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Characterization of the ultrafast x-ray heating of iron foils[1]
ELISEO GAMBOA, SLAC National Accelerator Laboratory, GUILLAUME LOISEL, Sandia National Laboratories, PHILIP HEIMANN, SLAC National Accelerator Laboratory, JAMES BAILEY, Sandia National Laboratories, ROGER FALCONE, University of California, Berkeley, ERIC GALTIER, SIEGFRIED GLENZER, ANDY MACKINNON, SLAC National Accelerator Laboratory, ROBERTO MANCINI, University of Nevada, Reno, ALISON SAUNDERS, University of California, Berkeley, STEPHANIE HANSEN, Sandia National Laboratories — We present experimental data showing the thermodynamic response of metal foils to intense x-ray irradiation. Thin (300 nm) iron foils were irradiated with up to 3 mJ of x-rays in a 9 keV, 40 fs free electron laser pulse generated by the Linac Coherent Light Source, Stanford University. The x-rays heat the foil uniformly, depositing several keV/atom to create a hot-dense state. We observed the non-collective x-ray scattering from the laser pulse, obtaining wavelength-resolved spectra that are sensitive to the temperature and charge distribution in the sample. The values inferred from the x-ray scattering are compared to predictions from atomic kinetics simulations as well as time-integrated measurements of the temperature from the soft x-ray bremsstrahlung emission.

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