

PROCEEDINGS OF SPIE

# ***Silicon Photonics XVIII***

**Graham T. Reed**  
**Andrew P. Knights**  
*Editors*

**30 January – 1 February 2023**  
**San Francisco, California, United States**

*Sponsored and Published by*  
SPIE

**Volume 12426**

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 *Silicon Photonics XVIII*, edited by Graham T. Reed, Andrew P. Knights, Proc. of SPIE 12426, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510659575

ISBN: 9781510659582 (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*

---

## OPTICAL COMPUTING AND OPTICAL PROCESSING

---

- 12426 01 **Scaling programmable silicon photonics circuits (Invited Paper)** [12426-1]
- 12426 02 **An integrated millimeter-wave and photonic system-on-chip solution with extended  $f_r$  and  $f_{max}$ : Can optoelectronic RF CMOS completely replace silicon photonics?** [12426-3]

---

## WAVEGUIDE DESIGN AND APPLICATIONS I

---

- 12426 03 **Tapered MMI splitters with unconstrained splitting ratio on a thick SOI platform** [12426-9]
- 12426 04 **Design of MMI-based 1x4 power splitters with optimized parabolic input and output ports on SOI platform** [12426-11]
- 12426 05 **Silicon photonics packaging using engineered scattering elements** [12426-12]

---

## ACTIVE DEVICE INTEGRATION I

---

- 12426 06 **Monolithic integration of InAs-based quantum cascade lasers on germanium** [12426-14]
- 12426 07 **10-m in-door high-accuracy distance measurement using Si optical phased array for LiDAR application** [12426-16]

---

## ACTIVE DEVICE INTEGRATION II

---

- 12426 08 **Hybrid laser integration in the mid-IR for silicon photonics sensing applications** [12426-19]
- 12426 09 **Monolithic silicon avalanche photodetector utilizing surface state defects operating at 1550 nm** [12426-20]
- 12426 0A **First O-band silicon coherent transmitter with integrated hybrid tunable laser and SOAs** [12426-49]

---

#### DEVICES USING EMERGING MATERIALS AND NOVEL PROCESSES

---

- 12426 0B **Study of SiGeSn-based multiple quantum well laser for photonics integrated circuits (Invited Paper)** [12426-21]
- 12426 0C **Silicon optomechanical waveguide based on subwavelength engineering of photons and phonons** [12426-23]
- 12426 0D **Fabrication of silicon nanowires (SiNWs) with nanosphere lithography: a comparison approach with laser ablation** [12426-24]

---

#### INTEGRATED SENSORS

---

- 12426 0E **Mid-infrared SOI waveguide thermo-optic Fourier-transform spectrometer** [12426-26]
- 12426 0F **A fully packaged silicon photonic Bragg grating temperature sensor with a compact back side interface based on a ball lens** [12426-27]
- 12426 0G **Improving tuberculosis treatment using mid-infrared spectroscopy for bedside therapeutic drug monitoring** [12426-28]
- 12426 0H **On-chip CO<sub>2</sub> sensor integrated with MEMS emitter and pyroelectric detector** [12426-29]
- 12426 0I **Ge-on-Si waveguide device for self-referenced fingerprint region absorption spectroscopy** [12426-30]

---

#### SILICON NITRIDE PHOTONICS

---

- 12426 0J **Effects of ultraviolet exposure on silicon nitride and its application in tuning passive photonic devices** [12426-32]
- 12426 0K **Monolithic coupling between high- and mid-index, multi-micron waveguides for O-band applications** [12426-34]
- 12426 0L **Characterization study of silicon nitride (SiN) thin-film hydrogen bonding for waveguide applications** [12426-35]

---

#### WAVEGUIDE DESIGN AND APPLICATIONS II

---

- 12426 0M **Tunable Fabry-Pérot interferometer integrated in a silicon waveguide of an on-chip optical platform for long infrared wavelengths** [12426-36]
- 12426 0N **Polarization splitter and rotator, and an optical demultiplexer for a polarization-diverse silicon photonic receiver** [12426-38]

12426 0O **Broadband and polarization-independent waveguide-fiber coupling** [12426-40]

---

**POSTER SESSION**

---

12426 0P **High-speed silicon waveguide 3-to-8 decoder based on electro-optic effects** [12426-41]

12426 0Q **Design of infrared phototransistors based on silicon feedback field effect transistors** [12426-43]

12426 0R **Engineering the PhC-slab waveguide for designing TM-pass polarization filter by restoring their polarization filtering property** [12426-44]

12426 0S **Simulation and design optimization of germanium-on-silicon single photon avalanche diodes** [12426-45]

12426 0T **Silicon-based, fractal metamaterial structure for IR broadband absorption** [12426-48]

---

**DIGITAL POSTER SESSION**

---

12426 0U **Enhanced coupling efficiency of optical fiber to green light waveguide by optical phased array** [12426-47]