PROCEEDINGS OF SPIE

SPIDigitalLibrary.org/conference-proceedings-of-spie

Front Matter: Volume 10902

, "Front Matter: Volume 10902," Proc. SPIE 10902, Nonlinear Frequency Generation and Conversion: Materials and Devices XVIII, 1090201 (21 May 2019); doi: 10.1117/12.2531366

SPIE.

Event: SPIE LASE, 2019, San Francisco, California, United States

PROCEEDINGS OF SPIE

Nonlinear Frequency Generation and Conversion: Materials and Devices XVIII

**Peter G. Schunemann
Kenneth L. Schepler**
Editors

**5–7 February 2019
San Francisco, California, United States**

Sponsored and Published by
SPIE

Volume 10902

Proceedings of SPIE 0277-786X, V. 10902

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Nonlinear Frequency Generation and Conversion: Materials and Devices XVIII, edited by
Peter G. Schunemann, Kenneth L. Schepler, Proc. of SPIE Vol. 10902, 1090201
© 2019 SPIE · CCC code: 0277-786X/19/\$18 · doi: 10.1117/12.2531366

Proc. of SPIE Vol. 10902 1090201-1

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.

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 XVIII*, edited by Peter G. Schunemann, Kenneth L. Schepler, Proceedings of SPIE Vol. 10902 (SPIE, Bellingham, WA, 2019) Seven-digit Article CID Number.

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

ISBN: 9781510624467
ISBN: 9781510624474 (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

Copyright © 2019, 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. 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/19/\$18.00.

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

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	<i>Authors</i>
ix	<i>Conference Committee</i>

UV-VISIBLE GENERATION

10902 03	High-power, continuous-wave, scalable, single-frequency 852nm laser source for 213nm generation [10902-2]
10902 05	Single pass 7 watts continuous wave 532 nm generation by focusing optimized second harmonic generation in MgO:PPLN [10902-4]

SUPERCONTINUUM SOURCES

10902 07	3 W Mid-IR supercontinuum extended up to 4.6 μm based on an all-PM thulium doped fiber gain-switch laser seeding an InF_3 fiber [10902-6]
10902 09	Spectral and temporal stability of cascaded Raman based high power, octave spanning, continuous-wave, supercontinuum sources [10902-8]

WAVEGUIDE SOURCES

10902 0C	Miniaturized watt-level laser modules emitting in the yellow-green spectral range for biophotonic applications [10902-11]
10902 0D	Efficient, watt-level frequency doubling and optical parametric amplification on periodically poled lithium niobate ridge waveguide [10902-12]
10902 0E	UV laser source implementing an IR pump laser with multi-element ridge waveguides [10902-13]
10902 0F	Generation of tunable visible light in periodically-poled nonlinear crystal waveguides (Invited Paper) [10902-14]

QUASI-PHASEMATCHED MATERIALS

10902 0G	Recent advances in sub-μm PPKTP for non-linear interactions with counter-propagating photons (Invited Paper) [10902-15]
10902 0I	Fabrication of a quasi-phase-matching stack of 53 GaAs plates for high-power mid-infrared wavelength conversion by use of room-temperature bonding [10902-17]

OPTICAL PARAMETRIC DEVICES

- 10902 0L **Coherent combining of difference frequency generators: experimental demonstration and application to optical parametric oscillators** [10902-20]
- 10902 0M **Tunable and chirp free femtosecond signal pulses generated by a PPLN OPO pumped by Ytterbium fiber laser chirped pulses** [10902-21]
- 10902 0N **Fan-out periodically poled structures in Rb-doped KTiOPO₄ for continuously tunable QPM devices** [10902-22]
- 10902 0P **Adaptive pulse shaping for enhanced spectral broadening of high repetition rate, electro-optic frequency combs** [10902-24]

NOVEL CONCEPTS IN NONLINEAR OPTICS

- 10902 0T **Whispering gallery optical parametric oscillators: Just a scientific oddity? (Invited Paper)** [10902-28]

FREQUENCY COMB SOURCES

- 10902 0V **Simulated supercontinuum generation in water and the human eye** [10902-30]
- 10902 0W **Generation of broad spectral components from midwave infrared ultrashort pulse laser propagation through ZnSe and ZnS** [10902-31]

