Strong Shock Generation for Shock-Ignition Inertial Fusion: Recent experiments and target design work at LLE, in collaboration with CELIA and CEA, have been carried out to validate the shock-ignition (SI) concept and to develop a target design for ignition experiments on the National Ignition Facility (NIF). Since shock ignition relies on launching an ignitor shock at pressures ≥300 Mbar, the demonstration of such strong shocks is crucial to the validation of the SI concept. Among the most recent experiments, solid spherical targets have been used to demonstrate the generation of ultrastrong shocks. The solid plastic target consisted of a core that was doped with ~5% atomic titanium and an undoped 50-μm outer layer. The outer target diameter was 430 μm and the solid ball was irradiated with 60 beams from the OMEGA laser equipped with small spot phase plates to reach high laser intensities of ~4×10^{15} W/cm^2. The timing of the x-ray flash from shock convergence in the center of the solid ball target is used to infer the shock velocity and the ablation pressure driving the shock. Very recent experiments have demonstrated the generation of convergent shocks launched by an ablation pressure approaching 300 Mbar. Figure 1 shows the inferred peak ablation pressure versus the absorbed laser intensity at the critical-density surface.

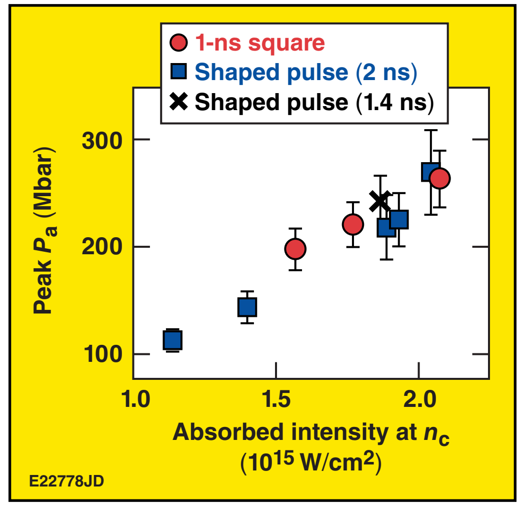

Figure 1. Inferred peak ablation pressure versus the absorbed laser intensity at the critical-density surface. The different symbols denote different laser pulse shapes.

These recent experiments were also used to study the laser–plasma instabilities and hot-electron generation at SI-relevant intensities. It was found that the hot-electron temperature was moderate (<100 keV) and instantaneous conversion efficiencies of laser energy into hot electrons reached up to ~10 % in the intensity spike. These results indicate that hot-electron preheat and laser-energy coupling can be controlled within acceptable levels at spike intensities relevant to ignition. However, the plasma scale length in these experiments is shorter than in ignition targets. A full validation of the laser–plasma interaction will require long-scale-length, high-intensity experiments at the NIF.

Donald and Linda Winter LLE/NROTC Intern Program: The University announced the selection of the first two interns for the Donald and Linda Winter LLE/NROTC Intern Program. The program is sponsored by past Secretary of the Navy Dr. Donald Winter ('69) and Linda Winter ('69). It was initiated to promote the nation's Naval Nuclear Power program by providing a summer internship to selected university undergraduates who have an interest in the nuclear power program and have demonstrated high academic excellence. The 2014 interns are MIDN Daniel Tucker, a junior with a double major in Mathematics and Economics and MIDN Ari Shaps, a junior majoring in Chemistry [Figs. 2(a) and 2(b)].

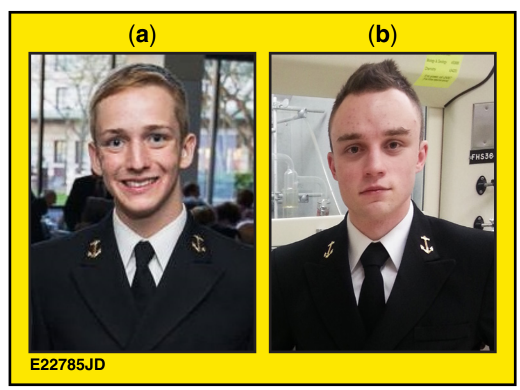

Figure 2. (a) MIDN Daniel Tucker and (b) MIDN Ari Shaps.

Omega Facility Operations Summary: The Omega Laser Facility conducted a total of 161 target shots in January. The OMEGA laser accounted for 118 shots at an average experimental effectiveness of 94.5%, while OMEGA EP conducted 43 shots with an average experimental effectiveness of 98.8%. The ICF program accounted for 93 of the shots for experiments led by LLE and LLNL, while 43 target shots were taken for the HED program by teams led by LANL and LLNL, respectively. One LBS campaign led by LLE had 6 shots and the NLUF program had 19 shots for 2 experiments led by the University of Michigan and MIT, respectively.

Contact: John M. Soures (585) 275-3866; fax: (585) 256-2586; e-mail: jsou@lle.rochester.edu