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Picosecond Thermal Dynamics in an Underdense Plasma Measured with Thomson Scattering D. HABERBERGER, J. KATZ, S. BUCHT, A. DAVIES, J. BROMAGE, J.D. ZUEGEL, D.H. FROULA, Laboratory for Laser Energetics, U. of Rochester, R. TRINES, Rutherford Appleton Laboratory, R. BINGHAM, University of Strathclyde, J. SADLER, P.A. NORREYS, University of Oxford
— Field-ionized underdense plasmas have many promising applications within the laser–plasma interaction field: nuclear fusion, particle accelerators, x-ray sources, and laser–plasma amplification. Having complete knowledge of the plasma dynamics is essential to establishing optimal parameters for a given application. Here picosecond-resolved Thomson scattering measurements have been used to determine the electron thermal dynamics of an underdense ($\sim 10^{19}$/cm) H_2 plasma irradiated by a 60-ps, 1053-nm laser pulse with an intensity of 2×10^{14} W/cm^2. The picosecond-resolved spectra were obtained with a novel pulse-front tilt compensated streaked optical spectrometer. The electron temperature was observed to rise from an initial 5 eV to a density-dependent plateau in 23 ps. Simulation results indicate that inverse bremsstrahlung heating, radiative cooling, and radial conduction cooling all play an important role in modeling the thermal dynamics. This material is based upon work supported by the Department of Energy National Nuclear Security Administration under Award Number DE-NA0001944.

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