IN BRIEF

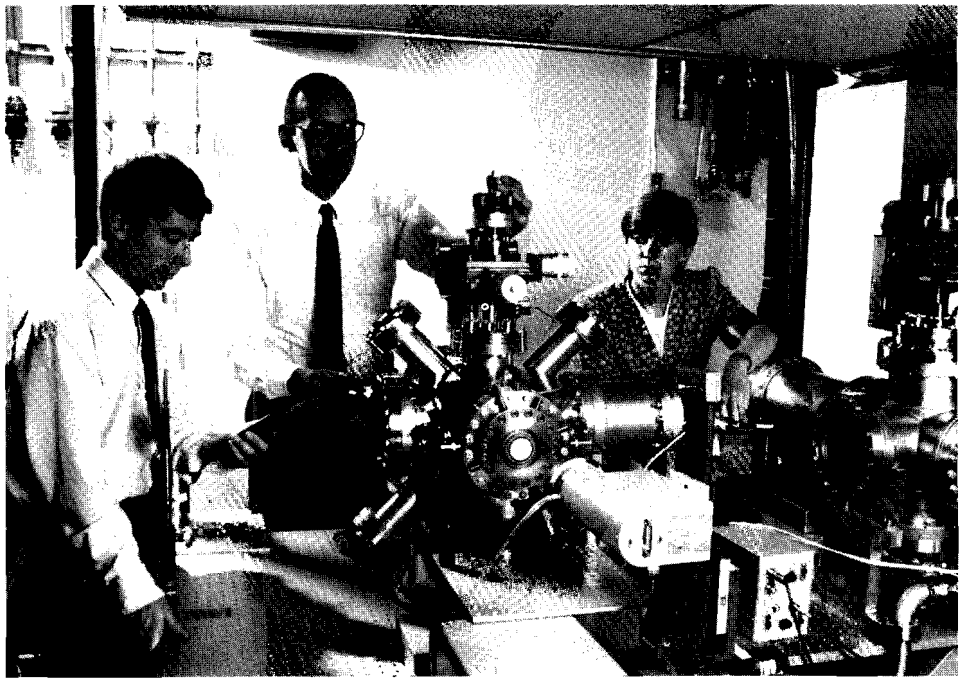
This volume of the LLE Review, covering the period April–June 1990, contains articles in two main sections, (1) Progress in Laser Fusion and (2) Advanced Technology Developments. The first article in Sec. (1) presents the theoretical interpretation of the glass-ablator cryogenic-implosion experiments recently conducted on OMEGA. It is followed by an article describing the analysis of neutron time-of-flight data taken during DT and DD experiments; and a discussion of the improvements to laser diagnostics that now provide for precise control of the OMEGA laser closes out Sec. (1). Section (2) contains a report on the development of transparent conductive coatings for KDP crystals, and a discussion of the study of the transient-surface Debye-Waller effect in materials irradiated with an ultrafast laser.

The highlights of this issue are

- Simulations of direct-drive, high-gain capsule designs have shown that thick, frozen-DT-fuel layers and low-atomic-number ablators are requirements for optimal performance. A series of direct-drive laser-fusion experiments using DT-filled cryogenically cooled glass-ablator capsules has been performed on the OMEGA 24-beam, 351-nm laser system. We present our latest understanding of the observed departures from predicted one-dimensional performance with respect to both neutron yield and ρR_f.

- The fuel-ion temperature for DD and DT target implosions can be determined from the neutron-energy spectrum obtained with a neutron time-of-flight (TOF) detector. A Monte Carlo model method of statistical error analysis has been developed to unfold the neutron-energy spectrum from the observed signal and extract the fuel-ion temperature.
- The current experiments relevant to the demonstration of inertial confinement fusion require that the target driver be capable of precise control. The OMEGA laser has been through a series of improvements allowing the system to be configured for a specific set of target experiments. These improved techniques give a well-characterized and reproducible illumination pattern to an implosion target.
- Several types of electro-optic devices require electrodes that are both optically transparent and electrically conductive. Some devices, such as the longitudinal Pockels cell, require application of a transparent electrode to a thermally sensitive substrate of potassium dihydrogen phosphate (KDP). The applied coating must also have a high laser-damage threshold for the infrared (1054 nm). A technique for depositing transparent conductors using indium-tin oxide (ITO) with ion-assisted deposition (IAD) is described.
- In the study of the interactions of ultrafast lasers with surfaces and the subsequent reactions, a key parameter is the time evolution of the surface temperature. We demonstrate the utilization of picosecond time-resolved reflection high-energy electron diffraction (RHEED) as a surface-lattice temperature probe.

CONTENTS



Dr. Hani Elsayed-Ali, Scientist, assisted by John Herman and Elizabeth Murphy, graduate students, prepares to perform an experiment on surface dynamics when the sample is subjected to a picosecond laser pulse. The top few atomic layers of a single crystal are probed using the technique of picosecond reflection high-energy electron refraction (RHEED), which provides a time-resolved surface temperature probe.