

PROCEEDINGS OF SPIE

Saratov Fall Meeting 2016

Laser Physics and Photonics XVII; and Computational Biophysics and Analysis of Biomedical Data III

Vladimir L. Derbov
Dmitry E. Postnov
Editors

27–30 September 2016
Saratov, Russian Federation

Sponsored by

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Published by
SPIE

Volume 10337

Proceedings of SPIE, 0277-786X, V. 10337

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

Saratov Fall Meeting 2016: Laser Physics and Photonics XVII; and Computational Biophysics and Analysis of Biomedical Data III, edited by Vladimir L. Derbov, Dmitry E. Postnov, Proc. of SPIE Vol. 10337, 1033701 · © 2017 SPIE · CCC code: 0277-786X/17/\$18 · doi: 10.1117/12.2277227

Proc. of SPIE Vol. 10337 1033701-1

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Author(s), "Title of Paper," in *Saratov Fall Meeting 2016: Laser Physics and Photonics XVII; and Computational Biophysics and Analysis of Biomedical Data III*, edited by Vladimir L. Derbov, Dmitry E. Postnov, Proceedings of SPIE Vol. 10337 (SPIE, Bellingham, WA, 2017) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-786X (electronic)

ISBN: 9781510611191

ISBN: 9781510611207 (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

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Printed in the United States of America.

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Contents

vii	<i>Authors</i>
ix	<i>Conference Committee</i>
xi	<i>Introduction</i>
xiii	<i>Organizers</i>

Part A Laser Physics and Photonics XVII

NONLINEAR OPTICAL MEDIA AND INTERACTIONS

10337 02	Nonlinear optical response of a glassy semiconductor illuminated near its fundamental absorption band edge [10337-115]
10337 03	Tunable excitons in gated graphene systems [10337-1]
10337 04	Emergence of multistability and quasi-periodicity in an optoelectronic oscillator [10337-14]
10337 05	Study of laser radiation detection by matrix sensor based on carbon nanotubes array [10337-33]
10337 06	Density of states in complex cavity with hyperbolic medium [10337-35]
10337 07	Tunnel electron photoemission in the nanoscale DLC film structure with electrostatic field localization [10337-64]
10337 08	Stabilization of enhanced field emission of the film DLC structure in conditions of field localization [10337-65]
10337 09	Optical reflection spectra of the structures with surface plasmons excited at the metal-amplifying heterogeneous medium boundary [10337-7]

QUANTUM OPTICS AND NON-CLASSICAL LIGHT

10337 0A	Entanglement in two-atom Tavis-Cummings model with Raman transitions [10337-29]
10337 0B	Sustainable entangled state of two qubits with time-dependent dipole-dipole interaction under coherent electromagnetic field influence [10337-52]
10337 0C	Entanglement between two atoms successively passing a thermal cavity taking into account detuning and atomic coherence [10337-28]

- 10337 OD **Dynamics of two superconducting qubits interacting with two different quantum resonators** [10337-26]
- 10337 OE **Dynamical symmetry, squeezing and many-photon correlations in spontaneous parametric down-conversion** [10337-30]
- 10337 OF **Dynamics of two N-level atoms (N=2, 3) in nonideal cavities** [10337-46]

