeling of the ELM cycle which couples transport codes to stability calculations and ELM crash models is briefly discussed. Nonlinear simulations using the BOUT code are used to provide further insight on non-ideal effects and ELM crash dynamics.

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P.B. Snyder
snyder@fusion.gat.com
General Atomics

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