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What sets the minimum tokamak scrape-off layer width?[1] ILON JOSEPH, Lawrence Livermore National Lab — The heat flux width of the tokamak scrape-off layer is on the order of the poloidal ion gyroradius, but the heuristic drift physics model [1] is still not completely understood. In the absence of anomalous transport, neoclassical transport sets the minimum width. For plateau collisionality, the ion temperature width is set by $q\rho_i$, while the electron temperature width scales as the geometric mean $q(\rho_e\rho_i)^{1/2}$ and is close to $q\rho_i$ in magnitude. The width is enhanced because electrons are confined by the sheath potential and have a much longer time to radially diffuse before escaping to the wall. In the Pfirsch-Schluter regime, collisional diffusion increases the width by the factor $(qR/\lambda)^{1/2}$ where qR is the connection length and λ is the mean free path. This qualitatively agrees with the observed transition in the scaling law for detached plasmas [2]. The radial width of the SOL electric field is determined by Spitzer parallel and neoclassical radial electric conductivity and has a similar scaling to that for thermal transport. [1] R. J. Goldston, Nucl. Fusion 52, 013009 (2012). [2] H. J. Sun, et al., Plasma Phys. Control. Fusion 57, 125011 (2015).

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