

PROCEEDINGS OF SPIE

# ***AOPC 2021: Micro-optics and MOEMS***

**Yuelin Wang**  
**Huikai Xie**  
**Yun-Feng Xiao**  
*Editors*

**20–22 June 2021**  
**Beijing, China**

*Organized by*  
University of Electronic Science and Technology of China (China)  
Science and Technology on Low-light-level Night Vision Laboratory (China)  
Science and Technology on Electro-Optical Information Security Control (China)  
Nano-Optoelectronics Laboratory, Department of Electronic Engineering, Tsinghua University  
(China)

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

*Published by*  
SPIE

**Volume 12066**

Proceedings of SPIE 0277-786X, V. 12066

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 2021: Micro-optics and MOEMS*, edited by Yuelin Wang, Huikai Xie, Yun-Feng Xiao, Proc. of SPIE 12066, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510650077

ISBN: 9781510650084 (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

## PHOTONIC MEMS, THZ MEMS AND METAMATERIALS

---

- 12066 02 **Research on application of laser in interferometric fiber optic gyroscope for excellent scale factor stability** [12066-3]
- 12066 03 **Highly sensitive fiber Bragg grating sensor interrogation system based on a Fourier domain mode-locked optoelectronic oscillator** [12066-4]
- 12066 04 **Analysis of nonlinear crosstalk suppression in weakly multi-core fiber based on coupled-power theory** [12066-5]
- 12066 05 **Micromachined double-layer chiral metasurface** [12066-6]
- 12066 06 **10Gb/s single user hybrid fiber-FSO-fiber system based on optical CDMA** [12066-7]
- 12066 07 **Electrically reconfigurable terahertz digital metasurface based on vanadium dioxide phase transition** [12066-8]
- 12066 08 **A micro optical sensor based on twin-core fiber** [12066-9]
- 12066 09 **Inverse nanotapers and lensed fibers for highly efficient coupling** [12066-10]
- 12066 0A **A compact and low power SLM system for augmented reality applications** [12066-11]
- 12066 0B **The effect of central frequency of ultrasonic transducer on the glucose detection based on photoacoustic spectroscopy** [12066-12]
- 12066 0C **A high-frequency angular vibration calibration system based on phase modulated laser interferometer technique** [12066-13]
- 12066 0D **Design and fabrication of silicon-based optical phased array** [12066-14]
- 12066 0E **Research on the construction method of the displacement field for a star sensor bracket based on fiber Bragg grating strain monitoring** [12066-15]
- 12066 0F **Design and optimization of a compact polarizer on the surface plasmon polaritons based SOI waveguide** [12066-21]
- 12066 0G **Thermal resistance and optical performance of SMD LEDs with traditional package and chip scale package** [12066-22]
- 12066 0H **Experimental analysis for recorded data frame of amplitude-modulation coaxial holographic data storage** [12066-27]

