

PROCEEDINGS OF SPIE

# ***AOPC 2023: Laser Technology and Applications; and Optoelectronic Devices and Integration***

**Pu Zhou**  
**Jianguo Liu**  
*Editors*

**25–27 July 2023**  
**Beijing, China**

*Sponsored by*  
Chinese Society for Optical Engineering (CSOE) (China)

*Technical Sponsor*  
SPIE

*Organized by*  
Laser Technology Committee, CSOE (China)  
Infrared Technology Committee, CSOE (China)  
THz Technology Committee, CSOE (China)  
Imaging and Detection Technology Committee, CSOE (China)  
Advanced Optical Manufacturing Youth Expert Committee, CSOE (China)

*Published by*  
SPIE

**Volume 12959**

Proceedings of SPIE 0277-786X, V. 12959

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 [SPIDigitalLibrary.org](http://SPIDigitalLibrary.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 *AOPC 2023: Laser Technology and Applications and Optoelectronic Devices and Integration*, edited by Pu Zhou, Jianguo Liu, Proc. of SPIE 12959, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

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

ISBN: 9781510672246  
ISBN: 9781510672253 (electronic)

Published by  
**SPIE**  
P.O. Box 10, Bellingham, Washington 98227-0010 USA  
Telephone +1 360 676 3290 (Pacific Time)  
[SPIE.org](http://SPIE.org)

Copyright © 2023 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](http://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.

**SPIE. DIGITAL  
LIBRARY**  
[SPIDigitalLibrary.org](http://SPIDigitalLibrary.org)

---

**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

vii *Conference Committee*

## LASER TECHNOLOGY AND APPLICATIONS

---

- 12959 02 **The control of fast nonlinear growth in picosecond laser** [12959-1]
- 12959 03 **A mathematical model for high precision laser beam figuring of fused silica based on densification effect** [12959-2]
- 12959 04 **Quantitative analysis of coal industrial index based on data set partitioning method** [12959-3]
- 12959 05 **Design of a multi-laser module for optical pumping in compact atomic gyroscopes** [12959-5]
- 12959 06 **Power ratio measurement of dual wavelength dye laser with picometer-level wavelength difference** [12959-6]
- 12959 07 **Simulation study on thermal damage of triple-junction GaAs solar cell under laser irradiation** [12959-7]
- 12959 08 **Research on laser threat to satellite** [12959-10]
- 12959 09 **Comparative study on damage characteristics of triple-junction GaAs solar cell irradiated by pulsed laser in different environments** [12959-11]
- 12959 0A **Design of HUST-UED femtosecond laser delivery system** [12959-13]
- 12959 0B **Research on failure mechanism of high-power tapered semiconductor laser** [12959-14]
- 12959 0C **Simulation research on coherent detection of pulsed laser based on LFM** [12959-15]
- 12959 0D **Analysis and exploration of spatial and spectral information with small-footprint hyperspectral lidar returns** [12959-16]
- 12959 0E **Low-cost fixed-angle ground-based lidar integration with point cloud registration** [12959-17]
- 12959 0F **Design on amplitude control circuit for DDS signal source based on AD9834** [12959-19]
- 12959 0G **Design of driving and temperature control circuitry for VCSEL** [12959-20]
- 12959 0H **Study on nanosecond pulse laser propulsion microspheres based on a tapered optical fiber in water environment** [12959-21]

