# Mechanisms of Edge-Core Coupling: Some Speculations on How SOL Flows Influence Intrinsic Rotation and the L$\rightarrow$H Transition

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Recently, experimental studies[1,2] of SOL flows phenomena has prompted renewed interest in the role of such flows in the dynamics of intrinsic rotation in L-mode and the threshold for the L$\rightarrow$H transition. In particular, the key question which must be answered is just how do SOL flows influence core plasma rotation and electric field shear. Moreover, the proposed explanation must take account of turbulence and turbulent transport, since the phenomena in question occur in L-mode.

Here we explore the possibility that SOL flows exert a turbulent viscous stress on the plasma near the separatrix. The specific scenario is:

a.) poloidally asymmetric outward particle transport and the up-down asymmetry of a single-null divertor configuration drive a radially sheared SOL flow. The ultimate source for the flow is the particle flux, and the requisite symmetry breaking is via magnetic geometry (i.e. null point location).

b.) the radially sheared flow, which can be of substantial magnitude, in turn drives momentum flux, inward toward the core plasma. This flux can be driven by the parallel shear flow instability or by viscosity originating from generic edge/SOL transport. We expect the flux to be primarily diffusive.

c.) the turbulent momentum flux driven by SOL flow shear then exerts a Reynolds stress on the core plasma, affecting both core rotation, electric field shear, and the transition threshold.

Of course, once the L$\rightarrow$H transition occurs, the outward particle flux asymmetry is drastically reduced by electric field shear, thus quenching the entire process. In H-mode, the electric field shear driven residual stress (which originates *inside* the LCFS) is a more likely candidate for the origin of intrinsic rotation[3].

The key unknown elements of this scenario are the magnitude of the flux-induced SOL flow and the radial profile of the SOL flow. This will clearly be influenced by the magnetic geometry of the SOL plasma. Research is ongoing, and focuses on the viability of the basic scenario, with detailed calculations to come later. Results will be presented and discussed in the spirit of a workshop atmosphere.

[1] B. LaBombard, et al., Nucl. Fusion 44, 1047 (2004).
[2] B. LaBombard, et al., submitted to Phys. Plasmas (2007).
[3] O. Gurcan, et al., Phys. Plasmas 14, 042306 (2007).