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Heuristic Drift-Based Model for the Power Scrape-off Width in H-Mode Tokamaks at Low Gas Puff[1] ROBERT GOLDSTON, Princeton Plasma Physics Laboratory — An heuristic model for the plasma scrape-off width in H-mode plasmas is presented, in which magnetic drifts into the SOL are balanced against $c_s/2$ parallel flows to the divertor plates. The overall particle flow pattern is a modification for open field lines of Pfirsch-Shlüter flows, including sinks to the divertors. This model results in an estimated SOL width of $\sim 2a\rho/R$. It also results in a first-principles calculation of the particle loss rate from low-gas-puff H-mode plasmas, given n_{sep} and T_{sep}, and thus the global particle confinement time. Using measured values of n_{sep} and T_{sep}, these are in reasonable agreement with experiment. It is next assumed that anomalous perpendicular electron thermal diffusivity is the dominant source of heat flux across the separatrix, investing the SOL particle width derived above with heat from the main plasma. The separatrix temperature is then calculated self-consistently, based on a two-point model balancing power input to the SOL against Spitzer-Härm parallel thermal conduction losses to the divertor. This results in a closed-form prediction for the power scrape-off width that is in reasonable quantitative agreement both in absolute magnitude and scaling with recent experimental data.

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