

PROCEEDINGS OF SPIE

# ***Sixteenth National Conference on Laser Technology and Optoelectronics***

**Weibiao Chen  
Jianrong Qiu  
Pu Wang  
Zhenxi Zhang  
Jianqiang Zhu**  
*Editors*

**3–6 June 2021  
Shanghai, China**

*Technical Co-Sponsor and Publisher*  
SPIE

**Volume 11907**

Proceedings of SPIE 0277-786X, V. 11907

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 *Sixteenth National Conference on Laser Technology and Optoelectronics*, edited by Weibiao Chen, Jianrong Qiu, Pu Wang, Zhenxi Zhang, Jianqiang Zhu, Proc. of SPIE 11907, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510646636

ISBN: 9781510646643 (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 © 2021 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

## ADVANCED SOLID-STATE LASERS AND NEW LASERS

---

- 11907 02 **Spatial characteristics of nonlinear Thomson scattering from tightly focused single-cycle laser pulse with varied initial phases** [11907-2]
- 11907 03 **Generation of a quasi-monochromatic x-ray via collision of electron with tightly focused laser pulses** [11907-3]
- 11907 04 **Measurement of distributed refractive index through Rayleigh backscattering spectra detection using a U-bent common fiber** [11907-4]
- 11907 05 **Influence of electron's initial position on space radiation of a high-energy electron interacting with linearly polarized tightly focused laser** [11907-6]
- 11907 06 **Effect and mechanism of initial phase on electron radiation under linearly polarized Gaussian laser pulse** [11907-7]
- 11907 07 **Influence of different pulse width on electron emission characteristics driven by circularly polarized intense laser** [11907-8]
- 11907 08 **Hybrid mode-locked wavelength tunable semiconductor laser based on optoelectronic feedback** [11907-9]
- 11907 09 **Effect of polarization parameters on electron motion and radiation characteristics under intense laser field** [11907-10]
- 11907 0A **Radiation spectrum characteristics of circularly polarized laser colliding electrons at different intensities** [11907-11]
- 11907 0B **Radiation characteristics of single and double peak pulses produced by a high energy electron head-on colliding with an intense laser pulse** [11907-13]
- 11907 0C **Suppression RIN of CW fiber laser by nonlinear absorption effect** [11907-14]
- 11907 0D **Graphene-coated gold nanotubes based surface plasmon resonance fiber biosensor** [11907-16]
- 11907 0E **Dynamic multiple beam forming based on the fiber laser phased array** [11907-17]
- 11907 0F **Numerical research on thermal effect of photodiode damaged by nanosecond pulsed laser** [11907-18]
- 11907 0G **Research on stability of laser-sustained pulsed plasma thruster** [11907-19]
- 11907 0H **Surface micromorphology of poly-ether-ether-ketone with pulse laser surface modification** [11907-20]

- 11907 0I **Periodic intensity fluctuations in spatiotemporal mode-locked lasers** [11907-22]
- 11907 0J **Distributed Brillouin temperature sensing based on single-photon detector in optical fiber** [11907-23]
- 11907 0K **The development for a mixed static LiDAR system with SiPM detecting technology** [11907-24]
- 11907 0L **Orbital angular momentum detection of vortex beam based on diffraction grating** [11907-25]
- 11907 0M **Analysis of propagation characteristics of Gaussian beam in weakly compressible flow** [11907-26]
- 11907 0N **Depth imaging through realistic fog using Gm-APD Lidar** [11907-27]
- 11907 0O **Multilevel filtering image denoising algorithm based on edge information fusion** [11907-28]
- 11907 0P **Ultraviolet radiation characteristics of NO in shock layer of hypersonic vehicle** [11907-29]
- 11907 0Q **Influence of hybrid laser and shaped tube electrochemical machining by using retracted electrode** [11907-30]
- 11907 0R **Characterizations of the kaolin analyzed by terahertz time-domain spectroscopy** [11907-31]
- 11907 0S **Recognition of underwater moving submarine based on lidar intensity image** [11907-32]
- 11907 0T **3D printing a Faraday anomalous dispersion optical filter housing** [11907-33]
- 11907 0U **Sub-aperture field of view mismatch in differential synthetic aperture lidar** [11907-34]
- 11907 0V **Study on the influence of target parameters on the mechanical properties of laser propulsion** [11907-35]
- 11907 0W **Blood identification of NIR spectroscopy based on BP neural network combined with particle swarm optimization** [11907-37]
- 11907 0X **Research on femtosecond infrared laser cutting 4H-SiC wafer** [11907-38]
- 11907 0Y **Study the effect of single pulse energy on surface roughness of aluminum alloy by laser marking** [11907-39]
- 11907 0Z **Parameters optimization of short pulse laser milling Inconel 718 laser deposition manufacturing parts** [11907-41]
- 11907 10 **Study on the effect of picosecond laser cleaning on the performance of CFRTS-titanium alloy laser joint** [11907-44]
- 11907 11 **Review of terahertz nonreciprocal devices based on gyrotropic material InSb** [11907-46]

