Implementation of a One-Dimensional Electromagnetic Wave Solver

in Initial Plasma Formation Modeling

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The modeling of initial plasma formation (IPF) provides a pathway for understanding the ultrafast dynamics of laser–material interactions. A one-dimensional electromagnetic wave solver has been developed using the finite-difference time-domain (FDTD) method to accurately model laser propagation in metals and dielectrics. Laser absorption is modeled by the collisional damping of the light wave, which is determined by the dielectric function of the materials. A two-temperature model is employed to describe the heat transfer between electrons and lattices ions. Differences in the heat transfer dynamics to electrons and ions modeled by the wave solver and a ray trace approach are compared. The objective of this approach is to enhance the modeling accuracy of laser-matter interactions in inertial confinement fusion (ICF) codes. This material is supported by the Department of Energy National Nuclear Security Administration under Award No. DE-NA0003856. This work was made possible by funding from the Department of Energy for the Plasma and Fusion Undergraduate Research Opportunities (PFURO) program. This work is supported by the US DOE Contract No. DE-AC02-09CH11466.