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Non-resonant Particle Heating due to Collisional Separatrix Crossings[1] C. FRED DRISCOLL, F. ANDEREGG, M. AFFOLTER, D.H.E. DUBIN, University of California San Diego — We observe plasma heating when a pure ion column is "sloshed" back and forth across a trapping separatrix, with heating rate larger than expected from simple collisional viscosity. Here, an externally applied theta-symmetric "squeeze" potential creates a velocity separatrix between trapped and passing particles, and weak collisions at rate ν_c cause separatrix crossings. The trapped particles are repeatedly compressed and expanded (by δL at rate f_{sl}) whereas the passing particles counter-stream and Debye shield the resultant potential variations. LIF diagnostics clearly show the separatrix energy $E_{sep}(r)$, in close agreement with (r, z) Boltmann-Poisson equilibrium calculations. With $\nu_c \ll 2\pi f_{sl} \ll 2\pi f_{plas}$, simple bounce-averaged transport theory of the separatrix boundaries layer predicts heating scaling as $\dot{T}/T \propto (\delta L/L)^2 f_{sl} \sqrt{\nu_c/f_{sl}} \quad V_{sq}^2/T^2$, distinct from bulk-viscosity heating scaling as ν_c^1. Experiments corroborate the scalings with f_{sl} (and hence ν_c), with δL, and with V_{sq}, and give overall quantitative agreement with theory within a factor-of-two.

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