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Tokamak edge flows and their effect on the L-H transition power threshold A.Y. AYDEMIR, The University of Texas at Austin, Institute for Fusion Studies — At the edge collisional effects lead to a residual vertical electric field associated with the Pfirsch-Schlüter currents. Non-neutralized portion of this field, whose origin can be traced back to charge-dependent classical grad-B and curvature drifts, drives an ExB flow at the edge. Its poloidal component is in the direction of increasing major radius, regardless of the orientation of the fields and currents. The toroidal component is anti-symmetric about the mid-plane for an up-down symmetric system and reverses with the toroidal field. These flows have many features in common with the observed edge flows in tokamaks. 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. We are continuing to study these effects using both initial value and free-boundary equilibrium codes.

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