Scaling of Plasma Parameters in the SOL and Divertor for Alcator C-Mod

B. LaBombard, D. Jablonski, B. Lipschultz, G. McCracken, J. Goetz

Plasma Fusion Center
Massachusetts Institute of Technology
Cambridge, MA 02139, USA

A fast-scanning Langmuir probe and an array of divertor Langmuir probes are used to characterize the cross-field heat transport ($X_\perp$) and to compare plasma conditions 'upstream' along a magnetic flux tube to conditions at the divertor. Three distinct regimes are found which depend on the power into the SOL and the edge plasma density: (1) a sheath-limited conduction regime where the divertor target temperature and density is similar to the values upstream, (2) a high-recycling regime where plasma pressure is approximately constant along field lines while $n_e$ is high and $T_e$ is low at the divertor and (3) a detached divertor regime where $n_e$ and $T_e$ collapse near the divertor strike points. The scaling between regimes (1) and (2) can be described by a transport model that includes anomalous cross-field heat transport ($0.25 < X_\perp < 0.5 \text{ m}^2 \text{s}^{-1}$), sheath conduction, and classical parallel electron conduction.