Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Dynamic response of matter heated by ultrafast laser pulses[1]
ELISEO GAMBOA, LUKE FLETCHER, SEBASTIAN GOEDE, ULF ZASTRAU, HAE-JA LEE, ERIC GALTIER, WILL SCHUMAKER, ROHINI MISHRA, PHILIPP SPERLING, MAXENCE GAUTHIER, ALESSANDRA RAVASIO, MICHAEL MACDONALD, SIEGFRIED GLENZER, SLAC National Accelerator Laboratory — The material properties of the light elements at extreme conditions are of utmost importance to a diverse set of fields, from astrophysics and cosmology to research into controlled nuclear fusion energy production. These high-energy density states, defined as solid density plasmas with T>10 eV, may be produced in the laboratory by irradiation of materials with high-energy or high-power lasers. Characterizing these material conditions using optical means is challenging because the plasma is above critical density and the experimental conditions are maintained over only very brief timescales. We present a preliminary analysis of x-ray scattering data from ultrafast, isochorically-heated hydrogen and carbon in experiments conducted at the Matter in Extreme Conditions endstation at the Linac Coherent Light Source (LCLS) x-ray free electron laser, SLAC National Accelerator Laboratory. By observing the collective and non-collective x-ray scattering of the LCLS beam at multiple pump-probe delays, we infer the time-history of the electron and ion temperatures and thus the equilibration rate.

[1]This work was performed at the Matter at Extreme Conditions (MEC) instrument of LCLS, supported by the DOE Office of Science, Fusion Energy Science under contract No. SF00515. This work was supported by DOE Office of Science, Fusion Energy Science under F

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Date submitted: 14 Nov 2014 Electronic form version 1.4