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Kinetic-based layer response to RMPs[1] J.D. CALLEN, C.C. HEGNA, Univ. of Wisconsin, A.J. COLE, Columbia Univ. — Plasma toroidal rotation can prevent reconnection of resonant magnetic perturbation (RMP) fields near rational surfaces. A low collisionality kinetic toroidal model of RMP-flutter-induced electron density and thermal transport in toroidally flowing plasmas has been developed [1]. Since this electron transport is non-ambipolar, it produces a co-current toroidal torque on the plasma. This low collisionality torque differs from fluid-based cylindrical results [2] in three key ways: the effective electron collision frequency is increased because only untrapped electrons carry parallel currents, this effect increases the singular layer width, and electron temperature gradient effects are included. A T_e gradient torque is caused by the parallel electron thermal force which is usually neglected in Ohm's law. It changes the perpendicular electron flow where the torque at the rational surface vanishes to where $(e/T_e)(d\Phi/dr) = d\ln p_e/dr + c_T d\ln T_e/dr$ in which c_T is 0.71 for Z=1. The $c_T \neq 0$ effect moves the radial location for RMP field penetration and hence reconnection to smaller radii relative to theories [2] that neglect the thermal force.

[1] J.D. Callen, A.J. Cole and C.C. Hegna, UW-CPTC 11-15R (2012).
[2] F.L. Waelbroeck et al., Nucl. Fusion 52, 074004 (2012).

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