- 12959 OI **Experimental study on the irradiation effect of fiber CW laser on three junction GaAs solar array** [12959-22]
- 12959 OJ **Generation of bound solitons in a synchronized bidirectional passively mode-locked all-fiber ring laser** [12959-23]
- 12959 OK **Optical design of speckle suppression in laser measurement system** [12959-24]
- 12959 OL **Production, characteristics, and biological effects of protonated small water clusters** [12959-25]
- 12959 OM **Ultrafast pulse generation via magnetic topological insulator  $\text{MnBi}_2\text{Te}_4$  nanosheets** [12959-26]
- 12959 ON **Measurement method for the key terminal ballistic parameters of the supersonic projectile using the sparse distribution detector array** [12959-27]
- 12959 OO **Research on folding and inflation process of the drag balloon deorbit device** [12959-29]
- 12959 OP **Commercialization analysis of on-orbit servicing for spacecraft** [12959-30]
- 12959 OQ **Study on green picosecond laser machining quality of carbon fiber reinforced polymers** [12959-31]
- 12959 OR **Annular sampling cylindrical vector beam polarization measurement error analysis based on the Stokes parameter method** [12959-32]
- 12959 OS **Research on INS/LDV integrated navigation aided by geomagnetic matching** [12959-33]
- 12959 OT **1319 nm single-frequency injection seeded Q-switched laser based on ramp-hold-fire** [12959-34]
- 12959 OU **Enhanced signal-to-noise ratio of array imaging using quantum state engineering** [12959-35]
- 12959 OV **Design and implementation of PPM modulation and demodulation algorithm in atmospheric turbulence channel** [12959-36]
- 12959 OW **A differential low noise photodetector module and its application in high precision fiber optic gyroscope** [12959-37]
- 12959 OX **Design of rectangular gold-coated fused silica gratings with high diffraction efficiency for femtosecond pulse compression** [12959-38]
- 12959 OY **Research on vortex lens based on full dielectric cross-shaped antenna** [12959-39]
- 12959 OZ **Diffusion of electron clouds in high-speed ultraviolet photonic imaging detectors** [12959-44]
- 12959 IO **Analysis of the current development status and future trends of on-orbit servicing technology globally** [12959-45]

- 12959 13 **10 kHz high-power widely tunable dual-end pumped Ti:sapphire laser** [12959-48]
- 12959 14 **Performance analysis of dual-frequency coherent lidar for rough target detection in turbulent atmosphere** [12959-49]
- 12959 15 **A digital representation algorithm for long distance transmission laser spot energy intensity distribution** [12959-50]
- 12959 16 **A novel coherent beam combining system based on active polarization-and-phase control** [12959-51]
- 12959 17 **Abnormal residual pump behavior in homemade DSCCP fiber** [12959-52]
- 12959 18 **Impact of mode instability on polarization extinction ratio in backward pumped fiber amplifiers** [12959-53]
- 12959 19 **Optimization and far-field characteristic of metal/dielectric coated circular semiconductor nano-lasers** [12959-54]
- 12959 1A **Development trend and integrated design of liquid launch vehicle** [12959-55]
- 12959 1B **Micro-mirror select and angle set algorithm of freeform pupil illumination systems in immersion scanners** [12959-56]
- 12959 1C **High power 780nm single emitter with 16W and bar with 180W of continuous-wave output laser diodes** [12959-57]
- 12959 1E **Simulation of thermal focal length of conduction cooling end-pumped slab laser amplifier** [12959-61]
- 12959 1F **Development of measurement technology for high energy laser beam quality  $\beta$  factor** [12959-62]
- 12959 1G **Simulation of thermal stress on soldering surface of conduction cooling end-pumped slab laser amplifier** [12959-63]
- 12959 1H **Study on green picosecond laser machining quality of carbon fiber reinforced polymers** [12959-64]

---

#### OPTOELECTRONIC DEVICES AND INTEGRATION

- 12959 1I **Thermally tunable high Q-factor and low-power silicon resonators using graphene transparent electrodes** [12959-4]
- 12959 1J **Research on high precision control algorithm** [12959-9]
- 12959 1K **Optimization of energy storage welding packaging process for special optoelectronic devices** [12959-12]

- 12959 1L **Effect of SrO, ZrO<sub>2</sub> on ion bombardment-resistant for the lead-silicate glass-based microchannel plate** [12959-65]
- 12959 1M **Lifetime properties of microchannel plate based on the (SrO, ZrO<sub>2</sub>) doped lead-silicate glass** [12959-66]
- 12959 1N **Direction discrimination of laser Doppler velocimetry system based on acousto-optic frequency shifter** [12959-67]
- 12959 1O **Photonic circuit design of adaptive two-wave mixing photorefractive interferometer** [12959-68]
- 12959 1P **Target flow field reconstruction based on dual tree complex wavelet transform and optical flow** [12959-69]
- 12959 1Q **A synaptic phototransistor for image processing and memory** [12959-70]