PROCEEDINGS OF SPIE

20th International Conference and School on Quantum Electronics: Laser Physics and Applications

Tanja Dreischuh Latchezar Avramov Editors

17–21 September 2018 Nessebar, Bulgaria

Sponsored by

The National Science Fund, Ministry of Education and Science of Bulgaria (Bulgaria) Aquachim PLC (Bulgaria)

Cosponsored by SPIE

Organized by Institute of Electronics, Bulgarian Academy of Sciences (Bulgaria)

Published by SPIE

Volume 11047

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 20th International Conference and School on Quantum Electronics: Laser Physics and Applications, edited by Tanja Dreischuh, Latchezar Avramov, Proceedings of SPIE Vol. 11047 (SPIE, Bellingham, WA, 2019) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510627680

ISBN: 9781510627697 (electronic)

Published by

SPIF

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time)· Fax +1 360 647 1445 SPIF 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.



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

Authors

vii

iv	Conference Committees
xi	Introduction
	LASERS IN BIOLOGY AND MEDICINE
11047 02	Towards bridging non-ionizing, ultra intense, laser radiation and ionizing radiation in cancer therapy (Invited Paper) [11047-54]
11047 03	Lasers for in-vivo skin diagnostics: some recent developments (Invited Paper) [11047-38]
11047 04	Multispectral autoflourescence detection of skin neoplasia using steady-state techniques [11047-10]
11047 05	Comparative study on the bio-activity of hemoglobin and myoglobin as recognition materials in biosensors [11047-24]
11047 06	Effect of tissue temperature and radiation parameters on the quantum efficiency of photodissociation of oxyhemoglobin in cutaneous blood vessels [11047-7]
11047 07	Multiwavelength polarimetry of gastrointestinal ex vivo tissues for tumor diagnostic improvement (Best Student Paper Award) [11047-32]
11047 08	Stomach and intestine neoplasia fluorescence detection using 5-ALA/PpIX photosensitization [11047-11]
11047 09	Detection of stress-induced gastrointestinal lesions using Al-phythalocynanines in experimental animals [11047-9]
11047 0A	Six months follow-up with pulse oximetry and electric pulp test of teeth with trauma [11047-6]
	LASER-MATTER INTERACTIONS
11047 OB	Light irradiation effect on the gas sensing properties of the ZnO nanostructures [11047-18]
11047 OC	Laser removal of chlorine from historical metallic objects [11047-46]

11047 OD	X-ray photoelectron spectroscopy characterization of amorphous and nanosized thin carbon films [11047-8]
11047 OE	Ablation of graphite in water by Nd:YAG laser [11047-16]
11047 OF	Optical response of azopolymer (PAZO) layers doped with TiO ₂ nanoparticles [11047-42]
11047 0G	Gas-sensing properties of metal-oxide nanostructures produced by PLD [11047-43]
11047 OH	Determination of residual stresses in fiber laser welded stainless steel joints by neutron diffraction method $[11047-17]$
11047 01	Synthesis and characterization of surface embedded silver nanoparticles in ZnO matrix [11047-23]
11047 OJ	Direct laser writing of Ag nanoparticle-composed structures in glass [11047-19]
11047 OK	Synthesis of submicron-dispersed carbon phases in water by Nd:YAG laser ablation of graphite [11047-28]
11047 OL	Laser-assisted preparation of complex colloidal nanostructures by nanosecond ablation in liquid [11047-33]
11047 OM	Fabrication of multicomponent nanowires by laser ablation of mixed target in a presence of magnetic field [11047-31]
11047 ON	Ellipsometric study of thin carbon films deposited by pulsed laser deposition [11047-48]
11047 00	Comparative study of the characteristics of red Bulgarian and French wines using applied photonics methods $[11047\text{-}61]$
	LASER SPECTROSCOPY AND METROLOGY
11047 OP	Search for deviations from the ideal Maxwell-Boltzmann distribution for a gas at an interface (Invited Paper) [11047-60]
11047 0Q	Dark matter search by laser spectroscopy (Invited Paper) [11047-49]
11047 OR	Rydberg atoms and quantum information (Invited Paper) [11047-59]
11047 OS	Formation of cesium dimers and observation of high-resolution dimer spectra in spatially restricted Cs vapor [11047-40]
11047 OT	Spectral line narrowing due to velocity selective optical pumping on the D_2 line hyperfine transitions in spatially restricted Cs vapor [11047-51]
11047 OU	Asymmetric frequency-tuning behavior of the D1 line hyperfine spectrum of Rb vapor contained in high quality paraffin coated optical cell [11047-29]

11047 OV	Light induced atomic desorption for spectroscopy of optically thick Rb atomic vapor [11047-5]
11047 OW	Monitoring of a drying process in polymer water and methanol solutions by dynamic speckle metrology [11047-12]
11047 OX	Spectral interferometric measurement of a birefringence photonic crystal fiber [11047-1]
11047 OY	Quantum dot array built into a nanoscale vibration detection scheme and the comparison with microlasers-based devices $[11047\text{-}3]$
	LASER REMOTE SENSING AND ECOLOGY
11047 OZ	Implementation of synergetic observations by terrestrial and space lidar systems and sunradiometer for study of large scale aerosol changes (Invited Paper) [11047-13]
11047 10	Elastic backscatter lidar in PBL study (Invited Paper) [11047-53]
11047 11	Unusual wintertime transport of Saharan dust to Sofia, Bulgaria, detected by lidar [11047-25]
11047 12	Simultaneous vertical LIDAR profiling of Saharan dust layers and high-altitude cirrus clouds in the troposphere $[11047\text{-}15]$
11047 13	Lidar and contact investigations of aerosol characteristics near high traffic urban sites [11047-52]
11047 14	Application of paired powerful laser diodes for detection and reconnaissance of atmospheric methane [11047-50]
11047 15	Saharan dust mixed with marine aerosols: lidar measurements and characterization [11047-26]
11047 16	Elastic-lidar signal statistics and sensing efficiency depending on the laser radiation wavelength [11047-22]
11047 17	Delay of GPS signals in the D and E atmospheric layers: is the quantum theory applicable? $[11047\text{-}44]$
	LASER SYSTEMS AND NONLINEAR OPTICS
11047 18	Radiation generation via non-linear optical processes during propagation of high peak and high average power fs pulses (Invited Paper) [11047-2]
11047 19	Tappert transformation in nonlinear wave theory [11047-4]
110471A	Depolarization of femtosecond pulses in air by nonlinear mechanisms [11047-58]

11047 1B	Parametric four-photon mixing: exact analytical solutions in Jacobi functions [11047-56]
110471C	Vortex solutions of vector nonlinear amplitude equations in optics [11047-57]
11047 1D	Vortex interactions revisited: Formation of stable elementary cells for creation of rigid vortex lattices [11047-21]
11047 1E	Luminescence of Iridium complexes upon short laser pulses [11047-34]
11047 1F	Competitive light wavelength division multiplexing element based on tunable interference wedged structures [11047-36]
11047 1G	Interference wedged structures as light beam splitting elements [11047-35]
11047 1H	Flexible and stretchable optoelectronic devices using graphene [11047-41]
11047 11	Properties of polymeric materials for optical systems [11047-39]
11047 1J	Perspective laser medium for random lasing [11047-37]
11047 1K	Powerful high-beam-quality sealed-off laser system oscillating in middle infrared spectral range on strontium atomic transitions for medical applications [11047-14]