LLE Review Quarterly Report

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In Brief

This volume of the LLE Review, covering the period July–September 1995, includes a description of the first target experiments performed on the upgraded OMEGA laser system. These experiments, carried out to activate and test several diagnostics systems, have demonstrated successful functioning of the overall experimental system and have produced high neutron yields and high core temperatures. Other articles in this volume describe the diagnosis of core conditions using krypton line spectroscopy, a mix model for *LILAC* that can be applied to study the deceleration instability at the pusher-core interface, a simulated-annealing algorithm for improved phase-plate design, a simple method for characterizing the thickness and uniformity of transparent laser-fusion targets, and femtosecond pump-probe experiments on semiconducting YBCO.

Highlights of the research presented in this issue are as follows:

- A series of initial target implosion experiments has been carried out with the upgraded OMEGA laser system. Record neutron yields of 10¹⁴ (corresponding to 1% of scientific breakeven) have been achieved, and high fuel electron and ion temperatures (4 and 13 keV, respectively) have been diagnosed.
- Improved calculations of krypton Stark profiles have been used to refine the diagnostic technique of doping the fuel with small amounts of krypton. Using different doping levels, krypton lines can be used to measure the electron and ion temperatures and the density-radius product of the compressed core.
- A new mix model has been added to the one-dimensional hydrocode *LILAC*. The model describes the evolution of the mixed region near the unstable fuel-pusher interface and is fully incorporated into the hydrodynamics simulation. Calculations using the model support the feasibility of diagnosing mix using thin x-ray-emitting additive layers placed in the pusher near the unstable interface.
- A new simulated-annealing algorithm has been used to design phase plates that generate the desired far-field profile while minimizing wide-angle scattering outside this profile. The flexibility of this algorithm should enable a wide range of phase plates to be designed for a variety of applications.
- A new technique is presented for the characterization of transparent laser-fusion targets. When irradiated with narrow-bandwidth, spatially incoherent light and viewed in a microscope, these shells display self-interference patterns that provide for a rapid assessment of wall thickness and uniformity.
- Femtosecond pump-probe experiments have been carried out to study the electronic structure of semiconducting YBCO. The bandwidth of the O-2*p* band has been measured to be approximately 1.9 eV.

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