Abstract Submitted
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PIC Simulation of Magnetic Fusion Plasmas on High Performance Computers[1] C-S CHANG, W. LEE, Princeton Plasma Phys Lab, Z. LIN, University of California Irvine, SCOTT PARKER, University of Colorado Boulder, W. TANG, W. WANG, Princeton Plasma Phys Lab — This talk will overview the state-of-the-art HPC-oriented PIC techniques, which are used in the magnetic fusion plasma research and which could be useful in the application plasma research. Magnetic fusion plasma is governed by multi-scale multi-physics phenomena that span millions of order in configuration space and billions of order in time-space, with many of the multi-physics being non-separable in space and time scales. The discussion topics will include the concept of the magnetic field-line following meshing, the turbulent and non-turbulent physics, the delta-f and total-f techniques, the whole-device modeling, the multiscale self-organization phenomenon, the quite start, the collision operators, the 5-D gyrokinetic and 6D full kinetic simulations, the addition of velocity-space grid to PIC mesh, the neutral particle recycling and Monte Carlo transport, the large scale parallelization and programing models, the optimization on CPU and GPU type accelerators, the load balancing, the in-memory in-transit data managements, the employment of machine learning technologies, and others.

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