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LLE Review

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Contents

In Brief

This volume of the LLE Review, covering April–June 2005, features "High-Density and High-ρR Fuel Assembly for Fast-Ignition Inertial Confinement Fusion" by R. Betti and C. Zhou. In this article (p. 117), the authors optimize implosion parameters for fast-ignition inertial confinement fusion and design fast-ignition targets relevant to direct-drive inertial fusion energy (IFE). It is shown that a 750-kJ laser can assemble fuel with $V_I = 1.7 \times 10^7$ cm/s, $\alpha = 0.7$, $\rho = 400$ g/cc, $\rho R = 3$ g/cm^2, and a hot-spot volume of less than 10% of the compressed core. If fully ignited, this fuel assembly can produce energy gains of 150.

In the second article (p. 122), C. Stoeckl, T. R. Boehly, J. A. Delettrez, V. Yu. Glebov, J. Miller, V. A. Smalyuk, W. Theobald, B. Yaakobi, and T. C. Sangster, along with J. A. Frenje, C. K. Li, R. D. Petrasso, and F. H. Séguin (MIT), S. P. Hatchett (LLNL), and R. B. Stephens (GA) describe recent OMEGA experiments that have studied the fuel assembly of gas-filled, cone-in-shell, fast-ignition targets. Using both fusion products and backlit images, an areal density of ~60–70 mg/cm^2 was inferred for the dense core assembly. The results are promising for successful integrated fast-ignition experiments on the OMEGA EP facility, scheduled to be completed in 2007.

Additional highlights of research presented in this issue include the following:

- D. Jacobs-Perkins, R. E. Earley, S. G. Noyes, M. J. Bonino, L. D. Lund, and R. Q. Gram describe a high-performance "planar" cryogenic target handling system that has been added to LLE's OMEGA Laser Fusion Facility (p. 128). The system has demonstrated a shot-to-shot cycle interval of less than two hours and has fielded more than 125 experiments using several distinct target types. This article provides an overview of the cryogenic capabilities at LLE and then compares operational requirements of LLE's spherical and planar cryogenic systems.

- V. A. Smalyuk, O. Sadot, J. A. Delettrez, D. D. Meyerhofer, S. P. Regan, and T. C. Sangster present nonlinear growth measurements of 3-D broadband nonuniformities near saturation using x-ray radiography in planar foils accelerated by laser light (p. 137). The initial target modulations were seeded by laser nonuniformities and later amplified during acceleration by Rayleigh–Taylor instability.

- W. T. Shmayda describes the significant developments in tritium-capture technology that have occurred over the past two decades (p. 142). The merits and drawbacks of the various technologies that have been developed for both air and inert gas streams are discussed.

- A. V. Okishev, R. G. Roides, I. A. Begishev, and J. D. Zuegel describe an all-solid-state, diode-pumped Nd:YLF laser system that has been developed and tested (p. 155). It produces fiducial timing signals at three wavelengths (fundamental, second, and fourth harmonics) and will be used as a primary timing reference for the OMEGA facility diagnostics. Performance results of the new OMEGA fiducial laser are reported.

- B. Yaakobi, T. R. Boehly, D. D. Meyerhofer, and T. J. B. Collins of LLE and B. A. Remington, P. G. Allen, S. M. Pollaine, H. E. Lorenzana, and J. H. Eggert of LLNL present extended x-ray absorption fine structure (EXAFS) measurements (p. 161). These have been used to demonstrate the phase transformation from body-centered-cubic (bcc) to hexagonal-closely-packed (hcp) iron due to nanosecond, laser-generated shocks. This is a direct, atomic-level, and *in-situ* proof of shock-induced transformation in iron.

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Editor