APR08-2008-000565

Abstract for an Invited Paper
for the APR08 Meeting of
the American Physical Society

**Creating and probing matter compressed and heated by shock waves on OMEGA**

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A physical understanding of the energy transport from the laser-deposition region to the target is required for many laser-driven, high-energy-density experiments and to achieve energy gain with inertial confinement fusion. Direct-drive target-physics experiments are initiated by the ablation of material from the outside surface of the target with intense laser beams. The ablated shell mass forms a coronal plasma that can accelerate the target via the rocket effect. Laser absorption occurs in the underdense corona via inverse bremsstrahlung and the energy is transported by electrons to the ablation surface. The ablation process launches shock waves into the target that set the target on the desired isentrope. Using a planar target geometry, time-resolved Al $1s$–$2p$ absorption spectroscopy is used to probe shock-heated and compressed matter on OMEGA. The measured Al absorption spectra were modeled with the atomic physics code *PrismSPECT* [Prism Computational Sciences, Inc., Madison, WI 53711] to infer the $T_e$ and $n_e$of the nearly Fermi-degenerate matter ($T_e \sim 10$ to 30 eV, $n_e \sim 1$ to $6 \times 10^{23}$ cm$^{-3}$). Detection of low charge states (i.e., F, O, N, C) indicates the 10- to 50-Mbar shock wave has transited an Al layer buried in a CH target, while evidence of even higher charge states indicates the arrival of the heat front. Simulations of the shock heating and heat-front penetration, performed with the 1-D hydrodynamics code *LILAC* [J. Delettrez *et al.*, Phys. Rev. A **36**, 3926 (1987)] using a nonlocal transport model, are close to the measured results. This work was supported by the U.S. Department of Energy Office of Inertial Confinement Fusion under Cooperative Agreement No. DE-FC52-08NA28302. *In collaboration with H. Sawada, D. D. Meyerhofer, P. B. Radha, J. A. Delettrez, R. Epstein, V. N. Goncharov, D. Li, V. A. Smalyuk, T. C. Sangster, and B. Yaakobi, *UR/LLE*; R. C. Mancini, *UNR*