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UEDGE Modeling of the Scrape-Off Layer and Divertor in SPARC[1] SEAN BALLINGER, MIT PSFC, DANIEL BRUNNER, CFS, MARTIN GREENWALD, ADAM KUANG, BRIAN LABOMBARD, JAMES TERRY, MIT PSFC, MAXIM UMANSKY, LLNL, MICHAEL WIGRAM, MIT PSFC, THE SPARC TEAM — The SPARC divertor will need to handle unprecedented levels of heat flux, and detachment through impurity seeding could provide significant benefits. In this work, the UEDGE code is used to explore the SPARC divertor and edge plasma parameter space. The simulations are carried out in the lower-half edge plasma domain of an up-down symmetric double-null configuration. The Braginskii fluid equations are used with anomalous cross-field transport coefficients chosen to obtain agreement with expected midplane plasma profiles, target plate heat flux profiles, and inner/outer divertor power sharing, based on existing empirical scalings. Convective effects are included in the anomalous transport model, a fluid model is used for hydrogen neutrals, and carbon and neon impurities are introduced using the fixed-fraction model. We find that at the full projected exhaust power, a 2% carbon fraction can significantly reduce the peak heat flux to the divertor surface, though not enough ensure divertor survivability without sweeping the strike point. Sensitivity studies are carried out to assess the robustness of the results with respect to the assumptions in the model, in particular the choice of boundary conditions at the outer walls.

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