COMPUTATIONAL APPROACHES AND NUMERICAL SIMULATIONS IN PHOTONICS

- 10337 OG **The numerical-analytical implementation of the cross-sections method to the open waveguide transition of the "horn" type** [10337-23]
- 10337 OH **Field calculation for the horn waveguide transition in the single-mode approximation of the cross-sections method** [10337-25]
- 10337 OI **Mathematical synthesis of the thickness profile of the waveguide Lüneburg lens using the adiabatic waveguide modes method** [10337-27]
- 10337 OJ **Three-body scattering model: diatomic homonuclear molecule and atom in collinear configuration** [10337-93]
- 10337 OK **Geometrization of Maxwell's equations in the construction of optical devices** [10337-50]
- 10337 OL **Maxwell's equations instantaneous Hamiltonian** [10337-36]
- 10337 OM **A geometric approach to the Lagrangian and Hamiltonian formalism of electrodynamics** [10337-39]
- 10337 ON **Simulation of resonance focusing of light by dielectric cylinder with a square section** [10337-51]
- 10337 OO **Propagation of evanescent waves in multimode chalcogenide fiber immersed in an aqueous acetone solution: theory and experiment** [10337-70]
- 10337 OP **Electromagnetically induced disintegration and polarization plane rotation of laser pulses** [10337-4]
- 10337 OQ **Zernike basis-matched multi-order diffractive optical elements for wavefront weak aberrations analysis** [10337-81]
- 10337 OR **Vortex lenses for optical micromanipulation** [10337-15]
- 10337 OS **Dynamic interference fringe processing algorithms based on non-linear optimization** [10337-57]
- 10337 OT **Transmitting subwavelength azimuthal micropolarizer** [10337-43]
- 10337 OU **The effect of the "fast" light in the large-sized carbon nanostructures in the nanosecond time range** [10337-5]

- 10337 0V **The effect of "fast" light in the carbon nanostructures in the nanosecond range of pulsewidth** [10337-53]
- 10337 0W **The regenerative and super-regenerative amplifications of the ultrashort laser pulses** [10337-19]

Part B Computational Biophysics and Analysis of Biomedical Data III

ADVANCED ANALYSIS OF COMPLEX DATA

- 10337 0X **A fast method for the detection of vascular structure in images, based on the continuous wavelet transform with the Morlet wavelet having a low central frequency** [10337-63]
- 10337 0Y **Mathematical approach to recover EEG brain signals with artifacts by means of Gram-Schmidt transform** [10337-17]
- 10337 0Z **Study of pattern formation in multilayer adaptive network of phase oscillators in application to brain dynamics analysis** [10337-8]
- 10337 10 **Quantifying chaotic oscillations from noisy interspike intervals with Lyapunov exponents** [10337-9]
- 10337 11 **Multifractal spectrum of physiological signals: a mechanism-related approach** [10337-10]
- 10337 12 **Dealing with noise and physiological artifacts in human EEG recordings: empirical mode methods** [10337-11]
- 10337 13 **The study of evolution and depression of the alpha-rhythm in the human brain EEG by means of wavelet-based methods** [10337-12]
- 10337 14 **Patterns recognition of electric brain activity using artificial neural networks** [10337-13]
- 10337 15 **Intermittency in electric brain activity in the perception of ambiguous images** [10337-16]

ASSESSMENT AND MODELING OF PHYSIOLOGICAL RHYTHMS

- 10337 16 **A modeling study on the influence of blood flow regulation on skin temperature pulsations** [10337-45]
- 10337 17 **Spatio-temporal cerebral blood flow perfusion patterns in cortical spreading depression** [10337-48]
- 10337 18 **The assessment of sympathetic activity using iPPG based inter-limb coherence measurements** [10337-22]

- 10337 19 **Phase synchronization of oscillations in cardiovascular and respiratory systems in humans** [10337-3]
- 10337 1A **Formation of the peak amplitude of blood flow oscillations at a frequency of 0.1 Hz in the human cardiovascular system by the noise effect on the heart** [10337-6]
- 10337 1B **ATP concentration as possible marker of liver damage at leukaemia treatment: confocal microscopy-based experimental study and numerical simulations** [10337-44]

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.

