## **PROCEEDINGS OF SPIE**

# Terahertz Emitters, Receivers, and Applications XV

Manijeh Razeghi Mona Jarrahi Editors

18–19 August 2024 San Diego, California, United States

Sponsored by SPIE

Published by SPIE

Volume 13141

Proceedings of SPIE 0277-786X, V. 13141

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 Terahertz Emitters, Receivers, and Applications XV, edited by Manijeh Razeghi, Mona Jarrahi, Proc. of SPIE 13141, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

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

ISBN: 9781510679429 ISBN: 9781510679436 (electronic)

Published by **SPIE** P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) SPIE.org Copyright © 2024 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

#### **TERAHERTZ LASER TECHNOLOGIES**

- 13141 02 Fundamental scaling limits and bandwidth shaping of frequency-modulated combs (Invited Paper) [13141-1]
- 13141 03 Anti-diffusive loss shaping of quantum cascade laser frequency combs [13141-4]
- 13141 04 Characterizing absolute gain of quantum cascade lasers using terahertz time-domain spectroscopy measurements [13141-5]

#### **INTEGRATED TERAHERTZ DEVICES**

- 13141 05 Recent advances in the research of graphene-based 2D heterostructures for fast, sensitive terahertz detections (Invited Paper) [13141-7]
- 13141 06 **3D rectification effect in grating-gate InGaAs-channel HEMT THz plasmonic detectors** (Invited Paper) [13141-8]
- 13141 07 Synthesis of Bi<sub>2</sub>Se<sub>3</sub> and its application to sensitive and fast THz detection (Invited Paper) [13141-9]
- 13141 08 Towards broadband, low-capacitance, far-infrared photoelectric tunable-step detectors [13141-11]

#### **TERHERTZ METADURFACES AND PLASMONICS**

13141 09 THz metasurfaces for nonlinear optics (Invited Paper) [13141-14]

#### **TERAHERTZ IMAGING SYSTEMS**

- 13141 0A Terahertz demethylation for cancer therapy (Invited Paper) [13141-19]
- 13141 OB Terahertz time-domain spectroscopy (THz-TDS) fingerprinting for integrated circuit (IC) identification in tracking and tracing applications [13141-22]

#### NEAR-FIELD AND HIGH-INTENSITY TERAHERTZ PHENOMENA

- 13141 OC Tunable intense source at sub-THz frequencies and its nonlinear interaction in condensed matter (Invited Paper) [13141-25]
- 13141 0D Subcycle optical microscopy with Angstrom-scale resolution [13141-28]

#### POSTER SESSION

- 13141 OE Coherent detection terahertz imaging with a continuous wave source [13141-29]
- 13141 OF About rapid phase-wrapping in terahertz phase contrast imaging [13141-30]