Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Developing solutions for GW/m^2-level divertor heat fluxes for a 10 second flat top discharge in SPARC[1] A.Q. KUANG, S. BALLINGER, B. LABOMBARD, M. GREENWALD, J.L. TERRY, S. WUKITCH, MIT Plasma Science and Fusion Center, M. UMANSKY, Lawrence Livermore National Laboratory, D. BRUNNER, Commonwealth Fusion Systems, THE SPARC TEAM — The heat flux width in the SPARC tokamak is projected to be approximately 0.2 mm [1,2]. This implies that operation with the planned 100 MW of fusion power will result in unmitigated steady state parallel heat fluxes to the divertor that are roughly 30 GW/m^2 and potentially higher during transients, presenting one of the most challenging power exhaust scenarios to date. Furthermore, the compact design and lack of a neutron shielding blanket means that there is limited space for advanced divertor geometries. The current baseline scenario involves the implementation of a rapid strike point sweep to spread the heat flux over a large divertor target surface area. Nevertheless, a modest level of divertor and core radiation is required to reduce surface heat fluxes. Because SPARC will operate with a 25 second pulse length, which includes a 10 second flat top, inertial cooling of target plate components can be employed. This eliminates the need for an active cooling system, greatly simplifying the design and reducing risk of component failure. UEDGE simulations of a preliminary divertor design concept will be presented and areas for further research and development identified. [1] T. Eich, et al., *NF*, 58(9), 093031, 2013. [2] D. Brunner, et al., *NF*, 58(7), 076010, 2018.

[1]Research supported by Commonwealth Fusion Systems

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Date submitted: 30 Jun 2019 Electronic form version 1.4