About the Cover:

Top left: LLE has deployed 3-D printing techniques to produce a variety of target components to support the large Omega User Community. Shown here is the 3-D–printed vibration absorber attached to the printer support structure. The vibration absorber can protect future fill-tube cryogenic targets from vibrations caused when the protective shroud is quickly retracted to expose the target to laser beams.

Top right: Shot number 100,000 is a historic marker of the productivity and longevity of the 60-beam OMEGA Laser System. The OMEGA shot counter has cycled the "state machine" through all shot types from laser system shots to diagnostic timing test shots to target physics shots. The OMEGA 100,000th shot marks the 33,374th target shot, which means that more than 33% of the total were for target physics. This milestone shot was conducted during a high-energy-density (HED) campaign (CyLDRT-21A) led by Los Alamos National Laboratory. Shown is the shot image and a group photo of the operations team.

Middle left: LLE's expertise in fusion research and instrumentation is well recognized by the community including industry. Shown here is the LLE neutronic lab that provided testing and calibration of neutron detector prototypes developed by NK Labs for muon catalyzed fusion experiments. This work was supported by ARPA-E (DOE's Advanced Research Project Agency–Energy).

Middle center: LLE completed the multiyear OMEGA crygenic pump isolation project (shown in the picture). The new system has reduced the vibrations imparted to the OMEGA target chamber by a factor of 30 compared to the old system. In addition, the new system has noticeably damped the vibration from the pumps transmitted to the rest of the facility.

Middle right: LLE Horton graduate student John J. Ruby (Ph.D. 2021) was awarded the prestigious Lawrence Fellowship from Lawrence Livermore National Laboratory. During his gradate research at LLE, Ruby built models of the physical system and combined them with Bayesian inference techniques to extract information from integrated HED physics experimental measurements to self-consistently inform the underlying physical models (sample case is shown here).

Bottom left: LLE Horton graduate student Connor Williams developed a novel laser-fusion target design with a temporally shaped laser pulse to achieve record fusion yield for direct-drive cryogenic DT implosions on OMEGA. His initial design yielded 220 trillion fusion reactions—a new facility record for fusion yield on 17 June 2021. Follow-on experiments also designed by Connor with the most-optimized target specifications surpassed the 300 trillion fusion reaction in November 2021.

Bottom right: LLE developed an in-house UV fluorescence microscope that captures the images in the inset showing a dielectric material monolayer and a network of absorbing defect structures formed inside the layer. Such absorbing structures are believed to lower the laser-induced–damage performance of optical components used in high-power laser systems. Understanding the defects' distributions and how to control them is critical for developing optical components that exhibit higher resistance to laser damage and, ultimately, increase the power output of such systems.

The work described in this volume includes current research at the Laboratory for Laser Energetics, which is supported by New York State Energy Research and Development Authority, the University of Rochester, the U.S. Department of Energy Office of Inertial Confinement Fusion under Cooperative Agreement No. DE-NA0003856, and other agencies.

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Prepared for
U.S. Department of Energy
Albuquerque Service Center
DOE/NA/3856-1688

Distribution Category
October 2020–September 2021

Printed in the United States of America
Available from
National Technical Information Services
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
www.ntis.gov