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On the Divertor Heat Flux Width Scaling[1] X.Q. XU, LLNL, N.M. LI, DLUT, ZEYU LI, X.Y. WANG, PKU, T.Y. XIA, ASIPP, BEN ZHU, LLNL, V.S. CHAN, USTC, BOUT++ TEAM — The BOUT++ code has been used to simulate edge plasma electromagnetic (EM) turbulence and transport, and to study the role of EM turbulence in setting the scrape-off layer (SOL) heat flux width . More than a dozen tokamak discharges from C-Mod, DIII-D, EAST, ITER and CFETR have been simulated with encouraging success. The parallel electron heat fluxes onto the target from the BOUT++ simulations of C-Mod, DIII-D, and EAST follow the experimental heat flux width scaling of the inverse dependence on the poloidal magnetic field. Transport simulations show two distinct regimes: drift dominant regime and turbulence dominant regime. The simulations for ITER and CFETR indicate that divertor heat flux width λ_q of the future large machines may no longer follows the $1/B_{pol,MP}$ experimental Eich scaling and the Goldston's HD model gives a pessimistic limit of divertor heat flux width. The simulation results show a transition from a drift dominant regime to a turbulence dominant regime from current machines to future machines such as ITER and CFETR for two reasons. (1) The magnetic drift-based radial transport decreases due to large CFETR and ITER machine sizes. (2) the SOL turbulence thermal diffusivity increases due to larger turbulent fluxes ejected from the pedestal into the SOL when operating in a different pedestal structure, from an ELM-free H-mode pedestal regime to a small/grassy ELM regime.

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