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Contents

In Brief

This volume of the LLE Review, covering January–March 2002, features "First Results from Cryogenic Target Implosions on OMEGA" by C. Stoeckl *et al*. (p. 49). This article describes initial results from direct-drive spherical cryogenic target implosions on the 60-beam OMEGA laser system. These experiments are part of the scientific base leading to direct-drive ignition implosions planned for the National Ignition Facility (NIF). Results shown include neutron yield, secondary-neutron and proton yields, the time of peak neutron emission, and both time-integrated and time-resolved x-ray images of the imploding core. The experimental values are compared with 1-D numerical simulations. The target with an ice-layer nonuniformity of $\sigma_{rms} = 9\ \mu$m showed 30% of the 1-D predicted neutron yield. These initial results are encouraging for future cryogenic implosions on OMEGA and the NIF.

Additional highlights of research presented in this issue include the following:

- T. J. B. Collins and T. R. Boehly (p. 57) present a theory that models equation-of-state measurements of porous materials. Experiments have been performed on OMEGA as part of the Stockpile Stewardship Program to investigate the equation of state of carbonized resorcinol foam, a porous material. Using the impedance-matching method, the foam Hugoniot was calculated from the well-known equation of state of aluminum and from measured shock speeds over the range of 100 kbar to 2 Mbar.

- A second article by T. R. Boehly and T. J. B. Collins (p. 68) describes the perturbation of a target by nonuniformities in the drive laser. Drive lasers, with known, single-mode modulations, produce nonuniform shocks that propagate into CH targets. An optical probe beam is used to measure the arrival of these modulated shocks at various surfaces in the target. Experiments at moderate laser intensities ($\lesssim 10^{13}$ W/cm^2) exhibit behavior that is predicted by hydrocodes and simple scaling laws. This technique may be used to observe various dynamic effects in laser-produced plasmas and shock-wave propagation.

- A. Sunahara, J. A. Delettrez, C. Stoeckl, R. W. Short, and S. Skupsky (p. 73) describe the time dependence of electron thermal flux inhibition in direct-drive laser implosions. They calculate the nonlocal electron thermal conduction in direct-drive CH target implosions with square pulses by a one-dimensional Fokker–Planck solver combined with a hydrodynamic code. The results show that the electron thermal flux inhibition at the critical surface is time dependent, confirming that a larger flux limiter must be used for shorter-duration pulses. Also, the growth of the Rayleigh–Taylor instability for short-wavelength perturbations is shown to be smaller due to the longer density scale length.

- L. J. Waxer and J. H. Kelly (p. 79) have demonstrated precision spectral sculpting of broadband FM pulses amplified in a narrowband medium. Amplification of broadband frequency-modulated (FM) pulses in high-efficiency materials such as Yb^{+3}:SFAP results in significant gain narrowing, leading to reduced on-target bandwidths for beam smoothing and to FM-to-AM conversion. These effects were compensated for by applying precision spectral sculpting, with both amplitude and phase shaping, before amplifying the broadband FM pulses in narrowband gain media. The spectral sculpting, for center-line small-signal gains of 10^4, produced amplified pulses that have both sufficient bandwidths for on-target beam smoothing and temporal profiles that have no potentially damaging amplitude modulation.

- T. Z. Kosc, K. L. Marshall, S. D. Jacobs, J. C. Lambropoulos, and S. Faris (p. 83) describe electric-field-induced motion of polymer cholesteric liquid crystal flakes in a conductive fluid. Polymer cholesteric liquid crystal flakes suspended in a fluid with non-negligible conductivity can exhibit motion in the presence of an ac electric field. The platelets have a strong selective reflection, which is diminished or extinguished as the flakes move. Flake motion was seen within a specific frequency bandwidth in an electric field as low as 5 mV_{rms}/mm.

- X. Zheng, Y. Xu, R. Sobolewski, R. Adam, M. Mikulics, M. Siegel, and P. Kordos (p. 88) discuss the femtosecond response of a freestanding LT-GaAs photoconductive switch. A novel, freestanding LT-GaAs photoconductive switch has a femtosecond response time. The switch was formed by patterning a 1-mm-thick layer of a single-crystal LT-GaAs into a 5-μm by 15-μm bar The bar was separated from its GaAs substrate and placed across a gold coplanar transmission line deposited on a Si wafer. The switch was excited with 110-fs-wide optical pulses, and its photoresponse was measured with an electro-optic sampling system. Using 810-nm optical radiation, 470-fs-wide electrical transients (640-GHz bandwidth) were recorded.

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