Recent experiments\(^2\) indicate that RMP fields can reduce fluctuation-driven Reynolds forces and so inhibit the initiation of the L-H transition. We present a theory of vorticity flux decoherence and its implications for zonal flow evolution. This theory builds upon recent fundamental work on vorticity mixing in a tangled magnetic field\(^3\).

We calculate the decoherence of the vorticity flux due to stochastic magnetic field scattering in presence of a strong toroidal field. The three relevant rates are: (1) the bandwidth of the ambient electrostatic micro-instabilities (\(\Delta \omega\)), (2) the bandwidth of Alfvén waves excited by Drift-Alfvén coupling (\(v_A |\Delta k_\parallel|\)), and (3) the stochasticity-induced decorrelation rate (\(1/\tau_c = \max(k_D^2 D, (k_\theta^2 v_A^2 D/L_s^2)^{1/3})\), where \(D\) accounts for scattering by the stochastic field). Decoherence requires \(1/\tau_c > \Delta \omega\), as well as \(1/\tau_c \geq |\Delta k_\parallel v_A|\) (i.e. Kubo number \(Ku \geq 1\)). These inequalities define the critical value of \(\langle (\delta B)^2 / B^2 \rangle\) for an effect on the transition. The analysis proceeds by considering the Elsässer population responses. The implications for decoherence of the particle and heat flux are discussed, as well.

---

\(^1\) This work is supported by the U.S. Department of Energy under Award No. DE-FG02-04ER54738
