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Intensity-dependent criteria for PIC simulations of relativistic electrons in a laser field GINEVRA E. COCHRAN, The Ohio State University, Department of Physics, ALEXEY V. AREFIEV, University of Texas at Austin, Institute for Fusion Studies, DOUGLASS W. SCHUMACHER, The Ohio State University, Department of Physics, A.P.L. ROBINSON, Central Laser Facility, STFC, GUANGYE CHEN, Los Alamos National Laboratory — We present a study of particle-in-cell simulation error in modeling a free electron in an ultraintense laser field, comparing the codes PSC and LSP. We find an unexpectedly small timestep is required for both codes to resolve the classical electron motion, decreasing with increasing a_o, the normalized vector potential. We consider grid dispersion, the field solver, and the particle pusher as sources of error, and find by comparing the codes with a simple particle pusher that the particle pusher error dominates the results. We derive the constraint imposed by use of the relativistic Boris particle pusher on the timestep and find that it must decrease inversely as a_o. We find the particle pusher error accumulates on the small trajectory segments where the gamma-factor is approximately unity and the laser fields are strong, and present a sub-cycled version of the simple particle pusher code which reduces error. This work was supported in part by an allocation of computing time from the Ohio Supercomputer Center. This work was supported by U.S. Department of Energy Contract Nos. DE-FC52-06NA26262 and DE-FG02-04ER54742, and National Nuclear Security Administration Contract No. DE-FC52-08NA28512.

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