Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Dynamic Ultra-Bright X-ray Laser Scattering from Isochorically Heated Cryogenic Hydrogen LUKE FLETCHER, SLAC National Accelerator Laboratory, HIGH ENERGY DENSITY COLLABORATION — Recent x-ray scattering experiments performed at the MEC end-station of the LCLS, have demonstrated novel plasma measurements of the electron temperature, pressure, and density by simultaneous high-resolution angularly and spectrally resolved x-ray scattering from shock-compressed materials in the warm dense regime. Such measurements provide the structural properties relating the microscopic quantities in terms of thermodynamic properties using first-principles calculations. These studies have led us on a path where we create conditions with increasing temperatures and pressures to explore the high-energy density phase space. Specifically, we have begun experiments on hot and dense hydrogen plasmas producing energetic proton beams that find applications in fusion research and astrophysical phenomena. For our experiments with the 25 TW short pulse laser we apply repetition rates and pulse widths with a good match to the LCLS x-ray beam capabilities allowing pump-probe experiments with ultrahigh temporal resolution with very high data throughput with shot rates of up to 5 Hz. In this talk we will discuss our recent measurements that have resolved the ultrafast structural response of hydrogen to intense heating.

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Date submitted: 24 Jul 2015 Electronic form version 1.4