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Projections of ripple-loss of fast ions in SPARC[1] S SCOTT, CFS, N HOWARD, P RODRIGUEZ-FERNANDEZ, E TOLMAN, PSFC, AND THE SPARC TEAM — A major design consideration for the compact SPARC facility (R=1.65 m, a=0.50 m) is avoiding excessive first-wall heating from fast ions that are lost from the plasma. At full performance, the SPARC tokamak is projected to have 30 MW of energetic RF tail ions and up to 20 MW of alpha particles, yielding ˜40 MW of banana-trapped energetic ions. These will be subject to radial transport and loss from the plasma by the ripple-trapping, collisional-banana, and stochastic banana-drift diffusion mechanisms. Full-orbit simulations of alpha loss expected in ITER by the ASCOT code (Nucl. Fusion **49** (2009) 095001) yielded an alpha-loss 'footprint' that was highly concentrated both toroidally and poloidally on limiters mounted on the outer midplane, and such a concentration is expected in SPARC also. A rudimentary analysis suggests that the ITER ripple-loss calculations scale to maximum surface heating of ˜1 MW/m^2 in SPARC when $\delta_{\max} = 0.5\%$. Here we report full-orbit simulations of the ripple loss of RF-tail and alpha particles in SPARC by the ASCOT and SPIRAL codes, including simulations of the synergistic effect of sawteeth on ripple losses.

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