Abstract Submitted
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First-principles edge physics simulation in diverted tokamak geometry at SciDAC CPES[1] C.S. CHANG, PPPL, AND THE CPES TEAM — Primary mission of the SciDAC Proto-FSP CPES (Center for Plasma Edge Simulation) is (a) to build a new kinetic code applicable to realistic diverted edge geometry, (b) to create a new code integration framework to couple the multi scale edge physics including MHD and neutrals, and (c) to make scientific discoveries in the edge physics and the edge effect on the core confinement. Absence of a kinetic code applicable to realistic diverted edge geometry has been a critical missing element in the world fusion program. The insurmountable difficulties in building such a kinetic code has been in the requirement of the full-f approach instead of the popular delta-f approach, the complicated edge geometry, existence of the X-point, and the necessity of extreme scale computing. We have succeeded in building two such kinetic HPC codes XGC0 and XGC1, and in creating a state-of-the-art code integration framework EFFIS. The current capability of the XGC codes, including the kinetic ion-electron turbulence physics and 3D magnetic perturbation physics, will be described. Scientific discoveries on the edge neoclassical and turbulence physics, the non-local core-edge interaction, 3D RMP physics, pedestal physics, wall load, plasma rotation physics, and other edge physics will be reported.

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