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Algorithm Development for Simulation of the Interaction of Intense Laser Light with a Multiscale Plasma[1] BRUCE COHEN, ANDREAS KEMP, LAURENT DIVOL, Lawrence Livermore National Laboratory — The kinetic simulation of the interaction of intense laser light with plasma in a multiscale limit presents severe challenges. Conventional, explicit-integration, particle-in-cell (PIC) methods require resolving the light waves and electron plasma waves with appropriately small time steps and mesh sizes in order that the simulation be both numerically stable and accurate. In the simulation of laser light interacting with a fast-ignition target plasma, the domain spans a range of electron densities going from vacuum to thousands of times the critical density. For the electron temperatures in the target plasmas, the underdense plasma is collisionless and the overdense plasma becomes highly collisional. We have introduced a new two-region algorithm that is well suited to the simulation of fast ignition, employing explicit PIC with complete Maxwell's equations at low densities through densities above critical and a reduced set based on Ohm's law for higher densities. Collisions in the high-density region set limits on time steps, and we examine subcycling the collisions to improve efficiency. Analysis and demonstrations of the algorithm are presented.

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