- 11907 12 **Theoretical study on the self-healing property of cotangent phase modulated RAiGV** [11907-50]
- 11907 13 **Study on propagation property of self-focusing pin-like beams** [11907-52]
- 11907 14 **Optimization of the epitaxial structure of low-loss 885nm high-power laser diodes** [11907-53]
- 11907 15 **Tuning of opto-electronic properties of SiC by laser irradiation** [11907-54]
- 11907 16 **Raman analysis of the microstructures of nano-silicon coatings grown on different substrates** [11907-55]
- 11907 17 **1kHz, Er<sup>3+</sup>/Yb<sup>3+</sup>: glass passively Q-switched microchip laser with long time stable operation** [11907-57]
- 11907 18 **Giant and tunable Goos-Hänchen shifts with a surface plasmon resonance structure** [11907-58]
- 11907 19 **Optical Magnus effect by transverse orbital momentum currents in reflection** [11907-59]
- 11907 1A **The influence of sample porosity on refractive index in THz non-destructive testing** [11907-60]
- 11907 1B **Variable polarization processing based on femtosecond laser** [11907-61]
- 11907 1C **Large inner diameter carbon nanotubes hybrids for intracellular drug delivery and imaging** [11907-63]
- 11907 1D **Research on 3D high speed precision machining of sapphire based on femtosecond laser** [11907-64]
- 11907 1E **Effect of UV irradiation on photo-thermo induced nucleation of PTR glass** [11907-65]
- 11907 1F **Optimization of diffusion bonding process for QPM GaAs crystals** [11907-66]
- 11907 1G **Experimental study on micro texture processed by coaxial water assisted laser processing** [11907-67]
- 11907 1H **Root hump defect monitoring of high power fiber laser thick plate welding based on the character of keyhole and molten pool** [11907-68]
- 11907 1I **Dissipative soliton pulsation in a Mamyshev oscillator** [11907-69]
- 11907 1J **Numerical demonstration of a multistage cascaded Raman soliton shift structure in mid-infrared region** [11907-70]
- 11907 1K **Study on laser coloring and color erasing-rewriting of TC4 surface** [11907-71]
- 11907 1L **Research on hundred-watt level megahertz femtosecond pulse laser based on rod-type photonic crystal fiber** [11907-72]

- 11907 1M **Nonlinear dynamics in direct-connected twin circular-sided square microcavity lasers with mutual optical injection** [11907-73]
- 11907 1N **Investigation on the generation of laser chaos based on dual-mode microsquare laser with optical feedback** [11907-74]
- 11907 1O **Quantitative analysis of organics based on terahertz frequency-domain spectroscopy** [11907-75]
- 11907 1P **Large dynamic range and high sensitive signal detection technology of spaceborne laser altimeter** [11907-76]
- 11907 1Q **Novel four-step phase shifting algorithm based on the products of sines and cosines** [11907-77]
- 11907 1R **Preparation of superhydrophobic surface by laser ablation-chemical etching process on stainless steel** [11907-79]
- 11907 1S **Simulation of energy distribution of water guided laser in different morphological water column** [11907-80]
- 11907 1T **Experimental study on infrared water guided laser cutting of 7075 aluminum alloy** [11907-81]
- 11907 1U **Microstructure and mechanical properties of in-situ MC-reinforced CoCrMoNbTi high-entropy alloy coating by laser additive manufacturing** [11907-82]
- 11907 1V **Numerical simulation of phase noise in hybrid square-rectangular lasers** [11907-85]
- 11907 1W **Experimental study of surface quality during coaxial water-jet assisted nanosecond laser drilling** [11907-86]
- 11907 1X **118 nm-wavelength-tunable Er<sup>3+</sup>-doped ZBLAN passively mode-locked fiber laser** [11907-87]
- 11907 1Y **Femtosecond-laser-inscribed Fiber Bragg grating array for quasi-distributed high-temperature sensing** [11907-88]
- 11907 1Z **Absolute wavelength measurement of 633nm iodine stabilized He-Ne laser** [11907-89]
- 11907 20 **Research on polishing process of aluminum alloy curved surface by nanosecond laser beam coupling** [11907-90]
- 11907 21 **Influence of atmospheric turbulence on tracking performance of LIDAR and validation of vacuum experiment** [11907-92]
- 11907 22 **Optical digital-to-analog conversion based on weighted fiber coupler** [11907-93]
- 11907 23 **Research on parameters of micro-optical elements on quartz surface by femtosecond laser processing** [11907-94]
- 11907 24 **A satellite photon-counting laser altimeter calibration algorithm using CCRs and indirect adjustment** [11907-95]

