

# PHOTONICA2015.

V International School and Conference on Photonics  
& COST actions: MP1204 and BM1205  
& the Second international workshop "Control of light and  
matter waves propagation and localization in photonic  
lattices"  
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## *Book of Abstracts*



*Editors*

*Suzana Petrović, Goran Gligorić and Milutin Stepić*

Belgrade, 2015.

# Book of abstracts



## PHOTONICA2015

the Fifth international school and conference on  
photonics

& COST actions: MP1204 and BM1205

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24 August – 28 August 2015

Belgrade, Serbia

*Editors*

Suzana Petrović, Goran Gligorić and Milutin Stepić

Vinča Institute of Nuclear Sciences, Belgrade, Serbia

Belgrade, 2015

ABSTRACTS OF TUTORIAL, KEYNOTE AND INVITED  
LECTURES AND CONTRIBUTED PAPERS

of

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PHOTONICA2015

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1. Quantum optics
2. Nonlinear optics
3. Ultrafast phenomena
4. Laser spectroscopy
5. Devices and components
6. Biophotonics
7. Optical communications
8. Sensing: plasmonics, fiber optics and interferometers
9. Holography and adaptive optics
10. Optical materials



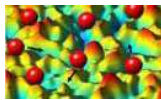
### **BMBS COST Action BM1205**

European Network for Skin Cancer Detection using Laser Imaging  
(24-28 August)



### **MPNS COST Action MP1204**

TERA-MIR Radiation: Materials, Generation, Detection and Applications  
(24-28 August)



### **WORKSHOP**

Control of light and matter waves propagation and localization in photonic lattices  
(28-29 August)

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, apart from the regular lectures, the plenary speakers will also give tutorial lectures specifically designed for students and scientists starting in this field.

The Conference consists of oral presentations and vibrant poster sessions. 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. This year our conference will contribute celebration of the International Year of Light as a global initiative which will highlight to the citizens of the world the importance of light and optical technologies. This PHOTONICA 2015 will include two COST Action meetings and one workshop with the main objective to promote knowledge in various disciplines of photonics. In addition to the lectures and seminars, a Round Table "Scientific publishing: Editors et altera" will be organized where the editors will present editorial and publishing policies of their journals and share their experiences. Following the official program, the participants will also have plenty of opportunity to mix and network outside of the lecture theatre with planned free time and social events.

This book contains 219 abstracts of all presentations at the **5th International School and Conference on Photonics, PHOTONICA2015**. Authors from 50 countries from all continents will present their work at the conference. There will be six tutorial and seven keynote lectures to the benefits of students and young researches. Twenty four invited lectures, five progress reports of young Serbian researchers and thirty one contributed talks will present most recent results in their research fields. Within the two poster sessions, students and young researches will present 146 poster presentations on their new results in a cozy atmosphere of the Serbian academy of science and arts.

Belgrade, July 2015  
Editors

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**Table 1.** Energies  $E$  ( $\text{cm}^{-1}$ ) of the YbI singly excited states.

Config.	J	MCHF+ BP(A)	MCHF+ BP(C)	MCHF+ BP(BD)	HFR	EA- MMBPT	WC	This work	[2]
$6s_{1/2} 2^*$	0	0	0	0	0	0	0	0	0
$6s_{1/2} 6p_{1/2}$	0	18087	17262	18730	17320	17400	17312	17310	17288
$6s_{1/2} 6p_{1/2}$	1	18174	17568	18813	17954	18100	17962	18008	17992
$6s_{1/2} 6p_{3/2}$	1	24614	26667	25257	25069	25500	25075	25094	25068
$6s_{1/2} 6p_{3/2}$	2	18357	18249	18999	19710	19800	19716	19715	19710
$6s_{1/2} 5d_{3/2}$	1	24094	28871	23740	24489	23900	24489	24410	24489
$6s_{1/2} 5d_{3/2}$	2	24505	28973	24172	24484	24600	24751	24824	24752
$6s_{1/2} 5d_{5/2}$	2	26984	29633	26841	27677	26100	27654	26970	27678
$6s_{1/2} 5d_{5/2}$	3	25860	29374	25500	25271	24900	25270	25098	25271

