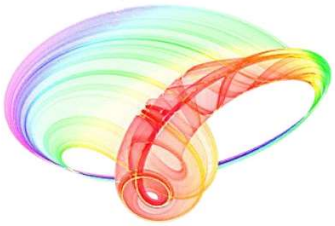
Book of abstracts



IX International School and Conference on Photonics

PHOTONICA2023

with joint events:

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

&

Biological and bioinspired structures for multispectral surveillance

&

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

&

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

August 28 - September 01, 2023, Belgrade, Serbia

Editors
Jelena Potočnik, Maja Popović, Dušan Božanić

Publisher
Vinča Institute of Nuclear Sciences – National Institute of the Republic of Serbia, University of Belgrade
Mike Petrovića Alasa 12-14
11351 Vinča, Belgrade, Serbia

Printed by
Serbian Academy of Sciences and Arts

Number of copies
200

ISBN 978-86-7306-165-8
ISBN 978-86-7306-168-9 (Online)

PHOTONICA2023 – IX International School and Conference on Photonics (www.photonica.ac.rs) is organized by Vinča Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade (www.vin.bg.ac.rs), Serbian Academy of Sciences and Arts (www.sanu.ac.rs), and Optical Society of Serbia (www.ods.org.rs).

Other institutions that helped the organization of this event are: Institute of Physics Belgrade, University of Belgrade (www.ipb.ac.rs), Faculty of Physics, University of Belgrade (www.ff.bg.ac.rs), School of Electrical Engineering, University of Belgrade (www.etf.bg.ac.rs), Institute of Chemistry, Technology and Metallurgy, University of Belgrade (www.ihtm.bg.ac.rs), Faculty of Technical Sciences, University of Novi Sad (www.ftn.uns.ac.rs), Faculty of Sciences and Mathematics, University of Niš (www.pmf.ni.ac.rs), Faculty of Biology, University of Belgrade (www.bio.bg.ac.rs) and Faculty of Sciences and Mathematics, University of Kragujevac (www.pmf.kg.ac.rs).

PHOTONICA2023 is organized under auspices and with support of the Ministry of Science, Technological Development and Innovation, Republic of Serbia (www.nitra.gov.rs). PHOTONICA2023 is supported and recognized by Optica (Formerly OSA) - The Optical Society (www.optica.org).

Committees

Scientific Committee

- Aleksandar Krmpot, Serbia
- Aleksandra Maluckov, Serbia
- Bojan Resan, Switzerland
- Boris Malomed, Israel
- Branislav Jelenković, Serbia
- Carsten Ronning, Germany
- Concita Sibilia, Italy
- Darko Zibar, Denmark
- Dmitry Budker, Germany
- Dragan Inđin, United Kingdom
- Edik Rafailov, United Kingdom
- Francesco Cataliotti, Italy
- Giannis Zacharakis, Greece
- Goran Isić, Serbia
- Goran Mašanović, United Kingdom
- Ivana Vasić, Serbia
- Jasna Crnjanski, Serbia
- Jelena Radovanović, Serbia
- Jelena Stašić, Serbia
- Jerker Widengren, Sweden
- Jovan Bajić, Serbia
- Ljupčo Hadžievski, Serbia
- Luca Antonelli, United Kingdom
- Marco Canepari, France
- Marko Krstić, Serbia
- Marko Spasenović, Serbia
- Milan Kovačević, Serbia
- Milena Milošević, Serbia
- Milivoj Belić, Qatar
- Mirjana Novaković, Serbia
- Nikola Stojanović, Germany
- Nikola Vuković, Serbia
- Nikos Pleros, Greece
- Pavle Anđus, Serbia
- Petra Beličev, Serbia
- Sergei Turitsyn, United Kingdom
- Vladan Pavlović, Serbia
- Vladan Vuletić, United States of America
- Vladana Vukojević, Sweden
- Zoran Grujić, Serbia

