XII International symposium „Optics and Biophotonics“ (Saratov Fall Meeting 2024), Saratov, 23–27 September 2024

Saratov Fall Meeting, the International School-Conference on Optics, Laser Physics and Biophotonics, has been held every autumn in Saratov on the venue of Chernyshevsky Saratov National Research State University for 28 years. During this time, the scientific symposium „Optics and Biophotonics“, which was held for the 12th time in 2024, was separated to become a special structure. To see SFM-24 program visit https://sfmconference.org/files/program-of-sfm-25-09-2024.pdf

This issue of the Journal of Technical Physics includes selected papers based on reports presented at six of the fifteen events of the symposium:

- Workshop on Laser Physics and Photonics XXIV
- Conference on Low-Dimensional Structures XIV
- Workshop on Electromagnetics of Microwaves, Submillimeter and Optical Waves XXIV
- Conference on Spectroscopy and Molecular Modeling XXV
- Combined conference session on terahertz optics and biophotonics VII and modern materials for optics and biophotonics VII
- Conference on nanobiophotonics XX

Workshop on Laser Physics and Photonics XXV is represented by a wide spectrum of research of both fundamental and applied character. In the field of quantum optics, along with the dynamics of entanglement of an isolated atom and two Jaynes-Cummings atoms (A.R. Bagrov, E.K. Bashkirov), new effects of quantum fluctuations in fiber lasers with mode synchronization have been investigated (Yu.A. Mazhirina, L.A. Melnikov), critical for the development of quantum computer science. Works in the field of nonlinear and coherent optics are focused on the theory of polarization effects in electromagnetically induced transparency (O.M.Parshkov), modeling of RED for the analysis of aberrations with increased diffraction efficiency (P.A. Khorin, A.P. Dzyuba, S.N. Khonina) and the development of an effective method for analyzing spatial correlations of stochastic wave field (L.A. Maksimova, D.V. Lyakin, N.Yu. Mysina, V.P. Ryabukho). Technological applications of lasers are outlined in the study of magnetic nanoparticles obtained by laser ablation (U.E. Kurilova, A.S. Chernikov, D.A. Kochuev, R.V. Chkalov, M.A. Dzus, A.V. Harkov, A.V. Kazak, I.A. Suetina, L.I. Russ, M.V. Mezentseva, K.S. Khorkov).

The conference on low-dimensional structures XIV in this issue continued to expand the research topics and the range of considered objects towards experimental developments and technologies. The optical limiting properties of composites of phthalocyanine complexes of iron, nickel and cobalt with single-walled carbon nanotubes have been studied and their effectiveness has been evaluated using the latest correlation methods (M.S.Savelyev, P.N.Vasilevsky, A.A.Dudin, A.Yu.Tolbin, A.A.Pavlov, A.Yu.Gerasimenko), as well as the effect of FeS nanoinclusions on photovoltaic characteristics of CdS : Fe (S.V. Stetsiura, P.G. Kharitonova, A.M. Zakharevich). Correlation of X-ray, TEM, and Raman scattering spectroscopy methods has been established in studies of orientation disorder in MWCNT (N.G. Bobenko, V.E. Egorushkin, A.N. Ponomarev). A technology for forming electrically conductive surfaces based on carbon nanomaterials for neurostimulation devices has been developed (A.Yu. Gerasimenko, A.V. Kuksin, D.T. Murashko, K.D. Popovich, U.E. Kurilova, M.S. Savelyev, I.A. Suetina, L.I. Russu, M.V. Mezentseva, Yu.P. Shaman, E.P. Kutsyuk, I.V. Nesterenko, O.E. Glukhova, S.V. Selishchev), as well as technology for the fabrication of modified metal-porous M-type cathodes (T.M. Krachkovskaya, O.E. Glukhova, D.A. Kolosov) and the emission properties of the latter have been studied. The chemoresistive response of SnO_2 thin films during dissociative adsorption of alcohols and ketones (A.A. Petrunin, O.E. Glukhova) and the effect of metric parameters on the conductive properties of thin films of perforated graphene functionalized with carboxyl groups (P.V. Petrunin, O.E. Glukhova) have been studied using methods of electron density functional and quantum equations of motion (P.V. Barkov, M.M. Slepchenkov, O.E. Glukhova). The development of the approach to parameterization of the SCC DFTB method for transition metals is illustrated by the example of copper oxide (P.A. Kolesnichenko, O.E. Glukhova).