NEW NONLINEAR CONCEPTS AND DEVICES

- 10902 16 **Optical investigation to minimize the electron bunch arrival-time jitter between femtosecond laser pulses and electron bunches for laser-driven plasma wakefield accelerators** [10902-41]
- 10902 17 **Modified Z-scan technique using a segmented photodiode** [10902-42]

THZ GENERATION AND DETECTION

- 10902 18 **Tunable narrowband THz generation in orientation patterned gallium phosphide for THz anisotropy identification (Invited Paper)** [10902-43]
- 10902 19 **Time-resolved nonlinear ghost imaging: route to hyperspectral single-pixel reconstruction of complex samples at THz frequencies** [10902-44]
- 10902 1A **High-efficiency THz wave generation and detection using laser chaos and metal V-grooved wave guide** [10902-45]

RAMAN LASERS

- 10902 1D **Demonstration of input wavelength flexible cascaded Raman resonators based on the inclusion of a broadband distributed feedback reflector** [10902-48]
- 10902 1F **Raman transformation properties of partially coherent laser pulses in phosphorus-doped silica fibre** [10902-50]

STIMULATED BRILLOUIN SCATTERING

- 10902 1G **Experimental analysis of stimulated Brillouin enhancement in high power, line-broadened, narrow-linewidth fiber amplifiers due to spectral overlap between the Brillouin gain spectrum and the signal back-scatter from the fiber termination** [10902-51]

POSTER SESSION

- 10902 1J **Compact and versatile OPG-OPA based on a periodically poled nonlinear crystal pumped by femtosecond Ytterbium fiber laser** [10902-54]
- 10902 1L **Influence of stimulated Raman scattering on random lasing** [10902-56]
- 10902 1M **Experimental study of the spectral width and flatness of a supercontinuum spectrum with several setups of optical fiber** [10902-57]
- 10902 1N **Simulations on nonlinear process in non-collinear phase-matching** [10902-58]
- 10902 1O **Nonlinear optical properties of "star type" triazotriphenylmethane dyes** [10902-59]
- 10902 1Q **Ultra-flattened chromatic dispersion in all-solid hybrid micro-structured optical fibers for mid-infrared lightwave generation** [10902-61]
- 10902 1R **Design and numerical investigation of a tapered tellurite step-index fiber for mid-IR supercontinuum generation** [10902-62]

10902 1T	Multi watt-level picosecond micro-laser sources in the yellow-green spectral range [10902-64]
10902 1U	Bell inequality experiment for a high brightness time-energy entangled source [10902-65]
10902 1V	Mid-infrared, single crystal, linear cavity optical parametric oscillators based on ZnGeP₂ [10902-66]
10902 1W	Obtaining a broad spectrum source in the visible spectrum by means of 2 conventional thin core fibers [10902-67]
10902 1X	Wavelength adjustability of PM-Yb-doped fiber laser based on FBGs for high power SHG generation [10902-68]

