

# PROCEEDINGS OF SPIE

## ***Quantum Technologies 2022***

**Eleni Diamanti**  
**Sara Ducci**  
**Nicolas Treps**  
**Shannon Whitlock**  
*Editors*

**3–7 April 2022**  
**Strasbourg, France**

**9–20 May 2022**  
**ONLINE**

*Sponsored*  
SPIE

*Cosponsored by*  
City of Strasbourg (France) • IdEx University of Strasbourg (France) • CNRS (France) • iCube (France)  
Université de Strasbourg (France) • Quantum Science and Nanomaterials (France)

*Cooperating Organisations*  
Photonics 21 (Germany) • EOS–European Optical Society (Germany) • Photonics Public Private  
Partnership (Belgium) • Photonics France (France)

*Published by*  
SPIE

**Volume 12133**

Proceedings of SPIE 0277-786X, V. 12133

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 *Quantum Technologies 2022*, edited by Eleni Diamanti, Sara Ducci, Nicolas Treps, Shannon Whitlock, Proc. of SPIE 12133, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510651425

ISBN: 9781510651432 (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 © 2022 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

v *Conference Committee*

---

## QUANTUM SENSING AND METROLOGY II

---

12133 02 **Ghost displacement** [12133-4]

---

## QUANTUM COMPONENTS AND THEIR APPLICATIONS I

---

12133 03 **Guided-wave solutions for non-classical state production (Invited Paper)** [12133-8]

12133 04 **On-chip integration of superconducting nanowire single-photon detectors and reconfigurable optical circuits in lithium-niobate-on-insulator waveguides** [12133-9]

---

## QUANTUM CRYPTOGRAPHY AND COMMUNICATION I

---

12133 05 **A long-lived spectrally multiplexed solid-state optical quantum memory for high-rate quantum repeaters** [12133-14]

---

## QUANTUM CRYPTOGRAPHY AND COMMUNICATION II

---

12133 06 **Receiver-device-independent quantum key distribution** [12133-18]

12133 07 **Quantum key distribution and classical communication coherent deployment with shared hardware and joint digital signal processing** [12133-19]

12133 08 **Towards low-cost monolithic QRNGs** [12133-20]

12133 09 **Optical quantum state engineering with multimode resources: between a drawback to be circumvented and an advantage to be exploited** [12133-21]

---

## NOVEL QUANTUM PLATFORMS AND HYBRID DEVICES I

---

12133 0A **Cavity QED with a Rydberg superatom: coherent control, single-shot detection, and conditional optical phase flips** [12133-28]

12133 0B **High-resolution imaging and manipulation of cold atoms through a multimode fiber** [12133-30]

---

**NOVEL QUANTUM PLATFORMS AND HYBRID DEVICES II**

---

12133 0C     **Integrating silicon detectors in a photonic chip** [12133-31]

---

**POSTERS SESSION**

---

12133 0D     **Towards a self-tuning quantum key distribution transmitter using a genetic algorithm** [12133-45]

12133 0E     **GaN-based external-cavity diode lasers for strontium ion cooling** [12133-47]

12133 0F     **Using optically pumped magnetometers to identify initial damage in bulk material during fatigue testing** [12133-53]

12133 0G     **Influence of QKD apparatus parameters on the backflash attack** [12133-57]

12133 0H     **Quantum aliasing: a negative influence of data scarcity on quantum machine learning** [12133-58]

12133 0I     **Dynamic assertion for quantum circuits based on stabilizers** [12133-60]

12133 0J     **Quantum computing calculations for nuclear structure and nuclear data** [12133-61]