Aban'shin, Nikolay P., 07, 08
Abdurashitov, Arkady S., 11
Agapov, Sergey N., 0F
Akchurin, Garif G., 07, 08
Andreev, A., 09
Arinushkin, Pavel A., 10, 11
Avetisyan, Artak A., 03
Avetisyan, Yuri A., 07, 08
Ayryan, Edik, 0I
Babak, S., 1B
Balakin, M., 04
Baranov, Michael S., 0W
Bashkirov, Eugene K., 0A, 0C, 0D
Biryukov, Alexander A., 0B
Budyak, Victoria V., 0P
Chaplygina, Alina V., 19
Chemeris, Nikolay K., 19, 1A
Chuluunbaatar, O., 0J
Dashitsyrenov, Genin, 0I
Degtyarev, Sergey A., 0Q
Demidova, A. V., 0K
Derbov, V. L., 0J
Divakov, Dmitriy, 0G
Djotyan, Anahit P., 03
Dvorak, A., 04
Eferina, E. G., 0L, 0M
Ermolaev, Petr A., 0S
Evseev, Mikhail M., 0D
Evseyko, S. A., 02
Ganchevskaya, Sofiya V., 0R
Gerasimenko, A. Yu., 05
Gevorkyan, Migran, 0H, 0K
Goremyko, Mikhail V., 0Z
Gorokhov, Alexander V., 0E, 0F
Gribkov, Vladislav Yu., 0U, 0V
Grinevich, Andrey A., 19, 1A
Grubov, Vadim V., 12, 15
Gusev, A. A., 0J
Hai, L. L., 0J
He, Ying, 16
Hramov, Alexander E., 0Y, 0Z, 12, 14
Khonina, Svetlana N., 0Q
Khramov, Vladimir N., 0W
Khramova, Marina V., 12, 13
Kirsanov, Daniil V., 0Z
Kitsyuk, E. P., 05
Kochetkova, Anastasia E., 0P
Korolkova, A. V., 0K, 0L, 0M
Koronovskii, Alexey A., 0Y, 15

Korsakova, S. V., 0O
Kotereva, T. V., 0O
Kotlyar, Maria V., 0T
Kotlyar, Victor V., 0N, 0T
Kozina, O. N., 06
Kozlov, Dmitry A., 0N
Kozlova, Elena S., 0N
Krassovitskiy, P. M., 0J
Kulyabov, Dmitriy, 0H, 0K, 0L, 0M
Kurochkin, Maxim A., 0X
Kurovskaya, Maria K., 15
Laneev, Evgeniy, 0I
Lavrova, A., 1B
Loginov, Alexander P., 07, 08
Lovetskiy, Konstantin, 0H, 0I
Makarov, Vladimir V., 0Z
Malashchenko, V., 1B
Malykh, Mikhail, 0G
Melnikov, L. A., 06
Mizeva, Irina, 16
Mosiyash, Denis S., 07, 08
Moulopoulos, Konstantinos, 03
Musatov, V. Yu., 14
Nalimov, Anton G., 0T
Nazvanov, V., 09
Nedaivozov, Vladimir O., 0Z
Nefedov, I. S., 06
Orlov, A. P., 05
Parshkov, Oleg M., 0P
Pavlov, A. A., 05
Pavlov, Alexey N., 10, 11, 15
Pavlova, Olga N., 10, 11
Pchelintseva, S. V., 14
Pisarchik, Alexander N., 15
Polokhin, A. A., 05
Porfirev, Alexey P., 0Q
Postnikov, Eugene B., 0X
Postnov, Dmitry E., 0X, 17, 18
Pysarchik, A. N., 13
Rogatina, Kristina V., 18
Romanova, E. A., 02, 0O
Runnova, Anastasiya E., 0Y, 11, 12, 13, 14, 15
Semyachkina-Glushkovskaya, Oxana V., 11
Sevastianov, Anton, 0G, 0H, 0I
Sevastianov, Leonid, 0G, 0H, 0I, 0K, 0L, 0M
Shaman, Yu. P., 05
Shiryaev, V. S., 0O
Shleenkov, Mark A., 0B
Skidanov, Roman V., 0R

Stafeev, Sergey S., 0T
Stiukhina, Elena S., 18
Sukhanov, M. V., 0O
Tang, Yanliang, 16
Tankanag, Arina V., 19, 1A
Tikhonova, Irina V., 19
Tiutiunnik, Anastasiia, 0G
Tomarzhevskaya, Anna S., 0S
Tsoy, Maria O., 0X, 18
Vasilyev, G. N., 02
Velieva, T. R., 0L, 0M
Velmuzhov, A. P., 0O
Verisokin, Andrey Yu., 17
Vervevko, Darya V., 17
Vinitzky, S. I., 0J
Volynsky, Maxim A., 0S
Yakunin, Alexander N., 07, 08
Zaryadov, I. S., 0L
Zatrudina, Rimma Sh., 0U, 0V
Zhuravlev, Maxim O., 0Y, 13, 15
Zyubin, A., 1B

