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Laser Physics, Photonic Technologies and Molecular Modeling

Vladimir L. Derbov
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Introduction

The Sixth International Symposium on Optics and Biophotonics (Saratov Fall Meeting; SFM18) was held in Saratov, Russian Federation, 24–28 September 2018 with over 500 participants from the Russian Federation, the United States, Canada, Europe, Asia, and Pacific Ocean countries. It covered a wide range of modern problems of fundamental and applied optics, laser physics, photonics, and biomedical optics.

This volume includes selected papers of the following Conferences and Workshops organized in the framework of the Symposium:

Laser Physics and Photonics XX
Vladimir L. Derbov (*Chair*)
Spectroscopy and Molecular Modeling XIX
Lev M. Babkov (*Chair*)
Low-Dimensional Structures VIII
Olga E. Glukhova (*Chair*)
Advanced Polarization and Correlation Technologies in Biomedicine and Material Science
Dmitry A. Zimnyakov (*Chair*)
Electromagnetics of Microwaves, Submillimeter and Optical Waves XVII
Michael V. Davidovich (*Chair*)

The volume begins with reports of recent studies in laser systems and photonic technologies, including novel semiconductor lasers, fiber lasers, parametric oscillators, and photosensors. Laser systems for distance measurements and material processing technologies are considered. The next section devoted to nonlinear optics, beam and pulse propagation is presented by theoretical studies of self-induced transparency observed with polarized pulses, nonlinear effects in susceptibility gratings, propagation of solitons and soliton-like pulses in variable fibers and phototropic media. Our meeting traditionally gives the floor to discussing urgent problems of quantum optics. In the present volume, the papers related to quantum optics are mainly focused on entangled quantum states of light, which are considered as qubits for quantum computers. General issues of quantum dynamics control and quantum fluctuations in a fiber Raman amplifier are discussed. In the next section, the problems of electrodynamics of laser and photonic systems are presented, including both novel formulations of the basic equations and original numerical approaches to modelling particular laser and photonic systems. These theoretical and numerical studies are stimulated by the necessity for efficient and universal theoretical methods and numerical algorithms aimed to optimize the existing waveguide and integrated optical systems and design new ones.

The studies reported in the section on advanced polarization and correlation technologies combine original theoretical approaches with experimental implementations that allow wide application both in biomedical diagnostics and in material science. In the present section, the main attention in this field is focused on low-coherence reflectometry, speckle correlation techniques and comparison of different phase scattering functions in modeling wave radiative transfer applied to media with complex structures and dynamics.

In this volume, we devote a special section to sources and applications of terahertz radiation, thus reflecting rapidly growing multidisciplinary interest to the THz range. Quantum cascade lasers, surface plasmon-polaritons, graphene-based hyperbolic media, and tapered metal-insulator-graphene heterostructures are considered in relation with generating, amplifying and using THz electromagnetic waves.

Spectroscopy and molecular modeling are traditionally an important part of Saratov Fall Meeting. The appropriate section of this volume combines the traditional molecular spectroscopy of new objects, relevant to modern photonics and biophysics, with theoretical analysis of more specific objects of study, e.g., hyperfine relativistic corrections and weakly bound dimer systems that arise due to electron correlations. In contrast to earlier years, a larger amount of experimental work were reported. Finally, the last but not the least, a section on low-dimensional structures mainly discusses electronic and optical properties of graphene-based systems, including graphene nanoblisters and graphene layers connected with nanotubes. Entropy evolution of carriers in graphene, generated by strong laser field is considered as a model of processes that accompany laser-induced pair creation in vacuum.

This is the second volume of *Saratov Fall Meeting 2018*. The preface to the first volume *Optical and Nano-Technologies for Biology and Medicine*, edited by Elina A. Genina and Valery V. Tuchin, provided the reader with thorough and impressive information about the entire event of Saratov Fall Meeting 2018.

On behalf of SFM18 organizers, the editor of this volume thanks all 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 the meeting: SPIE; OSA; IEEE - Institute of Electrical and Electronics Engineers; Russian Foundation for Basic Research; Russian Academy of Sciences; Government of the Russian Federation; European Technology Platform “Photonics21”; EPIC – European Photonics Industry Consortium; LLC SPE "Nanostructed Glass Technology" (Russian Federation); and RME "INJECT" LLC (Russian Federation); TechnoInfo Ltd. (Germany); BioVitrum Ltd. (Russian Federation); and LLC SPE OESSP (Russian Federation).

Vladimir L. Derbov

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