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Saratov Fall Meeting 2019

Laser Physics, Photonic Technologies, and Molecular Modeling

Vladimir L. Derbov

Editor

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- 5 Electromagnetics of Microwaves, Submillimeter and Optical Waves IXX
Michael V. Davidovich, Saratov State University (Russian Federation)

Introduction

The Seventh International Symposium on Optics and Biophotonics (Saratov Fall Meeting, SFM19) was held in Saratov, Russian Federation, 23–27 September 2019 with more than 500 participants from Russian Federation, United States, Canada, Europe, and Asian countries. It covered a wide range of modern problems of fundamental and applied optics, laser physics, photonics, and biomedical optics, as well as related fields of material science.

The Proceedings of the symposium are published in three SPIE volumes. The present volume includes selected papers of the following conferences and workshops organized in the framework of the symposium:

Laser Physics and Photonics XXI

Vladimir L. Derbov (*Chair*)

Spectroscopy and Molecular Modeling XX

Lev M. Babkov (*Chair*)

Low-Dimensional Structures IX

Olga E. Glukhova (*Chair*)

Advanced Polarization and Correlation Technologies in Biomedicine and Material Science VI

Dmitry A. Zimnyakov (*Chair*)

Electromagnetics of Microwaves, Submillimeter and Optical Waves IXX

Michael V. Davidovich (*Chair*)

The volume begins with the section reporting on recent studies in laser systems and laser and photonic technologies. Alongside the studies of VCSEL dynamics and modeling of MIR quantum cascade laser with high index contrast photonic crystal structure, a variety of laser applications is presented, including acceleration measurement, laser ablation for microfabrication technology, manipulation of microscopic objects, light-stimulated anomalous blocking of all-optical poling, near-surface plasma formation and laser-induced photo-modification of gold nanoparticles. Of particular interest for ecology and navigation are the results on laser manipulation of airborne particles.

The next section is devoted to nonlinear optics, beam and pulse propagation including self-modulation effects in electromagnetically induced transparency, generation of high-order harmonics in glass media, polarization and anisotropy effects, as well as experimental studies of spiral beams generation.

Our meeting traditionally gives the floor to discussing urgent problems of quantum optics. In the present volume, the papers related to quantum optics are focused

on entangled quantum states of light, which are considered as qubits for quantum computers.

Advanced polarization and correlation technologies in this volume are represented by four papers devoted to low coherence reflectometry and OCT probing of porous materials, on the one hand, and more traditional techniques of polarization optical analysis, on the other hand. The techniques reported here can be applied to both biomedicine and material science.

Spectroscopy and molecular modeling has traditionally been an important part of the Saratov Fall Meetings, both past and present. The appropriate section of this volume combined the traditional molecular spectroscopy of new objects, relevant to modern photonics and biophysics, with theoretical analysis of more specific objects of study, e.g., weakly bound dimer systems that have no chemical bond in the traditional sense and exist as bound systems only due to electron correlations. Following the trend of recent years, a considerable amount of experimental work was reported.

A special section is devoted to sources and applications of terahertz radiation, thus reflecting rapidly growing multidisciplinary interest to the THz range. In this section deceleration of terahertz plasma waves in tapered graphene-insulator-graphene heterostructure and generation of terahertz radiation in a system of coupled semiconductor lasers are considered.

Finally, last but not the least, a section on metamaterials, low dimensional and band-gap structures covers a wide range of studies of electronic and optical properties of graphene-based systems, heterostructures and low-dimensional nanostructures. Theoretical papers on electrostatics of protonic systems were also included in this section, since they mainly refer to the electromagnetics of metamaterials and left-handed media.

This was the second volume of *Saratov Fall Meeting 2019*. The preface to the first volume *Optical and Nano-Technologies for Biology and Medicine* (Proceedings volume 11457), 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 2019.

On behalf of SFM19 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: Saratov State University (Russian Federation); Research Center of Biotechnology RAS (Russian Federation); SPIE – The International Society of Photo-Optical Instrumentation Engineers; The Optical Society; Art Photonics GmbH (Germany); Avesta Projects Ltd. (Russian Federation); Becker & Hickl GmbH (Germany); RME INJECT, LLC

(Russian Federation); LLC SPE Nanostructured Glass Technology (Russian Federation).

Vladimir L. Derbov

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