- 12066 0I **Crosstalk-sensitive RCSA with dedicated path protection in spatial division multiplexing elastic optical networks** [12066-28]
- 12066 0J **Solution to engineering problems of silicon-optical switches: reliability of co-package** [12066-29]
- 12066 0K **Recognition of sound vibration by DCNN based on  $\phi$ -OTDR system** [12066-30]
- 12066 0L **Ultra-compact dual-mode silicon power splitter using sub wavelength gratings couplers** [12066-31]
- 12066 0M **DMD-based intelligent light distribution technology of LED headlamp** [12066-32]
- 12066 0N **A single sideband phase modulated radio over fiber link with spurious-free dynamic range enhancement** [12066-33]
- 12066 0O **Compact mode-insensitive ring resonator based on SWG coupler and Euler bends** [12066-36]
- 12066 0P **Automatic bias control of a silicon photonics dual parallel Mach-Zehnder optical modulator** [12066-37]
- 12066 0Q **Design of ultra-wide-angle beam splitter** [12066-38]
- 12066 0R **Improved structural and electrical properties of non-polar  $a$ -plane p-AlGaIn epi-layers with pulsed mass flow supply technique** [12066-40]
- 12066 0S **A cost-cutting solution for coherent optical device packaging: wafer-level combine test of optical and analog chips** [12066-41]
- 12066 0T **Research on microstructure of nickel disc and optical disc for long-life holographic storage by two-time electroplate** [12066-45]
- 12066 0U **Application of structured illumination microscopy in fast and accurate measurement of complex-surface and steep-edge** [12066-46]
- 12066 0V **Bayesian optimization of photonic nanojets generated by multilayer dielectric structures** [12066-47]
- 12066 0W **Enhanced efficiency and stability of perovskite solar cells with ultra-thin Al<sub>2</sub>O<sub>3</sub> contact interlayer via low temperature atomic layer deposition** [12066-48]
- 12066 0X **Computer-generated hologram with complete depth information of reflection and refraction using ray tracing rendering** [12066-49]
- 12066 0Y **Viewing-angle enhanced three-dimensional light-field display based on optical-digital joint optimization algorithm** [12066-50]
- 12066 0Z **Calculating method for circular interference fringe of Mach-Zehnder optical system** [12066-51]
- 12066 10 **Design of lighting system for head-mounted display device** [12066-52]

- 12066 11 **Research on influencing factors of GNSS-R ocean remote sensing satellite efficiency index** [12066-54]
- 12066 12 **Depth-based fusion network for human attention prediction in 3D light field** [12066-55]
- 12066 13 **Performance evaluation of 3D light field display based on air traffic control task** [12066-56]
- 12066 14 **Thermal sensitivity of the birefringence of photonic-bandgap fiber** [12066-57]
- 12066 15 **Real-time multi-view background matting for 3D light field video** [12066-58]
- 12066 16 **Inverse design of multifunctional metamaterial based on modified direct binary search algorithm** [12066-59]
- 12066 17 **Dynamical characterization of viewing zone in a super multi-view 3D display based on eye-tracking** [12066-60]
- 12066 18 **Long-distance gesture detection based on deep learning for 3D spatial interaction** [12066-61]
- 12066 19 **Exploiting LDPC coding to improve data reliability for phase modulated holographic storage** [12066-63]
- 12066 1A **Study on Kalman dynamic prediction and feedback parameter optimization of laser tracking system** [12066-64]
- 12066 1B **Design and error analysis of Gabor-type diffractive lens** [12066-65]
- 12066 1C **A chip-level 400G integrated coherent receiver optical-electronic testing system** [12066-66]
- 12066 1D **Highly balanced 2×2 multimode interferometers by optimizing the coupling of the taper fan-out** [12066-67]
- 12066 1E **Research on single fiber imaging technology under fiber deformation** [12066-68]
- 12066 1F **Study on the life test of optical information storage materials** [12066-69]
- 12066 1G **Controlled fabrication of graphene layers and devices based on plasma etching** [12066-70]
- 12066 1H **Generalized adaptively biased optical OFDM for optical wireless communications** [12066-71]
- 12066 1I **Performance of fixed-scale MIMO UOWC systems using OOK and spatial multiplexing under misalignment effect** [12066-72]
- 12066 1J **A flat panel light field 3D display with high resolution for a single user** [12066-73]
- 12066 1K **Machine learning accelerated holographic near-eye display system based on three-step diffraction** [12066-74]

- 12066 1L **Optical characteristics investigation on H-PDLC flexible curved radius grating [12066-76]**
- 12066 1M **Simultaneous enhancement of radial resolution and side lobe suppression of tubular hyperlens via introducing a nano-gap layer [12066-77]**
- 12066 1N **Diffusion kinetics investigations of the dual monomer system in the photopolymer holographic material [12066-79]**
- 12066 1O **On BER performance for misaligned underwater wireless MISO laser links [12066-81]**
- 12066 1P **Angle of arrival of underwater wireless optical communications [12066-82]**
- 12066 1Q **Rapid local modulation of VO<sub>2</sub> phase transition by graphene heater [12066-83]**