Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Creation of warm, dense Si by rapid heating with intense laser-driven protons and characterization by K-shell absorption spectroscopy[1]

C MCGUFFEY[2], UCSD CER, R HEETER, LLNL, K BHUTWALA, UCSD CER, J EMIG, E MARLEY, LLNL, J VAUGHAN, D ZIMMER, M BAILLY-GRANDVAUX, FN BEG, A HIGGINSON, J KIM, UCSD CER, D MARISCAL, LLNL, S MULLER, General Atomics, PM NILSON, W THEOBALD, LLE — The OMEGA EP short pulse lasers have been used to heat and characterize Si in the Warm Dense Matter (WDM) regime. The primary laser, with 1100J in 10ps produced a proton beam with ˜50J of total energy that was focused into a Si wafer face-on 500μm away, heating it to ˜50eV in a timespan of <100ps. The second laser, with 700J in 5ps, irradiated the tip of a Zn wire, producing a bremsstrahlung-like X-ray strobe to backlight the Si at various delays. Absorption measurements show the evolution of Si K-shell features throughout the heating. The Si was initially 0.9 or 1.8μm thick for adequate absorption, and it was tamped with 1.1μm CH layers to limit expansion. The expansion has been modeled with the radiation-hydrodynamics code HELIOS, and the X-ray transmission of the expanded target has been modeled with the atomic-radiative code PrismSpect. We present the spectroscopy alongside the modeling and compare the fit conditions to those predicted by LSP particle-in-cell. This proton source could be applied to thicker targets as a way to create uniform, near-solid WDM targets for opacity testing.

[1]This work was supported by the NNSA NLUF program, award DE-NA0003943, and by the NNSA HEDLP program, award DE-NA0003876.
[2]Current affiliation General Atomics

Christopher McGuffey
University of California, San Diego

Date submitted: 29 Jun 2020 Electronic form version 1.4