

# PROCEEDINGS OF SPIE

## ***Quantum Technologies 2018***

**Jürgen Stühler**  
**Andrew J. Shields**  
**Miles J. Padgett**  
*Editors*

**23–25 April 2018**  
**Strasbourg, France**

*Sponsored by*  
SPIE

*Cosponsored by*  
Strasbourg the Eurooptimist (France)  
CNRS (France)  
Investissements d'Avenir (France)  
iCube (France)  
Université de Strasbourg (France)

*Cooperating Organisations*  
Photonics 21 (Germany)  
EOS—European Optical Society (Germany)  
Photonics Public Private Partnership (Belgium)  
Comité National d'Optique et de Photonique (France)

*Published by*  
SPIE

**Volume 10674**

Proceedings of SPIE 0277-786X, V. 10674

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 2018*, edited by Jürgen Stuhler, Andrew J. Shields, Miles J. Padgett, Proceedings of SPIE Vol. 10674 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510618749

ISBN: 9781510618756 (electronic)

Published by

**SPIE**

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time) Fax +1 360 647 1445

[SPIE.org](http://SPIE.org)

Copyright © 2018, Society of Photo-Optical Instrumentation Engineers.

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 copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online 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. The CCC fee code is 0277-786X/18/\$18.00.

Printed in the United States of America Vm7 i ffUb '5gg: WJUH' q' bWZi bXYf' JW bg' Z'ca 'GD-9.

Publication of record for individual papers is online in the SPIE Digital Library.

**SPIE. DIGITAL LIBRARY**

[SPIDigitalLibrary.org](http://SPIDigitalLibrary.org)

---

**Paper Numbering:** *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article 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 Authors  
ix Conference Committee

---

## ATOMIC SPECTROSCOPY AND CLOCKS

---

10674 03 **A dual-frequency two-photon molecular clock with cold trapped HD<sup>+</sup> ions** [10674-2]

---

## QUANTUM SENSING

---

10674 09 **Testing gravity with atomic quantum sensors on ground and in space (Invited Paper)** [10674-7]

10674 0B **Interference-based multimode opto-electro-mechanical transducers** [10674-9]

10674 0C **A read-out enhancement for microwave electric field sensing with Rydberg atoms** [10674-10]

10674 0D **A transimpedance amplifier based on an LTPS process operated in alkali vapor for the measurement of an ionization current (Best Student Paper Award)**[10674-11]

---

## QUANTUM IMAGING

---

10674 0E **Quantum temporal imaging with squeezed light** [10674-12]

10674 0H **Correlation plenoptic imaging with entangled photons** [10674-15]

---

## QUANTUM TECHNOLOGY

---

10674 0Q **Protective measurements: extracting the expectation value by measuring a single particle** [10674-24]

10674 0S **Bridging integrated waveguides with single photon emitters** [10674-26]

10674 0T **Controlled excitation of diamond color centers using low-loss dielectric-loaded surface plasmon polariton waveguides** [10674-27]

---

## QUANTUM COMPONENTS II

---

- 10674 0V **Nonlinear photon-atom coupling in free space** [10674-29]
- 10674 0X **Generating entangled photon pairs in a parallel crystal geometry** [10674-31]

---

## QUANTUM COMMUNICATIONS I

---

- 10674 12 **All-optical synchronization for quantum networking** [10674-36]
- 10674 13 **Quantum optical state comparison amplification of coherent states** [10674-37]

---

## QUANTUM COMMUNICATIONS II

---

- 10674 15 **Design of an evaluation breadboard with SNSPD for testing various deep space optical communication applications** [10674-40]
- 10674 16 **Modeling high quantum bit rate QKD systems over optical fiber** [10674-42]

---

## METROLOGY FOR QUANTUM COMMUNICATION

---

- 10674 17 **High count rate InGaAs/InP SPAD system with balanced SPAD-dummy approach running up to 1.4 GHz** [10674-43]
- 10674 18 **Quantum key distribution security threat: the backflash light case** [10674-44]
- 10674 1A **Measurements towards providing security assurance for a chip-scale QKD system** [10674-46]

---

## POSTER SESSION

---

- 10674 1D **Quantum state comparison amplifier with feedforward state correction** [10674-49]
- 10674 1F **Transmission of polarization quantum state through a fiber optic channel by swapped time-bin state** [10674-51]
- 10674 1H **Time-integrated and time-resolved VUV LIBS: a comparative study** [10674-53]
- 10674 1J **Single- and multidimensional integrated optic photon sources for quantum communication** [10674-55]

- 10674 1K **European coordinated metrological effort for quantum cryptography** [10674-57]
- 10674 1L **Entanglement of two-mode Schrödinger cats** [10674-58]
- 10674 1P **High-dimensional quantum key distribution by coherence modulation and orbital angular momentum at the photon-counting level** [10674-62]
- 10674 1Q **Optical properties of biexcitons in ellipsoidal quantum dot** [10674-63]
- 10674 1R **Semiconductor quantum dot to fiber coupling system for 1.3 $\mu$ m range** [10674-64]