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Edge electric fields in the Pfirsch-Schlüter regime and their role in the L-I-H transitions[1] A.Y. AYDEMIR, B.N. BREIZMAN, R.D. HAZELTINE, Institute for Fusion Studies, The University of Texas at Austin — n the Pfirsch-Schlüter regime, a parallel electric field can be defined unambiguously on each flux surface within the separatrix as a function of the parallel density and temperature gradients, with a finite contribution from resistive effects. The integrated potential, unfortunately, is not unique and depends on an arbitrary flux function that is traditionally determined using high-order, toroidal angular momentum transport arguments. Here this flux function and the resulting radial electric field are calculated using a variational principle. The resulting net radial electric field at the edge, defined as the flux surface average $<E_\psi>$ just inside the separatrix, exhibits a high degree of correlation with a wide range of experimental observations on the L-I-H transitions in various devices. In particular, dependence of $< E_\psi >$ on magnetic topology, geometric factors like the upper/lower triangularity and elongation, and the relative position of the X-point(s) in the poloidal plane parallels the changes in the power threshold requirements for the transitions. This agreement with experimental results lend strong support to the variational principle used to derive the fields and imply that they may indeed be an important "hidden variable" in the L-H transitions.

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