Improved understanding of physics processes in pedestal structure, leading to improved predictive capability for ITER

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Abstract. Joint experiment/theory/modeling research has led to increased confidence in predictions of the pedestal height in ITER. This work was performed as part of a US Department of Energy Joint Research Target in FY11 to identify physics processes that control the H-mode pedestal structure. The study included experiments on C-Mod, DIII-D and NSTX as well as interpretation of experimental data with theory-based modeling codes. This work provides increased confidence in the ability of models for peeling-ballooning stability, bootstrap current, pedestal width and pedestal height scaling to make correct predictions, with some areas needing further work also being identified. A model for pedestal pressure height has made good predictions in existing machines for a range in pressure of a factor of 20. This provides a solid basis for predicting the maximum pedestal pressure height in ITER, which is found to be an extrapolation of a factor of 3 beyond the existing data set. Models were studied for a number of processes that are proposed to play a role in the pedestal n_e and T_e profiles. These processes include neoclassical transport, paleoclassical transport, electron temperature gradient turbulence and neutral fueling. All of these processes may be important, with the importance being dependent on the plasma regime. Studies with several electromagnetic gyrokinetic codes show that the gradients in and on top of the pedestal can drive a number of instabilities.