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LLE Review

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Contents

In Brief

This volume of the LLE Review, covering the period October–December 1995, contains a description of the generation and characterization of continuous, deep-surface-relief phase plates that are more efficient and versatile than previous designs. The LLE program plan has scheduled a number of enhancements to OMEGA's performance and uniformity, the first of which is the implementation of these new distributed phase plates. Other articles in this volume include the discussion of an x-ray diagnostic method to measure shell-fuel mixing, the theoretical analysis of ablation-front stability, a description of a major subsystem in the OMEGA control system software, a study of the population inversions in intensely pumped Nd:YLF, and a description of a new ultrafast laser system and its uses.

Highlights of the research presented in this issue are

- New continuous phase plates have been manufactured and characterized for use on the OMEGA laser system. These components have demonstrated the ability to couple up to 25% more energy to the target than previous designs, and to operate over a wider range of target diameters.

- A method is proposed to diagnose shell-fuel mixing using x-ray spectroscopy. Emission and absorption lines from dopant material, localized in the target shell, diagnose the extent that shell material has mixed with the fuel of an imploded target.

- Analytic calculations of the stability of ablation fronts subjected to the Rayleigh-Taylor instability are presented. This model assumes an arbitrary power-law dependence of the electron thermal conduction, thus allowing application to both direct and indirect drive. Excellent agreement is demonstrated between the model's growth-rate formula and numerical results for a variety of conditions.

- One of the top-level subsystems in the new control system for the OMEGA laser is the Power Conditioning Executive—the software that controls the power conditioning hardware. It provides interface to the system operators and is responsible for the safe and reliable execution of laser shots.

- To simulate and investigate the intense pumping associated with diode-pumped lasers, a pump-probe experiment has been performed. The results show that, at high population inversions, two-body energy transfer upconversion (ETU) can be a significant loss mechanism for the $^4F_{3/2}$ upper state of the Nd:YLF laser.

- Using commercially available subsystems, a Ti:sapphire laser system has been configured to produce ultrashort pulses that are tunable to a wide region. Using nonlinear optical conversion processes, femtosecond pulses have been produced in the spectral range from the ultraviolet to the infrared, including terahertz pulses. These pulses have been used to perform ultrafast measurements of solid-state media used in optics, electro-optics, and electronics.

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