

Temporal and Spatial Evolution of the H-mode Pedestal in DIII-D*

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The temporal and spatial variation of the H-mode pedestal has been measured in both the edge localized mode (ELM)-free phase and the inter-ELM phase in the DIII-D tokamak. These measurements show that the height and width of the electron temperature T_e and electron density n_e profiles increase with time during the initial ELM-free phase of H-mode discharges. These profiles collapse at an ELM but then grow in width and height until the next ELM. Likewise, the height of the ion temperature T_i profile increases during the ELM-free phase and in between ELMs. However, the T_i profile often does not have a sharp gradient at the plasma edge. Thus, a “width” for the T_i pedestal is sometimes difficult to define and so a simple characterization of this parameter is not available. Ion and electron pedestal temperatures tend to saturate late in the ELM-free phase and during ELM cycles with durations of tens of milliseconds; saturation of the electron density is typically not observed. These results are consistent with previous evidence of pedestal expansion during the ELM-free [1] phase and during the inter-ELM phase [2] of discharges in DIII-D. These results are consistent with time-dependent models which predict that the pedestal builds due to the reduction of turbulent transport due to the ExB shearing of turbulent eddies [3,4], where E_r arises to balance the pressure gradient in the pedestal. A feature of such models is that the pedestal width is predicted to grow in time in response to a constant flow of heat into the pedestal. Experimental measurements of the spatio-temporal evolution of turbulence, which would be required to make stricter tests of these models, are not available.

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