In Brief

This volume of LLE Review 172 covers the period from July–September 2022. Articles appearing in this volume are the principal summarized results for long-form research articles. Readers seeking a more-detailed account of research activities are invited to seek out the primary materials appearing in print, detailed in the publications and presentations section at the end of this volume.

Highlights of research presented in this volume include:

- J. Baltazar *et al.* develop a technique to diagnose the low- and mid-mode asymmetries in the post-stagnation phase of a deuterium–tritium (DT) cryogenic implosion with the aim of relating the post-stagnation phase measurement to the shell breakup caused by an increase in beam overlap perturbations due to a lower R_b/R_t (p. 1).

- M. J. Rosenberg *et al.* analyze laser–plasma instability mitigation techniques for direct-drive inertial confinement fusion (ICF) by examining stimulated Raman scattering and two-plasmon–decay instabilities, assessing their dependence on density scale length and overlapping laser beam geometry critical to ICF ignition/fusion gain (p. 4).

- A. Shvydky *et al.* propose a new approach in producing uniform beam intensity distributions applied on a sphere for laser-direct-drive ICF system configurations based on mathematical spherical *t* designs to find optimal beam configurations, targeting a reduction of spherical harmonics and nonuniformity modes (p. 7).

- R. K. Follett *et al.* develop a series of test cases for validation of ray-based cross-beam energy transfer (CBET) models against wave-based calculations. Comparisons between various ray-based models show that an etalon integral field reconstruction with a coherent caustic correction and caustic gain truncation is the preferred ray-based CBET model, with equal to improved performance without increasing compuational cost (p. 10).

- T. R. Joshi *et al.* extend the application of the x-ray self-emission imaging technique to polar-direct-drive ICF implosions with cryogenically layered DT targets on OMEGA, diagnosing in-flight asymmetries (p. 13).

- J. R. Davies, P. V. Heuer, and A. F. A. Bott develop an electrostatic particle-in-cell (PIC) algorithm that was compared to algorithms for charged-particle radiography and shadowgraphy used in laser-plasma experiments, deducing a Monge–Ampère code applied as first order, and a PIC code if the Monge–Ampère code fails or requires a subsequent, more-accurate inversion (p. 18).

- A. L. Milder *et al.* present first measurements of the threshold and linear growth rate of the return-current instability driven by electron heat flux, where characterization of the plasma conditions show that the return-current instability occurs concurrently with nonlocal transport (p. 22).

- G. Bruhaug *et al.* present a method to determine the resolution for laser-plasma acceleration electron radiography that include accounting for drive laser image distortions, quantifying plasma-generated electric fields in laser-ablated targets by measuring electron radiography image feature sizes, and estimating field strength needed to produce those features (p. 25).

- V. V. Karasiev *et al.* apply first-principles density functional theory to calculate optical properties (mass-absorption coefficient and opacity) of Cr and Fe at stellar interior temperatures to explore whether *ab initio* calculations can resolve the disagreement between previous atomic physics calculations and measured data (p. 28).

- D. A. Chin *et al.* designed and built two extended x-ray absorption fine structure (EXAFS) flat crystal x-ray spectrometers (EFX's) for high-resolution x-ray spectroscopy over a large energy range with flexible, on-shot energy dispersion calibration capabilities, enabling x-ray absorption near-edge spectroscopy measurements to be made on OMEGA (p. 31).

- J. Cheng *et al.* demonstrate a promising candidate for ultrafast optical/near-infrared to x-ray radiation detector applications with a photodetector sensitive to both optical and x-ray picosecond pulses based on in-house grown cadmium magnesium telluride (Cd,Mg) Te single crystal (p. 34).
- D. Ramsey *et al.* derive exact solutions to Maxwell's equations for the electromagnetic fields of a constant-velocity flying-focus pulse and identified small differences to the paraxial solutions for a wide range of parameters, justifying paraxial solutions for many applications in many regimes, such as a spatiotemporal pulse-shaping technique (p. 38).
- K. R. P. Kafka, T. Z. Kosc, and S. G. Demos assess operational performance limits of optics and aspects required for the development of improved optic designs/reliable operational fluence limits for ultrashort optical performance characterization beyond the standard laser-induced–damage threshold testing system specifications that only characterize the damage-initiation threshold (p. 41).
- E. P. Power *et al*. design, simulate, fabricate, and test a prototype flow-cell, integrated-cooling substrate built using cordierite ceramic and demonstrate average power handling up to 3.88-W/cm^2 absorbed power density with 54-nm peak-to-valley deformation in a sub-aperture test, with a <30 s observed mechanical stabilization time scale (p. 44).
- M. Romo-Gonzalez and R. Boni test a zero *B*-integral pellicle beam splitter composed of uncoated nitrocellulose, having a maximum reflectivity of ∼30% with negligible absorption in the near-infrared (p. 48).
- L. J. Waxer, J. Bromage, and B. E. Kruschwitz provide an overview of the various topics they wrote in the SPIE Spotlight series e-book on petawatt laser systems, introducing the reader to the laser science and technology underpinning petawatt laser systems and technological advances required for state-of-the-art high-intensity laser performance (p. 51).
- R. S. Craxton summarizes the 33rd LLE Summer High School Research Program (p. 54). Sixteen students were invited from Rochester-area high schools to participate in the lab's state-of-the art research environment.
- T. J. Kessler, M. Romo-Gonzalez, and R. Ghosh report on the Broad Exposure to Science and Technology (BEST) Program, a research program designed to engage teachers and students from historically marginalized experiences in various aspects of science and technology that support LLE's laser science and applications research (p. 57).
- J. Puth *et al.* summarize operations of the Omega Laser Facility during the fourth quarter of FY22 (p. 62).
- M. J. Shoup III highlights the groundbreaking and early days of the LLE building expansion (p. 64).
- This volume concludes with the FY22 Laser Facility Report, the FY22 Education Summary, and overviews of the National Laser Users' Facility, Laboratory Basic Science, and LaserNetUS Programs.

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