Organizing Committee

- Dušan Božanić, Vinča Institute of Nuclear Sciences, Belgrade (Chair)
- Jelena Pajović, Faculty of Physics, University of Belgrade (Deputy Chair)
- Radovan Dojčilović, Vinča Institute of Nuclear Sciences, Belgrade (Deputy Chair)
- Maja Popović, Vinča Institute of Nuclear Sciences, Belgrade (Deputy Chair)
- Jelena Potočnik, Vinča Institute of Nuclear Sciences, Belgrade
- Goran Gligorić, Vinča Institute of Nuclear Sciences, Belgrade
- Danijela Danilović, Vinča Institute of Nuclear Sciences, Belgrade
- Kolja Bugarski, Vinča Institute of Nuclear Sciences, Belgrade
- Milica Nedić, Vinča Institute of Nuclear Sciences, Belgrade
- Miljana Piljević, Institute of Physics Belgrade
- Đorđe Trpkov, Vinča Institute of Nuclear Sciences, Belgrade
- Dragana Tošić, Vinča Institute of Nuclear Sciences, Belgrade
- Anamarija Abu el Rub, Vinča Institute of Nuclear Sciences, Belgrade
- Vanja Ralić, Vinča Institute of Nuclear Sciences, Belgrade

Technical Organizer

Lufthansa City Center
Panacomp Wonderland
Travel

http://www.panacomp.net/
Tel: +381 21 466 075
Tel: +381 21 466 076
Tel: +381 21 466 077

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

Conference Topics

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

Table of Contents

Contributed Papers

1. Quantum optics and ultracold systems

2. Nonlinear optics

12. Other topics in photonics

Electron energy loss spectroscopy of multilayered structures: Theoretical aspects and the role of graphene-insulator distance

I. Radović[1], A. Kalinić[1], L. Karbunar[2] and Z.L. Mišković[3]
[1]*Department of Atomic Physics, "VINČA" Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia*
[2]*School of Computing, Union University, Belgrade, Serbia*
[3]*Department of Applied Mathematics, and Waterloo Institute for Nanotechnology, University of Waterloo, Waterloo, Ontario, Canada*
e-mail: iradovic@vin.bg.ac.rs

Electron energy loss spectroscopy (EELS) is a commonly used experimental technique for investigating electronic and plasmonic properties of materials, including van der Waals (vdW) materials [1]. Following Ref. [2] we derive a general expression for the effective dielectric function of multilayered structures made of two-dimensional (2D) vdW materials separated by insulating layers, in terms of the dielectric functions of the insulating layers and the 2D response functions of the vdW sheets, so the EEL spectrum of such structures may be deduced and compared with the available experimental data.

In our previous publications [3-5] we investigated the effects of plasmon-phonon hybridization in graphene-insulator-graphene heterostructures. In all those publications we assumed a zero gap between graphene and insulator to simplify calculations. In this work we assign for the first time a finite gap size between graphene and insulator, and apply the general expression for the effective dielectric function of multilayered structures to the case of graphene-insulator-graphene composite. The energy loss function (the imaginary part of the negative value of the inverse dielectric function) is shown for the cases of graphene-insulator-graphene composite systems with and without the finite gap size between graphene and insulator in order to study the role of graphene-insulator distance on the hybridization between the Dirac plasmons in graphene layers and the Fuchs-Kliewer phonons in both surfaces of the insulator slab. The response function of each graphene is obtained using the dynamic polarization function of graphene within the random phase approximation for its π electrons described as Dirac's fermions. The response of the insulator layer is described by a dielectric function consisting of several Lorentzian terms.

REFERENCES

[1] A.A. Govyadinov *et al.*, Nat. Commun. 8, 95 (2017).
[2] Ph. Lambin *et al.*, Phys. Rev. B 32, 8203 (1985).
[3] V. Despoja *et al.*, Phys. Rev. B 96, 075433 (2017).
[4] V. Despoja *et al.*, Phys. Rev. B 100, 035443 (2019).
[5] A. Kalinić *et al.*, Phys. Rev. B 106, 115430 (2022).