Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

High-performance PIC-BCA code for fusion-relevant plasma-material interactions[1] JON DROBNY, DAVIDE CURRELI, University of Illinois at Urbana-Champaign — Plasma-material interactions (PMI) are among the most difficult fusion-relevant phenomena to model. Reduced models of ion reflection, target sputtering, or redeposition are commonly used. However, reduced models neglect details such as the significant high-energy tails of ion energy-angle distributions at plasma facing component surfaces, leading to an underestimation of total sputtering and loss of information concerning the trajectories of emitted particles. Adequately modeling PMI requires kinetic models of the plasma-material interface to capture the behavior of the plasma sheath, the material, and their response to each other. To that end, we have produced a tightly coupled, high-performance particle-in-cell (PIC) and binary collision approximation (BCA) code with two components; hPIC, which has been recently upgraded to include RF effects and a nonuniform mesh to simulate large plasma domains beyond the surface, and Rustbca, which is a newly developed code benchmarked against previous codes but with many advantages, such as modern code design and high performance. Using this form of the PIC-BCA, we have analyzed the equilibrium PMI along an ITER-like target including redeposition fractions, energy-angle distributions, and calculations of net and gross erosion.

[1]This work was supported by the US Department of Energy through contract DOE-DE-SC0008658 as part of the PSI2-SciDAC Project

Jon Drobny
University of Illinois at Urbana-Champaign

Date submitted: 29 Jun 2020 Electronic form version 1.4