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Subgrid Model of Laser Propagation and Heating in a Foam¹ MIKHAIL BELYAEV, RICHARD BERGER, STEVEN LANGER, OGDEN JONES, Lawrence Livermore Natl Lab — Foams are considered an attractive design option for inertial confinement fusion (ICF), because they have densities intermediate between those of a gas and a solid. However, large-scale ICF simulations cannot resolve the microstructure of a foam. The work done by the laser in burning down the foam microstructure slows down the ionization front. It also modifies the properties of the resulting plasma, resulting in a higher ion temperature. We have developed a subgrid foam model for use in plasma physics simulations. We treat the foam as a medium with an anomalous opacity due to the cross-sections of foam elements above critical density. We model the expansion of heated foam elements within a computational cell using a reduced set of equations. When neighboring foam elements overlap, the foam homogenizes and the kinetic energy of expansion is deposited into ion thermal energy. After this point, the cell evolves in the same manner as a homogeneous plasma. We present comparison of our model to experimental results. We show that laser propagation in a foam is slower than in a homogeneous gas with equivalent properties, consistent with experiments. The resulting high ion temperatures have implications for Laser Plasma Instabilities and can suppress Stimulated Brillouin Scattering.

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