

PROCEEDINGS OF SPIE

Laser Resonators, Microresonators, and Beam Control XX

Alexis V. Kudryashov
Alan H. Paxton
Vladimir S. Ilchenko
Editors

29 January–1 February 2018
San Francisco, California, United States

Sponsored and Published by
SPIE

Volume 10518

Proceedings of SPIE 0277-786X, V. 10518

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.

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 *Laser Resonators, Microresonators, and Beam Control XX*, edited by Alexis V. Kudryashov, Alan H. Paxton, Vladimir S. Ilchenko, Proceedings of SPIE Vol. 10518 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510615212

ISBN: 9781510615229 (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 © 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. 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 g' bWZi bXYf' jW'bg' 'Zca 'GD-9.

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>
xiii	<i>Introduction</i>

NOVEL MICRORESONATOR TOPOLOGIES AND SENSORS I

10518 02	Electro-optic tuning of potassium tantalate-niobate whispering gallery resonators [10518-1]
10518 04	Nonlinear behavior in hybrid microcavities (Invited Paper) [10518-3]
10518 05	Hollow whispering gallery resonators (Invited Paper) [10518-4]

MICRORESONATORS AND OPTICAL FREQUENCY COMBS I: JOINT SESSION WITH CONFERENCES 10516 AND 10518

10518 0B	Integrated Kerr micro-comb sources for photonic microwave applications (Invited Paper) [10518-10]
10518 0D	Temporal cavity solitons in synchronously driven Fabry-Perot microresonators (Invited Paper) [10518-12]
10518 0E	Advances in nonlinear phenomena in whispering gallery mode resonators [10518-13]

MICRORESONATORS AND OPTICAL FREQUENCY COMBS II: JOINT SESSION WITH CONFERENCES 10516 AND 10518

10518 0H	Saturable absorption by carbon nanotubes on silica microtoroids for stable mode locking [10518-16]
10518 0I	Wideband critically coupled resonators [10518-17]
10518 0J	Agile generation of microresonator-based frequency combs without pump detuning and local temperature controlling [10518-18]

MICRORESONATOR LASERS AND RF PHOTONICS

- 10518 ON **Ultra-low noise microwave signal generation with an optical frequency comb (Invited Paper)**
[10518-22]
- 10518 OP **Whispering gallery mode resonators for mid-IR quantum and interband cascade laser analysis and control** [10518-24]

QUANTUM OPTICS AND OPTOMECHANICS WITH MICRORESONATORS

- 10518 OS **Surface scattering and opto-mechanical effects in droplet microresonators (Invited Paper)**
[10518-27]
- 10518 OU **Incoherently pumped lasing and self-pumped three-wave mixing in laser-active whispering-gallery resonators** [10518-29]

NOVEL MICRORESONATOR TOPOLOGIES AND SENSORS II

- 10518 OV **Using the lasing threshold in whispering gallery mode resonators for refractive index sensing**
[10518-30]
- 10518 OW **Environmentally stable integrated ultra-high-Q optical cavities** [10518-32]
- 10518 OX **Mid-infrared whispering gallery resonators based on non-oxide nonlinear optical crystals**
[10518-33]

NOVEL MICRORESONATOR TOPOLOGIES AND SENSORS III

- 10518 OY **Sensitivity-enhanced intracavity-absorption acetylene sensor based on mode competition**
[10518-35]
- 10518 OZ **Mode-splitting for refractive index sensing in fluorescent whispering gallery mode resonators with broken symmetry** [10518-37]
- 10518 10 **Dual coupler coupled cavities optical gyroscope with enhanced performance** [10518-31]

LASER MODE CONTROL AND MODELING I

- 10518 11 **Dynamically stable operation of a 100-watt level CW single frequency ring laser at 1064 nm**
[10518-38]
- 10518 13 **FPGA based laser frequency stabilization using FM spectroscopy** [10518-40]

10518 14 **Characterization on the effect of group delay in a total reflection prism ring resonator**
[10518-41]

LASER MODE CONTROL AND MODELING II

10518 15 **Analytic treatment of high power diode pumped lasers with unstable resonator in a flowing medium (Invited Paper)** [10518-42]

10518 16 **Intracavity diode-side-pumped Raman laser at 1147 nm and 1163 nm** [10518-43]

10518 17 **Spectrally stabilized high-power high-brightness DBR-tapered lasers in the VIS and NIR range**
[10518-44]

ADAPTIVE OPTICS I

10518 18 **Comparison of the efficiency of laser beam focusing through the scattering medium using 14- and 31-channel bimorph mirrors (Invited Paper)** [10518-45]

10518 19 **Development of an adaptive laser beam shaper** [10518-46]

10518 1A **Arbitrary control of the polarization state and intensity of non-diffracting beams along their propagation direction** [10518-47]

10518 1B **High-energy OPA stability control with adaptive lenses** [10518-48]

ADAPTIVE OPTICS II

10518 1E **Formation of the doughnut and super-Gaussian intensity distribution by means of different types of wavefront correctors** [10518-51]

ULTRASHORT LASER

10518 1H **Femtosecond laser transverse mode conversion by an achromatic volume phase mask**
[10518-54]

BEAM CHARACTERIZATION AND SHAPING I

10518 1I **Anamorphic beam shaping for efficient laser homogenization: methods and high power applications (Invited Paper)** [10518-55]

10518 1J **Analysis of wavefront structures of diode lasers by their spatial and current dependent evolution** [10518-56]

- 10518 1K **M-squared measurement with improved repeatability for CW to single pulse lasers** [10518-57]
- 10518 1L **Solving the logarithmic Monge-Ampère equation with a RK4-algorithm for beam shaping purposes of femtosecond laser beams with spatial light modulators** [10518-58]

BEAM CHARACTERIZATION AND SHAPING II

- 10518 1N **A novel laser resonator for fractal modes** [10518-60]
- 10518 1P **Manipulation of Airy beams in photonic lattices by means of optical Bloch oscillation** [10518-62]
- 10518 1Q **Non-paraxial diffractive and refractive laser beam shaping** [10518-63]
- 10518 1R **Power handling for LCoS spatial light modulators** [10518-64]
- 10518 1S **Gradient-index beam shapers: fabricated devices and 3D design method (Invited Paper)** [10518-65]
- 10518 1T **Generation and amplification of vector vortex beams** [10518-66]

POSTER SESSION

- 10518 1U **Dielectric equilateral triangle microresonators: integral equations and semi-classical physics approaches** [10518-67]
- 10518 1V **Investigation of an ultra large mode area power amplifier stage for a pulsed 1550-nm laser system** [10518-69]
- 10518 1X **Efficient octave-spanning frequency comb generation in normal dispersion regime** [10518-72]
- 10518 1Y **Longitudinally excited CO₂ laser with short laser pulse and high quality beam** [10518-73]
- 10518 1Z **High-efficiency coupling to small-core microstructured fibers for broadband dispersion characterization** [10518-74]
- 10518 20 **New topologies of femtosecond Er:fibre laser cavities** [10518-75]
- 10518 21 **High spatial resolution bimorph deformable mirror for laser beam control** [10518-76]