## **PROCEEDINGS OF SPIE**

# Nonlinear Frequency Generation and Conversion: Materials and Devices XXII

Peter G. Schunemann Editor

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

Sponsored and Published by SPIE

Volume 12405

Proceedings of SPIE 0277-786X, V. 12405

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 Nonlinear Frequency Generation and Conversion: Materials and Devices XXII, edited by Peter G. Schunemann, Proc. of SPIE 12405, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

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

ISBN: 9781510659155 ISBN: 9781510659162 (electronic)

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

#### SESSION 1 FREQUENCY COMBS AND SPECTROSCOPY

12405 02 Precision mid-IR: THz frequency combs produced by frequency division and optical rectification (Invited Paper) [12405-1]

#### SESSION 2 VISIBLE AND UV GENERATION

12405 03 Investigation of high harmonic generation through multiplexed broadband ptychography [12405-8]

#### SESSION 3 SUPERCONTINUUM GENERATION

12405 04 The existence of multi-octave spanning conical emission from ultrafast LWIR pulse filamentation [12405-11]

#### SESSION 4 OPTICAL PARAMETRIC DEVICES AND APPLICATIONS

- 12405 05 Efficient generation of femtosecond multi-mJ pulses at 3 μm (Invited Paper) [12405-13]
- 12405 06 Intense and coherent 7-octave light source (Invited Paper) [12405-14]

#### SESSION 6 INFRARED AND THZ GENERATION

- 12405 07 Noncritically phase-matched self-difference frequency generation using transition-metal doped chalcogenides [12405-22]
- 12405 08 Narrowband seeding of a PPLN nonresonant optical parametric oscillator [12405-23]
- 12405 09 Broadband high resolution sum frequency generation spectrometer for molecular vibrational spectroscopy at interfaces [12405-26]
- 12405 0A Portable, broadband, and sensitive terahertz time-domain spectrometer [12405-27]

#### SESSION 7 NEW NONLINEAR MATERIALS I

12405 OB	Sum-frequency generation in silicon nitride through coherent photogalvanic effect [12405-29]
12405 OC	Nonlinear optical analysis of superconductor metal nitride and oxides for advanced photonic sensor applications [12405-30]
12405 0D	Microscopic analysis of linear and nonlinear electro-optical properties of tellurium [12405-31]

#### SESSION 8 NEW NONLINEAR MATERIALS II

12405 OE Sellmeier and thermo-optic dispersion formulas for BaGa<sub>2</sub>GeS<sub>6</sub> [12405-35]

#### SESSION 9 NEW CONCEPTS IN NONLINEAR OPTICS I

12405 OF Photonic upconversion maximization for nonlinear meta-material enabled by deep learning [12405-41]

#### SESSION 10 NEW CONCEPTS IN NONLINEAR OPTICS II

- 12405 0G Cascaded third-harmonic generation approaching full efficiency through an unconventional pathway [12405-43]
- 12405 OH Computation using shaped supercontinuum generation within a neural network [12405-47]
- 12405 01 Characterization of a temporal-mode sorter using multiple-delay crossed-beam spectral interferometry [12405-46]

#### SESSION 11 NEW CONCEPTS IN NONLINEAR OPTICS III

12405 0J Examining viscoelastic properties of petroleum products using impulsive stimulated Brillouin scattering [12405-52]

#### DIGITAL POSTERS

12405 0K Giant second-harmonic generation in photonic crystal slabs possessing double-resonance bound states in the continuum [12405-39]
12405 0L Raman lasing in multimode diode-pumped graded-index fiber with fs-inscribed 3D random FBG array [12405-50]