Authors

Numbers in the index correspond to the last two digits of the seven-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first five digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Afanador Delgado, S. M., 1O	Godard, A., 0L
Aller, Josh, 0E	Hastings, Michael, 0W
Amiard-Hudebine, Gabriel, 0M, 1J	Hawthorne, Justin T., 0E
Aparanji, Santosh, 1G	Hernández-García, J. C., 1M, 1W
Arun, S., 09	Hirohashi, Junji, 03, 1X
Atarashi, Hiroki, 0I	Hofmann, J., 0C
Babych, O. S., 1L	Hoshi, Masayuki, 1X
Balaswamy, V., 09, 1D, 1G	Hsu, Cheng-Wei, 05, 0D
Banerjee, Sneha, 0P	Hsu, Chen-Shao, 05, 0D
Battle, Phil, 0E	Huang, Yu-Tai, 0D
Bege, Roland, 1T	Huss, G., 07
Berthelot, T., 07	Imai, Koichi, 1X
Bodin, L., 07	Ivanenko, Aleksey, 1F
Boullet, J., 07	Iwao, K., 1A
Bourdon, P., 0L	Jacobs, Cobus, 1V
Breunig, Ingo, 0T	Jáuregui-Vázquez, D., 1M, 1W
Bugge, Frank, 1T	Jedrzejczyk, Daniel, 0C, 1T
Buse, Karsten, 0T	Kaga, Tsubasa, 0I
Calvez, L., 07	Kaltenbach, André, 1T
Canalias, Carlota, 0G, 0N	Kaneda, Yushi, 03
Carrée, J-Y., 07	Katz, Evan J., 1U
Castañeda Contreras, J., 1O	Kitahara, H., 1A
Chen, Xiaohan, 1N	Kobtsev, Sergey, 1F
Child, Benjamin, 1U	Koen, Wayne, 1V
Chiu Zarate, R., 1O	Kokhanovskiy, Alexey, 1F
Chou, Ming-Hsien, 05, 0D	Kolesik, Miroslav, 0W
Choudhury, Vishal, 09, 1D, 1G	Kozlov, Vladimir, 18
Chowdhury, Enam, 0W	Kurihara, K., 1A
Chtouki, R., 0L	Kuwashima, F., 1A
Coetzee, Riaan, 0G	Lai, Jui-Yu, 05, 0D
Cong, Zhenhua, 1N	Lakshmi, C. G., 1D
Cozic, S., 07	Laurell, Fredrik, 0N
Dietz, Jonathan, 1U	Lekki, John D., 1U
Dobashi, Kazuma, 1X	Li, Ping, 1N
Durécu, A., 0L	Liebig, Carl, 17
Enriquez Sánchez, C. J., 1O	Liljestrand, Charlotte, 0G
Ensley, Trenton, 0W	Liu, Zhaojun, 1N
Esparza Ramirez, K. M., 1O	Lombard, L., 0L
Estudillo-Ayala, J. M., 1M, 1W	Luo, Xing, 1Q, 1R
Fedorova, Ksenia A., 0F	Makio, Satoshi, 1X
Feise, David, 0C, 1T	Marañon-Ruiz, V. F., 1O
Ferdinandus, Manuel, 17	Marble, Christopher B., 0V
Floyd, Bertram M., 1U	Markelz, A. G., 18
Freysz, Eric, 0M, 1J	Mattiello, S., 16
Freysz, Valerian, 1J	McNee, Ian, 18
Furukawa, Yasunori, 03	Moloney, Jerome, 0W
Gengler, Jamie, 17	Morikawa, O., 1A
George, D. K., 18	Morris, Daniel, 1V
Gervaziev, Mikhail, 1F	Nakajima, M., 1A

Nakao, Hiroaki, 03	Yakovlev, Vladislav V., 0V
Nemitz, Ian R., 1U	Yamamoto, K., 1A
Nguyen, Hoa Phuoc Trung, 1Q, 1R	Yashchuk, V. P., 1L
Ohishi, Yasutake, 1Q, 1R	Yehouessi, J-P., 07
Olivieri, Luana, 19	Zaldívar-Huerta, I. E., 1M
Paschke, Katrin, 0C, 1T	Zang, Jie, 1N
Pasiskevicius, Valdas, 0G, 0N	Zaouter, Yoann, 1J
Pasquazi, Alessia, 19	Zhang, Shaojun, 1N
Peccianti, Marco, 19	Zhang, Xingyu, 1N
Penirschke, A., 16	Zukauskas, Andrius, 0G, 0N
Planchat, C., 0L	
Poulain, S., 07	
Prakash, Roopa, 0P, 1D, 1G	
Qin, Zengguang, 1N	
Quintero-Mata, C. A., 1W	
Ramírez Quiros, Y., 1O	
Raybaut, M., 0L	
Reyes Ayona, J. R., 1W	
Roberts, Tony D., 0E	
Rojas-Laguna, R., 1M, 1W	
Sahm, Alexander, 0C, 1T	
Saini, Than Singh, 1Q, 1R	
Sasa, Toshiaki, 03	
Sasaura, Masahiro, 03	
Schlarb, H., 16	
Schunemann, Peter, 18	
Schweinsberg, Aaron, 0W	
Selvaraja, Shankar Kumar, 0P	
Shirao, T., 1A	
Shoji, Ichiro, 0I	
Sierra-Hernández, J. M., 1M, 1W	
Smirnov, Sergey, 1F	
Strauss, Hencharl J., 1V	
Supradeepa, V. R., 09, 0P, 1D, 1G	
Suzuki, Takenobu, 1Q, 1R	
Tago, Tsuyoshi, 03	
Takase, Hiroki, 0I	
Tani, M., 1A	
Tekavec, Patrick, 18	
Tong, Hoang Tuan, 1Q, 1R	
Torres González, D., 1M	
Totero Gongora, Juan S., 19	
Tränkle, Günther, 1T	
Tripepi, Michael, 0W, 17	
Valenzuela, Anthony, 0W	
Vanderhoef, Laura, 0W	
Vidal, S., 07	
Vikram, B. S., 0P, 1G	
Viotti, Anne-Lise, 0G	
Vynhalek, Brian, 1U	
Wang, Weitao, 1N	
Werner, Kevin, 0W	
Werner, Nils, 0C, 1T	
Wharmby, Andrew W., 0V	
Wilmer, Brian, 0W	
Wolfe, Christopher, 0W	
Wu, Dong-Yi, 05	
Wu, Karin, 05, 0D	
Wu, Lorinda, 1V	

