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# EX/11-4: Improved Understanding of Physics Processes in Pedestal Structure, Leading to Improved Predictive Capability for ITER

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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 DOE Joint Research Target in FY2011 to identify physics processes to control the H mode pedestal structure. This work included experiments on C-Mod, DIII-D and NSTX as well as interpretation of experimental data with theory-based modeling codes. The research provides new benchmarking of physics components in the EPED model, used to predict the height of the ITER pedestal. Validation studies performed with BOUT++ and ELITE increase confidence that the pedestals in the 3 machines reach the predicted peeling/ballooning limit at the onset of Type-I ELMs. Kinetic calculations with XGC0 and NEO, using realistic collision operators, show that analytic models of bootstrap current are accurate to ˜10–15% for C-Mod and DIII-D and to ˜40% in NSTX. Studies in all 3 devices show that the pedestal width scales approximately as expected if the pedestal p´ is limited by KBMs. The proposed KBM width scaling data quantitatively agrees with DIII-D and C-Mod data within ˜20%. These benchmarking studies improve confidence in the models for P-B modes, bootstrap current and KBMs used by the EPED model, which predicts values of pedestal pressure height and width that agree within ˜20% of measurements in Type I ELMy discharges on C-Mod and DIII-D. The JRT research included studies of other physics processes proposed to be important for pedestal structure. Studies of models for neoclassical and paleoclassical transport find that these mechanisms may be significant, but that additional transport is needed to describe the fully developed pedestal. Benchmarking of the electromagnetic gyrokinetic codes, GYRO, GEM and GTC for one DIII-D pedestal predict that electron drift modes and KBMs were linearly unstable within the pedestal and ion temperature gradient modes were unstable on the pedestal top. Experimental and modeling results suggest that electron temperature gradient modes may play a role in the pedestal structure of all 3 machines. Experimental and modeling evidence suggest that both atomic physics and a pinch play a role in controlling the density pedestal in all 3 devices. This work supported in part by the US DOE under DE-FC02-04ER54698, DE-AC02-09CH11466, DE-FC02-99ER54512, DE-AC05-00OR22725 and DEAC52-07NA27344.

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