Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Work Towards a Collisional Ionization Model for Particle-in-Cell Codes[1] STEPHEN DIIORIO, University of Michigan, Ann Arbor, BENJAMIN WINJUM, JOSHUA MAY, FRANK TSUNG, University of California, Los Angeles, JENNIFER ELLE, High Power Electromagnetics Division, Air Force Research Laboratory, ALEXANDER THOMAS, University of Michigan, Ann Arbor — The necessity for modeling collisional processes in plasmas is becoming ever more important as experimental efforts using higher density plasmas and solid targets come to fruition. We present progress towards an efficient module for simulating collisional ionization events within a particle-in-cell (PIC) framework. Our model has been tested rigorously for physical accuracy and does not suffer from statistical noise, thus decreasing the number of particles needed for a given simulation. This is done by calculating the rate of ionization deterministically and then adjusting the species densities within the simulation accordingly, which acts as a "smoothing" process reducing noise generated. Our model also includes proper momentum transfer due to the collisional process. This module has been integrated into the PIC code OSIRIS and has been benchmarked against other PIC codes, such as EPOCH and Smilei. We also use our model to simulate a variety of physical situations including electron beam propagation through air, electron stopping power through collisional ionization, and fast electron propagation through solids.

[1]Work supported in part by the Air Force Office of Scientific Research under grant FA9550-19-1-0072.

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Date submitted: 29 Jun 2020 Electronic form version 1.4