- 11907 25 **Processing study of laser marking on Si wafer** [11907-96]
- 11907 26 **Estimation of atmospheric turbulence intensity based on deep learning** [11907-98]
- 11907 27 **Dual-band terahertz biosensor based on metamaterial absorber** [11907-99]
- 11907 28 **Study on the characteristics of underwater target laser echo based on pulse broadening** [11907-100]
- 11907 29 **Feedback-type wavefront shaping multi-point light focusing technology based on phase superposition algorithm** [11907-101]
- 11907 2A **Pulse shape controlled MOPA fiber laser for marking of Si wafer** [11907-102]
- 11907 2B **Multi-wavelength Q-switched random fiber laser based on stimulated Brillouin scattering and multimodal interference** [11907-105]
- 11907 2C **Study on the process of laser marking for silicon wafer by 1060nm-MOPA laser** [11907-106]
- 11907 2D **Experimental investigation on dark solitons formation in Figure-9 Yb doped fiber laser** [11907-107]
- 11907 2E **Fourteen-core dual-mode fiber with low bending loss and large mode area** [11907-108]
- 11907 2F **Imbert-Fedorov shifts in anisotropic two-dimensional atomic crystals** [11907-111]
- 11907 2G **84 fs Yb-doped fiber nonlinear amplifier** [11907-112]
- 11907 2H **Research on multi-point light focusing based on complex neural network** [11907-115]
- 11907 2I **Quantitative assessment of anastomotic leakage in colorectal cancer by second-harmonic generation microscopy** [11907-116]
- 11907 2J **High fidelity image reconstruction of light passing through scattering medium based on convolutional neural network** [11907-118]
- 11907 2K **Generation of two types of pulses in a thulium-doped fiber laser** [11907-119]
- 11907 2L **Extraction of forward small angle particle scattering light pulse signal based on variable forgetting factor RLS algorithm** [11907-121]
- 11907 2M **2H-MoTe<sub>2</sub>-based passively Q-switched ytterbium-doped fiber laser** [11907-122]
- 11907 2N **Generation and manipulation for high-order catastrophe swallowtail beams** [11907-123]
- 11907 2O **Real-time detection of atmospheric fine particle mass concentration based on laser forward small angle scattering** [11907-126]

- 11907 2P **Reconstruction of infrared digital holography based on compressed sensing** [11907-127]
- 11907 2Q **Effect of laser remelting on microstructure and mechanical property of AlCoCuFeNi high entropy alloy fabricated by laser additive manufacturing** [11907-128]
- 11907 2R **Experimental research on pedestrian detection using LiDAR** [11907-130]
- 11907 2S **General calculation of transmission characteristics of programmable photonic integrated waveguide mesh** [11907-131]
- 11907 2T **Research and simulation analysis of laser ranging technology based on pulse compression** [11907-132]
- 11907 2U **Aerosol optical characteristics and influencing factors in the southern suburb of Xi'an** [11907-133]
- 11907 2V **Improve the performance of 2 $\mu$ m GaSb-based high-power lasers by reducing the thermal effect of series resistance** [11907-134]
- 11907 2W **Research on the linearity degradation caused by noise in microwave photonic temperature sensor with fiber ring structure** [11907-136]
- 11907 2X **Effect of laser shock peening and heat-treated on surface hardness of Ti-6Al-4V** [11907-146]
- 11907 2Y **Development of metrology and calibration device for ophthalmic optical instruments: fundus cameras** [11907-148]
- 11907 2Z **Simulation of time-stretched photon Doppler velocimetry** [11907-155]
- 11907 30 **TAG magneto-optic ceramics and its application in high power optical isolators** [11907-153]
- 11907 31 **High-resolution 3D imaging with a low-pixel APD array through multi-beam scanning of fiber-type OPA** [11907-157]
- 11907 32 **A method for determining laser pointing of spaceborne laser rangefinder and error analysis** [11907-158]
- 11907 33 **Optical properties of adult zebrafish brain detected by optical coherence tomography and photoacoustic imaging in vivo** [11907-159]
- 11907 34 **In-vivo characterization of zebrafish bone degradation and regeneration models by optical coherence tomography** [11907-160]
- 11907 35 **Directional effect and surface features of silicon nitride ceramics by laser spot ablation and microgrooving** [11907-162]
- 11907 36 **Changes in surface characteristics of stainless steel polished by nanosecond laser based on beam coupling** [11907-163]



- 11907 37 **Experimental study on ablation of stainless steel with a new type of beam-coupled nanosecond laser** [11907-165]
- 11907 38 **Three-dimensional fusion for large volumetric optical-resolution photoacoustic microscopy** [11907-166]
- 11907 39 **Virtual compressed sensing photoacoustic imaging using CoSaMP algorithm based on k-wave** [11907-167]
- 11907 3A **Ohmic thermal tuning optomechanical modes of optofluidic microbubble resonator** [11907-169]
- 11907 3B **Virtual platform of photoacoustic tomography based on K-Wave** [11907-170]
- 11907 3C **Optimal design of bifocal acoustic lens for large volumetric photoacoustic detection using ZEMAX** [11907-171]