

LLE Review

Quarterly Report



Contents

DIRECTOR'S REMARKS	iii
IN BRIEF	vii
INERTIAL CONFINEMENT FUSION	
Diagnosing Low-Mode ($\ell < 6$) and Mid-Mode ($6 \leq \ell \leq 60$) Asymmetries in the Post-Stagnation Phase of Cryogenic Implosions on OMEGA.....	1
Effect of Overlapping Laser Beams and Density Scale Length in Laser–Plasma Instability Experiments on OMEGA EP	4
Optimization of Irradiation Configuration Using Spherical t Designs for Laser-Direct-Drive Inertial Confinement Fusion.....	7
Validation of Ray-Based Cross-Beam Energy Transfer Models	10
Diagnosis of the Imploding Shell Asymmetry in Polar-Direct-Drive Deuterium–Tritium Cryogenic Target Implosions on OMEGA	13
PLASMA AND ULTRAFAST PHYSICS	
Quantitative Proton Radiography and Shadowgraphy for Arbitrary Intensities.....	18
Direct Measurement of the Return-Current Instability	22
Analysis Methods for Electron Radiography Based on Laser-Plasma Accelerators.....	25
HIGH-ENERGY-DENSITY PHYSICS	
A First-Principles Study of L-Shell Iron and Chromium Opacity at Stellar Interior Temperatures	28

DIAGNOSTIC SCIENCE AND DETECTORS

High-Resolution X-Ray Spectrometer for X-Ray Absorption	
Fine Structure Spectroscopy.....	31
(Cd,Mg)Te Crystals for Picosecond-Response Optical-to-X-Ray Radiation Detectors	34
Exact Solutions for the Electromagnetic Fields of a Flying Focus	38

LASER TECHNOLOGY AND DEVELOPMENT

Methods and Apparatus for Comprehensive Characterization of Performance	
Attributes and Limits of Ultrafast Laser Optics	41
Design and Demonstration of the “Flow-Cell” Integrated-Flow, Active-Cooling Substrate for High-Average-Power Substrates.....	44
Free-Standing Thin-Membrane, Zero <i>B</i> -Integral Beam Splitters.....	48

EDUCATION AND OUTREACH

Petawatt Laser Systems	51
LLE’s Summer High School Research Program.....	54
2022 BEST Student and Teacher Research Program	57

LASER FACILITY

FY22 Q4 Laser Facility Report	62
Groundbreaking for the LLE Building Expansion.....	64

ANNUAL REPORTS

FY22 Laser Facility Report	67
Education Summary	71
External Users’ Programs.....	79
FY22 National Laser Users’ Facility Program.....	83
FY22 Laboratory Basic Science Program.....	126
FY22 LaserNetUS Program	156

PUBLICATIONS AND CONFERENCE PRESENTATIONS

162