Electron Thermal Transport Through the Plasma Edge

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Thermal transport through the plasma edge is investigated with predictive integrated modeling simulations using a choice of different electron thermal transport models. In the region of the edge transport barrier, which is critically important for the transition to the enhanced confinement regime (H-mode), the ion thermal transport is reduced close to the neoclassical level. The electron thermal transport, along with the neoclassical ion thermal transport, determines the structure of the H-mode pedestal. The H-mode pedestal height and width influence the whole tokamak device performance and control the stability of abrupt MHD events called Edge Localized Modes (ELMs). It is important to have a reliable, well verified and validated model for electron thermal transport through the plasma edge. Two models for transport driven by Electron Temperature Gradient (ETG) modes are considered: The first model is an element in the GLF23 transport model; The second model is the Horton model modified with a Jenko threshold for the ETG anomalous transport. The physics included in the two models for the ETG anomalous thermal transport are compared and the models are benchmarked against one another. These ETG models are also used for modeling transport in the plasma core in tokamak. The paleoclassical model for electron thermal transport is also considered. The models for the ETG anomalous thermal transport and the model for the paleoclassical thermal transport are implemented in the integrated transport code ASTRA. The simulation results obtained using these models are compared with one another and with data with an emphasis on contributions to the thermal transport at the plasma edge. The results are also compared with experimental data in an effort to discriminate among the models.