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Introduction

The 4th International Symposium on Optics and Biophotonics (Saratov Fall Meeting SFM16) was held in Saratov, Russian Federation, 27–30 September 2016 with over 500 participants from the Russian Federation, United States, Canada, Europe, Asia, and South Pacific countries. It covered a wide range of modern problems of fundamental and applied optics, laser physics, photonics, and biomedical optics.

This volume is the second part of the symposium proceedings and includes selected papers of the following conferences and workshops within the symposium:

Laser Physics and Photonics XVII
Vladimir L. Derbov (Chair)

Computational Biophysics and Analysis of Biomedical Data III
Dmitry E. Postnov (Chair)

The first part of the volume, devoted to laser physics and photonics, began with papers related to nonlinear optical media and the mechanisms of light-matter interactions. The innovative feature of the presented papers included a variety of novel materials and artificial media interacting with laser light, such as graphene, arrays of carbon nanotubes, nanoscale DLC film structures with field localization, and planar structures with surface plasmons, hyperbolic metamaterials, etc.

SFM16 traditionally gave the floor to discussions on the urgent problems of quantum optics. In this volume, papers related to quantum optics and nonclassical light mainly focused on generalizing the known quantum optical models, and the theoretical interpretation of fundamental quantum optical experiments. Particularly those related to the formation and application of entangled quantum states, which are expected to play a crucial role in the implementation of quantum computers.

Quite naturally, a variety of new objects for laser exposure and the implementation of light-matter interactions beyond the limits of classical optics (belonging to a more general field of photonics) require novel theoretical approaches, software development, and various computer simulations. The papers on computational approaches and numerical simulations in photonics demonstrated both the numerical studies of material objects interacting with laser light; and the conceptual approaches to electrodynamics used in photonics, showing promising progress in further computer experiments. Finally, a considerable part of the papers were devoted to beam and pulse propagation as well as image formation using laser sources of light.

The second part of the volume is devoted to computational biophysics and analysis of biomedical data. Computational issues naturally accompany any research involving data processing; in particular, the measurements of physiological parameters of living systems. The mastering of relevant algorithms and numerical methods is typically as important as the development of research hardware. Another important computer-based field was the mathematical modeling of processes not yet assessable by direct measurements.

In the framework of the conference, both issues were a matter of discussions and are presented in the papers of this volume. Some are contributed methods of general interest (see 103370X), but the typical trend was to develop highly specialized, problem-optimized methods for specific tasks of physiology and dynamics of living systems, particularly the analysis of human electroencephalography (EEG) data. Here, the problem of detection of rhythms in noisy and incomplete data was in the focus of discussions. Another important topic was the mathematical modeling of physiological processes in microcirculation that underlie the formation of signals obtained from the skin surface.

This is the second part of the Saratov Fall Meeting 2016 proceedings collection. *Saratov Fall Meeting 2016: Optical Technologies in Biophysics and Medicine XVIII*, edited by Elina A. Genina and Valery V. Tuchin, SPIE volume 10336, contains part one. The introduction in 10336 provides the reader with detailed and impressive information about the entire Saratov Fall Meeting 2016.

The editors of this volume thank all of the authors for their contributions to the symposium, especially the plenary, invited, and Internet lecturers for their exciting presentations. We are also grateful to all the sponsoring organizations and programs that efficiently supported this meeting, with special thanks to:

SPIE – The International Society for Optics and Photonics;
The Optical Society;
Russian Foundation for Basic Research (Russian Federation);
SPE "Nanostructured Glass Technology" Ltd. (Russian Federation);
RME "INJECT" LLC (Russian Federation);
Saratov State University grant №14.Z50.31.0004 of the Government of
the Russian Federation;
Russian Technology Platforms: "The Medicine of the Future"
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