Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Separatrix-Induced Transport, Damping, and Wave-Coupling[1]

C.F. DRISCOLL, A.A. KABANTSEV, T.M. O'NEIL, D.H.E. DUBIN, UCSD, YU.A. TSIDULKO, Budker Inst. — Recent experiments have characterized a broad range of transport, damping, and wave-coupling effects caused by trapping separatrices in both the "collisional" and "chaotic" regimes. Here, the pure electron plasma columns have an electrostatic trapping separatrix created by an applied "squeeze" voltage; and this separatrix may have "θ-ruffles" from the applied voltages or from other $m_\theta \neq 0$ waves. For a θ-symmetric separatrix, traditional neoclassical theory predicts collisional dissipative effects scaling as $\nu_{ee}^{1/2} B^{-1/2}$. For a θ-ruffled separatrix, recent theory predicts chaotic dissipative effects scaling as $\nu_{ee}^{0} B^{-1}$. The experiments have characterized the wave damping for both diocotron (drift) waves and Langmuir (plasma) waves, as well as the bulk plasma expansion that occurs when external confinement asymmetries (such as magnetic tilt) are present. For $B > 10$kG, the $E \times B$ drift rotation is slow and collisional effects tend to dominate; for $B < 1$kG, rapid plasma rotation around θ-ruffled separatrices causes chaotic effects to dominate. This novel chaotic transport may have applicability to low-collisionality stellarator and tokamak separatrices also, especially given the ubiquity of wave-induced separatrix ruffles.

[1]Supported by NSF PHY-0903877.

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Date submitted: 18 Jul 2009 Electronic form version 1.4