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Contents

In Brief

This volume of the LLE Review, covering the period October–December 1998, includes two articles addressing issues applicable to direct-drive ICF on the National Ignition Facility (NIF): laser–plasma interactions and laser-irradiation uniformity. In the first article S. P. Regan, R. S. Craxton, D. D. Meyerhofer, W. Seka, R. W. Short, A. Simon, and B. Yaakobi present experimental results that indicate the parametric instabilities stimulated Raman scattering and stimulated Brillouin scattering are not likely to have a significant impact on target performance at the peak of the NIF direct-drive laser pulse. In addition, the production and characterization of long-scale-length plasmas, with parameters relevant to the peak of the direct-drive NIF laser pulses, on the OMEGA laser system are described. In the second article S. Skupsky and R. S. Craxton investigate laser-irradiation uniformity on OMEGA and the NIF and outline improvements in irradiation uniformity planned for the OMEGA laser during 1999 that will reduce the rms nonuniformity to less than 1% when the intensity is averaged over 300 ps. Higher uniformity will be achievable on the NIF due to the larger number of beams (192 versus 60).

Additional highlights of the research presented in this issue are

- P. B. Radha and S. Skupsky present a novel charged-particle diagnostic that performs simultaneous ρR measurements of the fuel, shell, and ablator regions of a compressed ICF target, consisting of an inner DT fuel region, a plastic (CH) shell, and an ablator (CD), by measuring the knock-on deuteron spectrum. This diagnostic technique relies on the new charged-particle spectrometer on OMEGA to obtain the particle spectrum.

- F. Dahmani, S. Burns, J. Lambropoulos, S. Papernov, and A. Schmid report results from stress-inhibited laser-driven crack propagation and stress-delayed damage-initiation experiments in fused silica at 351 nm. The damage initiation threshold was observed to increase by 70% when a modest amount of mechanical stress was applied to the fused-silica optic. Research is underway presently to determine the ramifications of these findings for large-aperture systems, such as OMEGA.

- V. Goncharov presents an analytic theory of the ablative Richtmyer–Meshkov instability, which shows that the main stabilizing mechanism of the ablation-front perturbations is the dynamic overpressure of the blowoff plasma with respect to the target material. The perturbation evolution during the shock transit time is studied to determine the initial conditions for the Rayleigh–Taylor phase of the instability and to analyze the level of laser imprint on ICF direct-drive targets.

- J. M. Larkin, W. R. Donaldson, T. H. Foster, and R. S. Knox examine the triplet state of rose bengal, a dye used in photodynamic therapy, that is produced by 1064-nm excitation of T_1. The triplet-triplet absorption cross section between 825 nm and 1100 nm was measured, and two-step laser-induced fluorescence was used to characterize the thermalization rate, lifetime, and quantum yield of reverse intersystem crossing of the triplet state.

- R. Adam, M. Currie, R. Sobolewski, O. Harnack, and M. Darula report measurements of the picosecond photoresponse of a current-biased YBCO microbridge coupled to a bicrystal YBCO Josephson junction. Single-pico-second switching of a high-temperature-superconductor Josephson junction was observed, and the junction turn-on delay time was measured. These findings provide confirmation of the potential of YBCO for ultrafast optical and electrical transient detection and processing.

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Editor