

LLE Review



Quarterly Report

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In Brief

This volume of the LLE Review, covering the period April–June 1996, contains articles detailing several nonlinear processes associated with lasers and their use, as well as an article describing the computer control systems necessary to maintain and operate a large laser system such as the 60-beam OMEGA laser. The specific topics discussed in this issue include stimulated scattering in laser plasmas, power exchange between interacting laser beams, charged particles interacting with a laser pulse, thermal equilibration of optically excited states, an overview of the laser control system software in OMEGA, and a technique for cancellation of the nonlinear phase accumulation in short-pulse lasers.

Highlights of the research presented in this issue are

- The findings of a series of experiments investigating the stimulated Brillouin backscattered light from long-scale-length laser plasmas. Backscattered light from future long-scale-length ICF plasmas may be significant and affect target coupling. Measurements of the time-resolved backscattered spectra are discussed and analyzed.
- The interaction of multichromatic laser beams in a nonlinear medium. As laser beams enter a hohlraum they overlap in space. The overlapping beams can interact and exchange power among themselves, changing the illumination symmetry conditions. The interaction process is studied both analytically and numerically.
- An analytical study of an electron's motion in the electromagnetic field of a circularly polarized laser pulse in a plasma. It is shown that the electron can be efficiently accelerated and easily extracted from the pulse.
- A new approach in analyzing the relationship between optical emission and absorption of complex systems. This analysis reveals the possibility of extensive lack of thermal equilibrium of the excited electronic states during emission. This is in contradiction to the assumptions of the "universal relationship" introduced by Kennard and Stepanov.
- An overview of the OMEGA laser control system software. With the upgrade of the OMEGA laser to 60 beams, manual control of the system is impossible. Virtually every movable optic in the system is motorized and under computer control. The extensive control system and its implementation are discussed in detail.
- A discussion of the technique for cancellation of the nonlinear phase distortion due to accumulated B -integral. A GaAs plate with a negative nonlinear index of refraction is used to cancel the B -integral accumulated in a regenerative amplifier. The plate is carefully chosen to offset the buildup of the nonlinear phase distortion due to accumulated B -integral. A high degree of success is achieved.

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