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On radial electric field, edge flows, and the L-H transition power threshold in tokamaks[1] A.Y. AYDEMIR, Institute for Fusion Studies, The University of Texas at Austin — At the collisional edge, there is a residual vertical electric field associated with the Pfirsch-Schlüter currents that drives an ExB flow. The poloidal flow is in the direction of increasing major radius, regardless of the orientation of the fields and currents, and the toroidal component is anti-symmetric about the mid-plane for an up-down symmetric system. These flows have many features in common with the edge flows observed in tokamaks like C-Mod. A more careful analysis leads to a radial electric field that depends on the edge temperature gradient and shear. Without up-down symmetry, total contribution to the toroidal momentum and the edge E_ψ clearly depends on the toroidal field direction. When the grad-B drift direction points towards the X- point, the net effect is positive; with toroidal field reversal, E_ψ and the toroidal flow oppose the ambient flows and electric field due to, for example, the ion-orbit loss mechanism. The magnitude of this positive/negative contribution is also plasma- shape dependent. These features provide a compelling explanation for the grad-B drift-dependence of the L-H transition power threshold.

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