Parallel and Perpendicular Plasma Flows in the Edge of Alcator C-Mod

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Previous experiments in Alcator C-Mod uncovered some interesting connections among ballooning-like transport, near-sonic parallel plasma flows in the scrape-off layer and magnetic topology [1]. In order to investigate this behavior in more detail and to gather information on perpendicular plasma flows, two new, four-electrode Gundestrup-like scanning probe heads have recently been installed: an electromagnetically actuated *WASP* (Wall-Actuated Scanning Probe) on the high-field side and a pneumatically driven scanning probe on the low field side. The new Gundestrup probes reproduce the previously observed parallel flow dynamics, e.g. near-sonic transport-driven flows on the high field side with direction dependent on magnetic topology and persistently co-current directed flows on the low field side. However, the measured cross-field flows present a puzzle. There are often strong disagreements between the Gundestrup velocities and ExB flow velocities deduced from the inferred plasma potentials. The Gundestrup flow measurements appear to be anomalously high, while tending to agree with the measured phase velocity of turbulent structures in the SOL. Similar problems with Gundestrup probe measurements have been observed in the past on other devices [2]. Despite these difficulties, a number of interesting trends have emerged from the data. Both the perpendicular fluid velocity and the perpendicular phase velocity exhibit a 'shear layer' near the separatrix, where the velocities take a large step in the electron diamagnetic direction. The magnitude of this step tends to decrease with increasing discharge density while its location moves further out into the SOL. Magnetic topology appears to affect the shear layer behavior: discharges with $B \times \nabla B$ toward the x-point in single-null maintain a stronger shear layer closer to the separatrix. This behavior potentially connects to the steeper pressure gradients that are also seen in such discharges [3]. Fixed probes mounted on both the inner and outer divertors also exhibit changes in pressure asymmetries, suggesting a further connection to the observed plasma flows.

[1] B. LaBombard, *et al.*, Nucl. Fusion **44** (2004) 1047.

[2] Gunn *et. al.,* Czechoslovak Journal of Physics, **51** (2001) 10.

[3] B. LaBombard *et al.*, to be published in Physics of Plasmas.

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