Abstract Submitted
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Particle-particle simulations of plasma-material interactions[1] JON DROBNY, DAVIDE CURRELI, University of Illinois at Urbana-Champaign — Plasma-material interactions (PMI) are key to the operation of plasma devices, from DC glow to fusion. Many computational device models rely on assumptions such as perfectly absorbing walls, specular particle reflection, or semi-empirical sputtering yield formulas. To correctly simulate the plasma-material interface, however, a complete PMI model must be developed, remaining as close to first-principles models as possible. To this end, we propose a fully ion-kinetic, particle-in-cell binary-collision-approximation (PIC-BCA) model with one-to-one, single-timestep particle coupling. Each timestep, every PIC superparticle that impacts the wall will generate a BCA superparticle trajectory, and emit any reflected or sputtered particles into the PIC domain, where neutrals can be ionized through a Monte Carlo ionization model. This coupling scheme permits modeling of PMI far from steady-state, without reliance on time-step separation arguments and without the implicit filtering of producing ion energy-angle distributions at the wall. For this presentation, we will present the methodology of the particle-particle coupling and results using pre-existing PIC and BCA codes.

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