Note: \* [2]  $E=-148710\text{cm}^{-1}$ ;  $E1=-148700\text{cm}^{-1}$ ;  $E2=-148695\text{cm}^{-1}$ ;

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## The interaction between variously shaped $\text{TiO}_2$ nanoparticles with UV laser determines the quality of the mass spectra of carbohydrates

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The important factor that determines the process of the laser-induced desorption and ionization of molecules for the mass spectrometric analysis is the interaction between the laser light and the substrate. It is of importance that substrate efficiently absorbs laser energy, which will be further rapidly transferred to the analyte. The overall goal in this process is to obtain good quality mass spectrum with low degree of fragmentation. Whereas the application of organic matrices instead of substrates results in the numerous undesired polymerization reactions, which complicate the spectra, and in some cases, even prevent the detection of the ions of interests, nanoparticles as substrates are convenient due to a lower number of background signals and low onset of fragmentation reactions in the gas phase.

Titanium dioxide ( $\text{TiO}_2$ ) is semiconductor-based and widely used substrate for laser desorption and ionization ((SA)LDI), and when it is in the excited state it transfers an electron or energy into the ground state molecule. This process is called sensitized photoreaction [1]. The desorption/ionization processes on  $\text{TiO}_2$  nanoparticles are related to the physical properties of the substrate such as ability to absorb and dissipate energy

from the irradiating laser light source [2]. TiO<sub>2</sub> has a large band gap (bulk anatase: 3.2 eV), and can therefore be used as a SALDI matrix with the N<sub>2</sub> laser (337 nm) [3].

The aim of our study is to investigate the influence, which the interaction of the UV laser with TiO<sub>2</sub> nanoparticles of various shapes and size has on the quality of the mass spectra of carbohydrates: D-(+)-glucose, D-(+)-maltose, raffinose, arabinose, β-cyclodextrine, substances which are otherwise difficult for mass spectrometric analysis. For this purpose, we used small, nearly spherically shaped colloidal TiO<sub>2</sub> nanoparticles (average diameter ~ 5 nm), prolate nanospheroids (length: 40–50 nm, the lateral dimension: 14–16 nm) and nanotubes (length: 100-150 nm, average diameter 11 nm). For comparison, the spectra are acquired also with traditionally used organic matrices.

The spectra of carbohydrates with organic matrices are overloaded with matrix signals, in which case the signals arising from the analyte of interest are suppressed, or it is possible to detect only adducts with matrix. Laser-induced ionization on nanostructures offers alternative ionization pathways through the formation of Na<sup>+</sup> and K<sup>+</sup> adducts with appreciable yield [4].

TiO<sub>2</sub> nanotubes showed extraordinary properties for detection of carbohydrates. Arabinose was detectable only with TiO<sub>2</sub>, and D-(+)-glucose and D-(+)-maltose were detected in negative ion mode, which was not the case with other organic matrices and substrates. Not only the highest intensities of mass peaks but also the smallest coefficient of variation was achieved with TiO<sub>2</sub> nanotubes. Taken together, TiO<sub>2</sub> nanotubes, due to their size and the shape, have the most suitable physical properties for the substrate in the SALDI technique.

The laser intensity was kept as low as possible in order to prevent fragmentation. Higher laser intensity is required for the process of desorption/ionization when TiO<sub>2</sub> NPs are used (2400 i.u.), but for TiO<sub>2</sub> PNSs and TiO<sub>2</sub> nanotubes were lower and nearly the same 1950 and 2000 i.u., respectively.

In conclusion, larger, tube-shaped TiO<sub>2</sub> substrates more efficiently absorb the laser energy and transfer it to the carbohydrates, enabling their desorption/ionization and preventing their fragmentation.

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