Workshop on Electromagnetics of Microwaves, Submillimeter and Optical Waves XXIV is presented by four theoretical articles. Methods for calculating plasmons localized in conductive nanoparticles are presented (M.V. Davidovich). In the course of the study of band-pass filters made using SIW and ESIW technologies (S.P. Burkin, S.V. Krutiev), models of these filters were synthesized and their prototypes were made, demonstrating the advantages of the new ESIW technology. A multilayered band-pass SIW-filter was synthesized and studied (V.S. Saburova, S.V. Krutiev). A new iterative method is proposed for solving the problem of diffraction on a nonlinear dielectric lattice in strong electromagnetic fields (A.M. Lehrer, I.N. Ivanova, V.I. Kravchenko) The articles based on reports from the combined session of conferences on Terahertz Optics and Biophotonics VII and Modern Materials for Optics and Biophotonics VII are mainly devoted to current design and research of composite and nanocomposite materials. For example, the use of machine learning methods has been successfully demonstrated to predict the optical absorption coefficient of composite ceramics based on hydroxyapatite (A.E. Rezvanova, B.S. Kudryashov, A.N. Ponomarev). New

nanocomposite piezoresistive elements based on carbon nanomaterials have been proposed for wearable electronics (K.D. Popovich, V.V.S uchkova, D.I. Ryabkin, A.A. Pugovkin, E.A. Gerasimenko, D.V. Telyshev, A.Yu. Gerasimenko, S.V. Selishchev). The mechanical characteristics of layered structures based on carbon nanomaterials for creating bioelectronic components have been studied (D.T. Murashko, U.E. Kurilova, K.D. Popovich, A.V. Kuksin, A.Yu. Gerasimenko). Acoustic emission method was used to monitor damage accumulation during mechanical and thermal deformations of a single crystal of paratellurite (A.S. Machikhin, A.Yu. Marchenkov, D.V. Chernov, T.D. Balandin, M.O. Sharikova, A.A. Bykov, D.D. Khokhlov, Ya.A. Eliovich, Yu.V. Pisarevsky, A.A. Pankina). The XX Conference on Nanobiophotonics includes two papers, the first of which (D.I.Ryabkin, D.D.Stavtsev, V.V.Suchkova, E.A.Morozova, G.A.Piavchenko, A.N. Konovalov, C.V. Selishchev, A.Yu. Gerasimenko) is devoted to the technology of laser repair of soft tissues that was tested using laser speckle contrast imaging *in vivo*. The growing use of quantum dots in nanobiophotonics and materials science makes it relevant to study the current transfer in the system of tunneling microscope probe–tunnel gap–quantum dots semiconductor layer (V.F. Kabanov, A.I. Mikhailov, M.V. Gavrikov). Finally, the XXV Conference on Spectroscopy and Molecular modeling is presented by an article on the urgent problem of machine processing of large spectroscopic data (A.S. Muschina, I.V. Isaev, O.E. Sarmanova, S.A. Burikov, T.A. Dolenko, S.A. Dolenko), which provides a comparative analysis of approaches to the increasing representativeness of spectroscopic data using variational autoencoders.

Even the above summary of works included in this issue is enough to see the pronounced multidisciplinary nature of the presented research. Therefore, publication in Technical Physics magazine best suits the goals and spirit of our symposium. The organizers of the symposium express their deep gratitude to the editors of the journal for publishing the works and to all the authors for their active participation in the preparation of this issue. Separately, I would like to emphasize the great work done by the reviewers, whose informal comments helped to significantly improve the quality of the submitted manuscripts.

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