PROCEEDINGS OF SPIE

Quantum Information Science, Sensing, and Computation XVI

Eric Donkor
Michael Hayduk
Editors

22–25 April 2024
National Harbor, Maryland, United States

Sponsored and Published by
SPIE

Volume 13028

Proceedings of SPIE 0277-786X, V. 13028

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 *Quantum Information Science, Sensing, and Computation XVI*, edited by Eric Donkor, Michael Hayduk, Proc. of SPIE 13028, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

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

ISBN: 9781510673748
ISBN: 9781510673755 (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.

SPIE. DIGITAL LIBRARY
SPIEDigitalLibrary.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*

QUANTUM SENSORS, CLOCKS, AND SYSTEMS I

13028 02 **Advancements towards fault-tolerant quantum computing with neutral atoms (Keynote Paper)** [13028-1]

QUANTUM SENSORS, CLOCKS, AND SYSTEMS II

13028 03 **Ruggedized low-SWaP optical frequency combs and laser modules for next-generation optical atomic clocks with pathways to operation in extreme radiation environments (Invited Paper)** [13028-4]

13028 04 **Magnetic field sensing via optically detected magnetic resonance and spin relaxometry using nitrogen vacancies in nanodiamonds** [13028-5]

QUANTUM SENSORS, CLOCKS, AND SYSTEMS III

13028 05 **Rare-earth ion-integrated silicon photonics for quantum networks (Invited Paper)** [13028-10]

QUANTUM SENSORS, CLOCKS, AND SYSTEMS IV

13028 06 **Improving performance of hyper-entangled and multiphoton entangled systems via wavefront design and quantum networks** [13028-12]

13028 07 **Photoluminescence of Er-doped YIG crystal** [13028-13]

QUANTUM INFORMATION SCIENCE I

13028 08 **Silicon photonics for LiDAR sensors, AR displays, trapped-ion systems, and beyond (Invited Paper)** [13028-50]

13028 09 **Asymptotic compression rate of quantum autoencoders** [13028-15]

QUANTUM INFORMATION SCIENCE II

13028 0A **Quantum inference engine: an architecture for quantum artificial intelligence** [13028-19]

CYBERSECURITY

13028 0B **Designing a photonic physically unclonable function having resilience to machine learning attacks (Invited Paper)** [13028-22]

13028 0C **Quantum machine learning for feature selection in Internet of Things network intrusion detection** [13028-23]

QUANTUM COMMUNICATION, NETWORKS, AND CRYPTOGRAPHY I

13028 0D **Automated quantum circuit generation for computing inverse hash functions** [13028-27]

QUANTUM COMMUNICATION, NETWORKS, AND CRYPTOGRAPHY II

13028 0E **Towards the on-chip realization of polarization encoded qubits (Invited Paper)** [13028-28]

13028 0F **Modulation of the vibrational and emission spectrum in 2D WSe_2 through defect generation schemes** [13028-29]

13028 0G **Multi-photon-pair production in packaged, foundry-fabricated, silicon waveguide spirals** [13028-30]

QUANTUM COMMUNICATION, NETWORKS, AND CRYPTOGRAPHY IV

13028 0H **Polarization–frequency hyperentangled photons: generation, characterization, and manipulation (Invited Paper)** [13028-35]

13028 0I **Mixing entropy of star couplers for path-based multi-plane light conversion** [13028-36]

QUANTUM COMMUNICATION, NETWORKS, AND CRYPTOGRAPHY V

13028 0J **Tunable quantum emitters and coherent modulation on foundry integrated photonics (Invited Paper)** [13028-37]

DIGITAL POSTER SESSION

13028 0K **Quantum tomographic reconstruction: a Bayesian approach using the extended Kalman filter** [13028-16]