

PROCEEDINGS OF SPIE

# ***AOPC 2021: Optical Spectroscopy and Imaging***

**Jianguo Liu**  
**Yueming Wang**  
**Huijie Zhao**  
**Liang Xu**  
*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 12064**

Proceedings of SPIE 0277-786X, V. 12064

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: Optical Spectroscopy and Imaging*, edited by Jianguo Liu, Yueming Wang, Hujie Zhao, Liang Xu, Proc. of SPIE 12064, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510650039

ISBN: 9781510650046 (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

## OPTICAL SPECTROSCOPY AND IMAGING

---

- 12064 02 **Study on tea classification based on provenance via random forests and laser induced breakdown spectroscopy** [12064-1]
- 12064 03 **Research on coal gangue recognition of GF-5 hyperspectral image** [12064-2]
- 12064 04 **Photonic nanojets with extended focusing length and narrowed beam waist by immersed engineered dielectric hemisphere** [12064-3]
- 12064 05 **Relative radiometric correction of DMD based coded aperture spectral imager in MWIR band** [12064-4]
- 12064 06 **Extraction of soil mineral information based on hyperspectral image** [12064-6]
- 12064 07 **Effect of surface roughness on the detection of aloe emodin by terahertz reflectance spectroscopy** [12064-7]
- 12064 08 **Spatial-spectral sparse unmixing for hyperspectral imagery based on graph Laplacian** [12064-10]
- 12064 09 **Digesting WRF-forecasted meteorological parameters for aerosol optical properties predicting with the CAM model** [12064-12]
- 12064 0A **Shape reconstruction of thin-diameter fiber grating sensors for flexible robots** [12064-13]
- 12064 0B **Thickness measurement of radial GRIN lens based on chromatic confocal technology** [12064-15]
- 12064 0C **A Solc liquid crystal tunable filter** [12064-20]
- 12064 0D **Optical design of a snapshot image mapping spectrometer** [12064-24]
- 12064 0E **Hyperspectral surface reflectance reconstruction based on non-negative matrix factorization and multispectral results** [12064-25]
- 12064 0F **Study on denoising method of hyperspectral data with multi-standard reflectivity correction** [12064-27]
- 12064 0G **A new eye-safe compact UV-Raman spectroscopy setup for the proximal detection of hazardous chemicals** [12064-28]
- 12064 0H **Optical design of volume phase holographic grating Raman spectrometer for lunar mineral detection** [12064-29]

- 12064 OI **A new fast atmospheric correction method for Landsat 8 images** [12064-30]
- 12064 OJ **Ground-based observation of aerosol optical properties in the ocean** [12064-32]
- 12064 OK **Ghost imaging with Gaussian-Schell model beam through oceanic turbulence** [12064-33]
- 12064 OL **Design of optical system of crossed astigmatism Czerny-Turner spectrometer** [12064-35]
- 12064 OM **Research on control technology of moving mirror in a double pendulum interferometer** [12064-37]
- 12064 ON **Characteristic distances of truncated Airy beams in turbulent atmosphere** [12064-41]
- 12064 OO **Research on multi-channel weak interference signal detection circuit of Fourier transform infrared spectrometer** [12064-42]
- 12064 OP **Laboratory x-ray spectrometer for XAFS measurements** [12064-43]
- 12064 OQ **Standoff detection of explosive materials using time-gated UV-Raman spectroscopy** [12064-45]
- 12064 OR **A compact multi-frame blind deconvolution algorithm with the Fourier constraints** [12064-46]
- 12064 OS **Study on attenuation of laser intensity by atmospheric haze particles** [12064-52]
- 12064 OT **Study of Raman spectroscopy detection for the mixture under opaque PTFE** [12064-54]
- 12064 OU **Study on the optical characteristics of the laser electromagnetic hybrid propulsion** [12064-56]
- 12064 OV **Effects of inner scale on beam wander of stochastic electromagnetic beams through atmospheric turbulence** [12064-58]
- 12064 OW **An interactive approach to text browsing based on anchor location** [12064-59]
- 12064 OX **Influence of polarization of laser beam on emission intensity of nanosecond laser-induced breakdown spectroscopy** [12064-60]
- 12064 OY **Super-resolution restoration technique for ground-based imaging of space objects** [12064-61]