

# Book of abstracts



IX International School and Conference on Photonics

## PHOTONICA2023

with joint events:

Understanding interaction light - biological surfaces: possibility for new electronic materials and devices

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Biological and bioinspired structures for multispectral surveillance

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Quantum sensing integration within microfluidic Lab-on-a Chips for biomedical applications

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Advanced Biophysical Methods for Soil Targeted Fungi-Based Biocontrol Agents

August 28 - September 01, 2023, Belgrade, Serbia

*Editors*

Jelena Potočnik, Maja Popović, Dušan Božanić

Vinča Institute of Nuclear Sciences – National Institute of the Republic of Serbia, University of Belgrade

Belgrade, 2023

ABSTRACTS OF TUTORIAL, KEYNOTE, INVITED LECTURES,  
PROGRESS REPORTS AND CONTRIBUTED PAPERS

of

IX International School and Conference on Photonics

# PHOTONICA2023

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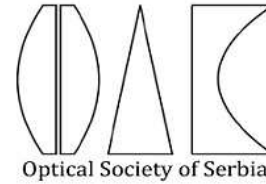
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Dear Colleagues, friends of photonics,

We are honored by your participation at our PHOTONICA 2023 and your contribution to the tradition of this event. It is our pleasure to host you in Belgrade and in Serbia. Welcome to the world of photonics.

The International School and Conference on Photonics, PHOTONICA, is a biennial event held in Belgrade since 2007. The first meeting in the series was called ISCOM (International School and Conference on Optics and Optical Materials), but it was later renamed to PHOTONICA to reflect more clearly the aims of the event as a forum for education of young scientists, exchanging new knowledge and ideas, and fostering collaboration between scientists working within emerging areas of photonic science and technology. A particular educational feature of the program is to enable students and young researchers to benefit from the event, by providing introductory lectures preceding most recent results in many topics covered by the regular talks. In other words, tutorial and keynote speakers will give lectures specifically designed for students and scientists starting in this field. Apart from the oral presentations PHOTONICA hosts vibrant poster sessions. A significant number of best posters will be selected and the authors will have opportunity to present their work through short oral presentations – contributed talks.

The wish of the organizers is to provide a platform for discussing new developments and concepts within various disciplines of photonics, by bringing together researchers from academia, government and industrial laboratories for scientific interaction, the showcasing of new results in the relevant fields and debate on future trends.

PHOTONICA 2023 will host three joint events: PhoBioS COST Action “Understanding interaction light - biological surfaces: possibility for new electronic materials and devices”, NATO Science for Peace and Security Program (grant G5618) workshop “Biological and bioinspired structures for multispectral surveillance”, workshop on “Quantum sensing integration within microfluidic Lab-on-a Chips for biomedical applications” and BioPhysFUN workshop “Advanced Biophysical Methods for Soil Targeted Fungi-Based Biocontrol Agents”. Following the official program, the participants will also have plenty of opportunities to mix and network outside of the lecture theatre with planned free time and social events.

This book contains 130 abstracts of all presentations at the IX International School and Conference on Photonics, PHOTONICA2023. Authors from all around the world, from all the continents, will present their work at this event. There will be 4 tutorial and 7 keynote lectures to the benefits of students and early stage researches. The most recent results in various research fields of photonics will be presented through 16 invited lectures and 8 progress reports of early-stage researchers. Within the poster sessions and a number of contributed talks, authors will present 95 presentations on their new results in a cozy atmosphere of the building of Serbian Academy of Science and Arts.

Belgrade, August 2023

Editors

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1. Quantum optics and ultracold systems
2. Nonlinear optics
3. Optical materials
4. Biophotonics
5. Devices and components
6. Optical communications
7. Laser spectroscopy and metrology
8. Ultrafast optical phenomena
9. Laser - material interaction
10. Optical metamaterials and plasmonics
11. Machine learning in photonics
12. Other topics in photonics

## **Joint Events**

PhoBioS COST Action - Understanding interaction light - biological surfaces: possibility for new electronic materials and devices

NATO Science for Peace and Security Program - Biological and bioinspired structures for multispectral surveillance

Workshop - Quantum sensing integration within microfluidic Lab-on-a Chips for biomedical applications

BioPhysFUN workshop - Advanced Biophysical Methods for Soil Targeted Fungi-Based Biocontrol Agents

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## Coupled vortex generator in active multi-core fibers

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Optical vortex is a coherent localized structure carrying energy around the pivot point. It is characterized by an optical angular momentum (OAM) mathematically described by azimuthal phase term  $\exp(il\varphi)$ . Here, the integer number  $l$  stands for the winding number or topological charge of the vortex [1]. Particularly interesting are vortices generated in discrete systems [2]. They are specified by quantized topological charge and exhibit inherent robustness on perturbations within the system [3].

One of the structures that support discrete vortices is multi-core fiber (MCF) [4]. Here, we study MCF structure composed of two concentric hexagonal rings, A and B (Fig. 1). Beside equal coupling constants among nearest sites of A and B ring, we also consider a presence of artificial flux ( $\Phi$ ) which affects coupling between sites in the A ring [5]. The presence of artificial flux does not change the topological charge of vortices, only shifts their corresponding eigenvalues. Moreover, vortex excitation in one of the rings produces a regular periodical energy exchange between A and B rings in a form of stable breathing coupled-vortex structure. In passive MCF the vortex excitation is necessary to propagate vortex through the system. However, including the saturable gain and linear loss in the MCF, the vortices of different topological charge can be excited even from the uniform background by tuning the flux value. Numerical simulations show high robustness of newly formed vortices, which offers possibility to utilize the proposed setup as highly controllable vortex generator. Moreover, this can be of particular importance in the ring array based lasers [6,7].

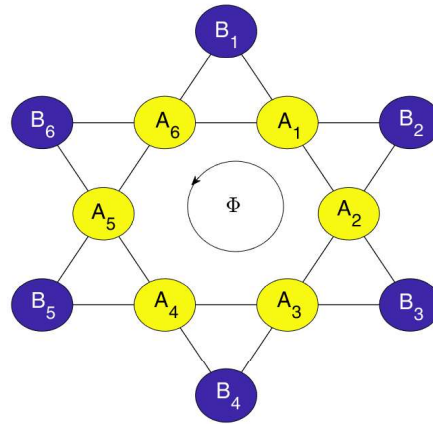


Figure 1. Schematic representation of nonlinear active MCF system with double rings A and B. Each ring has six cores. All couplings are equal (black solid lines between cores) and  $\Phi$  represents artificial flux which additionally affects coupling between A sites.

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