Abstract Submitted
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Spontaneous Toroidal Rotation in Tokamaks[1] MALCOLM HAINES, Imperial College London — When two-fluid MHD theory of stability is employed the resulting growth rates are complex, and the perturbing magnetic fields move with a velocity that depends both on the components of the electron drift and heat flux perpendicular to the equilibrium magnetic field and on the diamagnetic velocity. On diffusing into a resistive wall a drag force is exerted on the wall which is proportional to the square-root of the velocity of the perturbing fields. The equal and opposite force or torque will be on the plasma, centred at the singular rational surface for each mode[1]. For typical experimental conditions this leads to a spontaneous, or intrinsic toroidal rotation of 20km/s occurring in a few milliseconds for perturbing magnetic fields of 0.0025tesla. The induced poloidal rotation by this mechanism is generally much larger, but there is considerable poloidal damping due to trapped particles on the ion-ion collision time- scale[2]. Furthermore poloidal angular momentum is in general not conserved for an isolated plasma, and any up-down asymmetry can act as a source or sink[3]; for example, Pfirsch-Schluter diffusion [3 damping by trapped particles[2] and the Ware pinch[4]. [1] J.B.Taylor, Phys.Rev.Lett. 91, 115002 (2003). [2] R.C.Morris, M.G.Haines and R.J.Hastie, Phys.Plasmas 3, 4513 (1996). [3] M.G.Haines, Phys.Rev.Lett. 25, 1480 (1970). [4] M.G.Haines and P.Martin, Phys.Plasmas 3, 4536 (1996).

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