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Hydrodynamic Simulations of Laser-Induced Surface Ablation in the Warm Dense Matter Regime ASHER DAVIDSON, GEORGE PETROV, DANIEL GORDON, JOSEPH PENANO, United States Naval Research Laboratory — Here we use a fully nonlinear hydrodynamic simulation framework, SPARC, to model ablation of metal surfaces by ˜ps length, ˜mJ Class lasers. SPARC is a set of modules within a larger, TurboWAVE code, with expanded Equation-of-State (EOS) capabilities that include solid, liquid, and gaseous states. In problems such as these the laser deposits energy into the conduction band electrons at a much faster rate than the electron and ion temperatures equilibrate, and so a two-temperature model (TTM) is necessary to resolve the physics. The rapid heating of the electrons result in thermionic emission, followed by an electrostatic pull which initiates the ablation process before the ion temperature reaches the melting point. Our choice of EOS for both species will be discussed and elaborated. Special consideration is given to the fact that these electrons are neither a degenerate gas or an ideal plasma, but rather exist in the Warm Dense Matter (WDM) regime. The results of the simulations are benchmarked against experimental results, from which we can extrapolate some of the behaviors of EOS quantities in this intermediate regime while preserving the necessary limiting behaviors.

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