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LLE Review

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Contents

In Brief

This volume of LLE Review 167 covers the period from April–June 2021. 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:

- T. J. B. Collins *et al.* use 2-D radiation-hydrodynamic modeling of two cryogenic implosions on the OMEGA Laser System to infer the degree of fuel–shell mixing near stagnation (p. 123).
- P. T. Campbell *et al.* use data from two OMEGA EP campaigns to validate extended-magnetohydrodynamic models that include both nonlocal suppression of Biermann battery field generation and radiation transport (p. 127).
- P. V. Heuer *et al.* adapt the magnetized liner inertial fusion platform on OMEGA to observe suppression of self-generated magnetic fields in a cylindrical implosion geometry (p. 131).
- A. Colaïtis *et al.* compare the new fluid-scale laser model *IFRIIT* to direct-drive implosion experiments on OMEGA, showing excellent agreement with neutron data in the presence of various sources of 3-D effects (cross-beam energy transfer, beam imbalance, target misalignment, etc.) (p. 134).
- A. Lees *et al.* experimentally infer scaling laws for fusion yields on OMEGA by examining 177 shots and find that optimal yield is obtained for shots with adiabat >4.5 and low in-flight aspect ratio (p. 137).
- A. Shvydky *et al.* examine shock release in radiation-hydrodynamic models and compare to laser-driven CH shells on OMEGA EP (p. 141). Modeling shows the shock released from the back surface of the foil is strongly dependent on conditions immediately preceding shock breakout.
- A. Tentori *et al.* use a planar target experiment on OMEGA EP to characterize the hot-electron source and shock dynamics relevant to the shock-ignition inertial confinement fusion scheme, and find that the presence of hot electrons increases shock pressure by 25 Mbar up to a peak of 150 Mbar (p. 144).
- A. M. Saunders *et al.* create intersecting laser-driven tin microjets on OMEGA EP and observe no interaction for jets driven by 11.7-GPa shock pressures, while jets driven by 116-GPa shock pressures show collisions between jet particles resulting in velocity reduction, angular spread, and cloud formation (p. 147).
- P. Franke *et al.* propose a scheme to use laser pulses with shaped space–time and transverse intensity profiles (flying focus) to drive optical shocks for self-photon acceleration while avoiding group velocity walkoff and dispersion, resulting in dramatic self-steepening and spectral broadening into a multi-octave spectrum supporting pulses with duration <400 as (p. 150).
- D. Ramsey *et al.* describe nonlinear Thomson scattering with ponderomotive control—an adaptation of flying focus that shapes a single laser pulse to have a backward-propagating intensity peak at focus, driving electron acceleration counter to the phase velocity of the incoming laser pulse (p. 153).
- Y. Zhang *et al.* simulate kinetics of a magnetized collisionless shock formation using realizable parameters from the magneto-inertial fusion electrical discharge system (MIFEDS) on OMEGA EP and show shocks are collisionless and formed by a modified two-stream instability (p. 155).

- H. G. Rinderknecht *et al.* derive analytical scaling laws for the radiative properties of magnetic filaments, compare with 3-D particle-in-cell simulations, and describe initial experiments using the Texas Petawatt Laser System. Magnetic filaments are observed on two of eight laser shots, in line with the statistical likelihood of observation (p. 159).

- D. N. Polsin performs simultaneous x-ray diffraction and reflectivity measurements on ramp-compressed sodium using the OMEGA EP laser and observes the *hP4* phase at 480 GPa and ~3000 K, implying electride formation is possible on nanosecond time scales and at higher temperatures (p. 162).

- V. V. Karasiev *et al.* report on large-scale *ab initio* molecular-dynamics simulations elucidating the subcritical character of the insulator–metal transition in warm dense liquid hydrogen (p. 166).

- S. F. Nwabunwanne and W. R. Donaldson report on a new generation of fast UV photodiodes using $Al_xGa_{1-x}N$ substrates. Measurements show a bias-voltage–independent external quantum efficiency of 1198% at 19.5 V and mobility suitable for 1.31-ps response time (p. 170).

- J. Zhang, W. R. Donaldson, and G. P. Agrawal develop a frequency-domain transfer-matrix approach to solving temporal reflection and refraction at a temporal boundary with finite rise time and find that total internal reflection can occur even for shallow boundaries (p. 173).

- J. Zhang, W. R. Donaldson, and G. P. Agrawal calculate that a temporal analog of a Fabry–Perot resonator can be formed using two moving temporal boundaries inside a dispersive medium (p. 175).

- J. Bromage *et al.* report first light on the MTW-OPAL (Multi-Terawatt optical parametric amplifier line) Laser System, demonstrating 7.3-J, 19.7-fs pulses with 30%±1.4% pump-to-signal efficiency in the final amplifier (p. 177).

- G. W. Jenkins, C. Feng, and J. Bromage derive an analytical model for angular alignment tolerance in divided-pulse nonlinear compression and match with experiment (p. 180).

- S. Rai *et al.* perform a length-scale analysis on oceanographic satellite data and find that wind kills mesoscale eddies at an average rate of 50 GW (p. 182).

- J. Frenje *et al.* report on the 12th Omega Laser Facility Users Group Workshop, held virtually from 27–30 April 2021 (p. 184).

- J. Puth *et al.* summarize operations of the Omega Laser Facility during the third quarter of FY21 (p. 187).

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Editor