Conference Committee

Symposium Chairs

Beat Neuenschwander, Berner Fachhochschule Technik und Informatik
(Switzerland)
Xianfan Xu, Purdue University (United States)

Symposium Co-chairs

Koji Sugioka, RIKEN Center for Advanced Photonics (Japan)
Reinhart Poprawe, Fraunhofer-Institut für Lasertechnik (Germany)

Program Track Chairs

Vladimir Ilchenko, GM Cruise LLC (United States)
Paul O. Leisher, Lawrence Livermore National Laboratory (United States)

Conference Chairs

Peter G. Schunemann, BAE Systems (United States)
Kenneth L. Schepler, CREOL, The College of Optics and Photonics,
University of Central Florida (United States)

Conference Program Committee

Darrell J. Armstrong, Sandia National Laboratories (United States)
Carloa Canalias, KTH Royal Institute of Technology (Sweden)
Majid Ebrahim-Zadeh, ICFO - Institut de Ciències Fotòniques (Spain)
Baldemar Ibarra-Escamilla, Instituto Nacional de Astrofísica, Óptica y
Electrónica (Mexico)
Rita D. Peterson, Air Force Research Laboratory (United States)
Wei Shi, Tianjin University (China)
Michael Vasilyev, The University of Texas at Arlington (United States)
Konstantin L. Vodopyanov, CREOL, The College of Optics and Photonics,
University of Central Florida (United States)
Vladislav V. Yakovlev, Texas A&M University (United States)

Session Chairs

- 1 UV-Visible Generation
Darrell J. Armstrong, Sandia National Laboratories (United States)
- 2 Supercontinuum Sources
Rita D. Peterson, Air Force Research Laboratory (United States)

- 3 Waveguide Sources
Peter G. Schunemann, BAE Systems (United States)
- 4 Quasi-Phasematched Materials
Kevin Zawilski, BAE Systems (United States)
- 5 Optical Parametric Devices
Carlota Canalias, KTH Royal Institute of Technology (Sweden)
- 6 Novel Concepts in Nonlinear Optics
Darrell J. Armstrong, Sandia National Laboratories (United States)
- 7 Frequency Comb Sources
Kenneth L. Schepler, CREOL, The College of Optics and Photonics,
University of Central Florida (United States)
- 8 Birefringent Nonlinear Crystals
Rita D. Peterson, Air Force Research Laboratory (United States)
- 9 New Nonlinear Concepts and Devices
Carlota Canalias, KTH Royal Institute of Technology (Sweden)
- 10 THz Generation and Detection
Peter G. Schunemann, BAE Systems (United States)
- 11 Raman Lasers
Kenneth L. Schepler, CREOL, The College of Optics and Photonics,
University of Central Florida (United States)
- 12 Stimulated Brillouin Scattering
Kenneth L. Schepler, CREOL, The College of Optics and Photonics,
University of Central Florida (United States)