DPP07-2007-000098

Abstract for an Invited Paper
for the DPP07 Meeting of
the American Physical Society

Critical gradients and plasma flows in the edge plasma of Alcator C-Mod[1]

BRIAN LABOMBARD, MIT Plasma Science and Fusion Center

Recent experiments in both L- and H-mode plasmas on Alcator C-Mod have lead to a fundamental shift in our views of edge transport physics: transport in the 'near' scrape-off-layer (SOL) region may be more appropriately described in terms of a critical gradient phenomena rather than a diffusive and/or convective transport paradigm. L-mode pressure gradients, normalized by the square of the poloidal magnetic field strength (i.e., α_{MHD}) appear invariant in plasmas with the same normalized collisionality, despite vastly different currents and magnetic fields. These data suggest that local gradients are pinned to a 'critical gradient' condition, which is sensitive to local collisionality – a behavior that connects with first-principles electromagnetic fluid drift turbulence simulations [1]. H-mode pedestal gradients are found to follow a nearly identical scaling [2]. Thus, the near SOL, which forms the base of the H-mode pedestal, may play a key role in its creation. Prior to an L-H transition, strong SOL plasma flows are found to set a flow boundary condition for the confined plasma [3]. With favorable $Bx\nabla B$ direction (i.e., $Bx\nabla B$ pointed toward active x-point) these flows tend to spin the plasma in the co-current direction, perhaps reducing the L-H threshold power. Indeed, we find the edge profiles of the L-mode target plasmas to be fundamentally different, depending on the x-point topology: higher values of α_{MHD} are observed for favorable $Bx\nabla B$ direction, independent of the direction of B – supporting evidence that SOL flows play a role in affecting the observed 'critical gradient' value.

[1] LaBombard, B., *et al.*, Nucl. Fusion **45** (2005) 1658
[2] Hughes, J.W., *et al.*, Phys. Plasmas **13** (2006) 056103
[3] LaBombard, B., *et al.*, Nucl. Fusion **44** (2004) 1047.

[1]supported by U.S. D.o.E. Coop. Agreement DE-FC02-99ER54512