## **PROCEEDINGS OF SPIE**

# Optical Technologies for Inertial Fusion Energy

**Stavros G. Demos Carmen S. Menoni** *Editors* 

27–29 January 2025 San Francisco, California, United States

Sponsored by SPIE

Published by SPIE

Volume 13358

Proceedings of SPIE 0277-786X, V. 13358

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings: Author(s), "Title of Paper," in *Optical Technologies for Inertial Fusion Energy*, edited by Stavros G. Demos, Carmen S. Menoni, Proc. of SPIE 13358, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X ISSN: 1996-756X (electronic)

ISBN: 9781510684645 ISBN: 9781510684652 (electronic)

Published by **SPIE** P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) SPIE.org Copyright © 2025 Society of Photo-Optical Instrumentation Engineers (SPIE).

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.



**Paper Numbering:** A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

• The first five digits correspond to the SPIE volume number.

• The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

#### Contents

- v Conference Committee
- vii Introduction

#### **CURRENT APPROACHES TO LASER FUSION ENERGY**

- 13358 02 Status and prospects for inertial fusion energy via lasers (Invited Paper) [13358-1] 13358 03 Laser driver development efforts towards direct drive short pulse ignition (Invited Paper) [13358-2] 13358 04 Bridging the laser technology gap: advancing towards commercial direct drive inertial fusion energy (Invited Paper) [13358-3] 13358 05 Recent progress for commercializing IFE based on a novel high efficiency 10MJ laser and high-gain fuel target (Invited Paper) [13358-4] 13358 06 Longview fusion energy systems: commercializing laser fusion by building on the historic success at the National Ignition Facility (Invited Paper) [13358-6] NOVEL OPTICAL COMPONENTS AND DESIGNS 13358 07 Modeling of a plasma mirror: laser ablation of material and the optical effects of ionized fluids [13358-9] 13358 08 Experimental creation of volume diffraction gratings in ozone using interfering ultraviolet lasers [13358-10] 13358 09 Large aperture metasurfaces for the next generation of high-energy lasers [13358-11] 13358 0A Laser damage behavior of a gallium alloy liquid metal mirror as a function of pressure [13358-12]
- 13358 OB Anti-reflection structured surfaces (ARSS) on Lithium triborate (LBO): need, challenges, and recent successes [13358-14]

### THE 50 YEARS OF MATERIAL AND LASER TECHNOLOGIES DEVELOPMENT AND LESSONS LEARNED I

13358 0C **50**-years of laser glass development leading to the national ignition facility: a template for assessing inertial-fusion-energy laser drivers (Invited Paper) [13358-17]

13358 0D	The advent of third-harmonic-generation laser systems: personal recollections (Invited Paper) [13358-19]
13358 OE	Advancements in high fluence multilayer dielectric gratings for ultrafast lasers (Invited Paper) [13358-20]
13358 OF	Injection laser system architecture, upgrades, and future at the National Ignition Facility (Invited Paper, Sustainability Best Paper Award in LASE) [13358-21]
	THE 50 YEARS OF MATERIAL AND LASER TECHNOLOGIES DEVELOPMENT AND LESSONS LEARNED II
13358 0G	Lessons learned and ongoing research at Electra: a rep-rate excimer laser facility (Invited Paper) [13358-22]
13358 OH	Development of high energy and high average power diode pumped laser drivers for inertial fusion energy systems (Invited Paper) [13358-23]
	SIMULATIONS AND PROOF OF CONCEPT EXPERIMENTS
13358 01	Simulations and modeling for high power lasers (Invited Paper) [13358-24]
13358 OJ	Characterization of ablator dynamics initiated by picket-pulse conditions [13358-29]