Scaling of the H-mode Pedestal Characteristics with Gyro-radius in the DIII-D and JET Tokamaks*

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The dependence of the H-mode edge transport barrier width on ion gyro-radius ($\rho^*=\rho/a$) in discharges with Type I ELMs was examined in experiments combining data from the JET and DIII-D tokamaks. The plasma shape, q, normalized pressure (β), collisionality (ν^*), Mach number, and the ratio of ion to electron temperature at the H-mode pedestal top were kept constant, while ρ^* was varied by a factor of four. ρ^* scans were carried out in both low and high triangularity shapes. The width of the steep gradient region of the electron temperature (T_e) and density (n_e) profiles showed only a weak if any dependence on ρ^*, $\Delta/a\sim(\rho^*)^{0.0+/-0.15}$. In particular a dependence of $\Delta/a\sim(\rho^*)^{0.5}$ was ruled out to an 80% confidence level. The pedestal pressures and widths were consistent with predictions of the EPED1 model [1] where $\Delta/a\sim(\beta_P^{PED})^{1/2}$, including an observed increase in width at higher triangularity. In DIII-D, the n_e profiles shifted outward relative to T_e as pedestal n_e increased with decreasing ρ^* consistent with a particle source effect, however on JET the profiles remained aligned. The ELM energy loss normalized to the pedestal energy increased from 10% to 40% as ρ^* increased by a factor of 2 in DIII-D, but the trend did not continue in the smaller ρ^* JET discharges where the ELM energy loss was relatively fixed. Although the ELM depth increased at high ρ^*, the peeling-ballooning eigenmode width was relatively unchanged.

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