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LIGHT MATTER INTERACTIONS for

WORKSHOP on PHOTONICS

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sensors and devices

Kopaonik, Serbia

12-15/MARCH/2023

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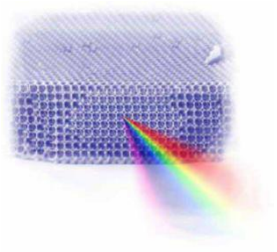
Kopaonik, March 12-15, 2023



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16th Photonics Workshop

(Conference)

16th Photonics Workshop (2023)

Book of abstracts

Kopaonik, Serbia, March 12-15, 2023

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Conference program

Sunday, March 12th

Chairman: Branislav Jelenković

16.00 – 16.30	**Registration & opening**
16.30 - 17.00	**Goran Mashanovich** *Mid-Infrared Silicon Photonics for Sensing*
17.00 - 17.20	**Bratislav Marinković** *"Photoelectron" Spectroscopy by Electron Impact: Scattered and Ejected Electrons*
17.20 – 17.40	**Danka Stojanović** *Data enrichment and calibration for PM 2.5 low-cost optical sensors*
17.40 – 18.00	**Dušan Božanić** *Valence Band Electronic Structure of Azobenzene-Functionalized Gold Nanoparticles*
18.00 – 18.15	**Duška Popović** *Analysis of the photoelectron energy spectra at resonant two-photon ionization of hydrogen atom by intense short laser pulses*
18.15 – 18.30	**Vladimir Damljanović** *Atlas of electronic band structures in two-dimensional materials*

Monday, March 13th

Chairman: Zoran Grujić

16.00 - 16.30	***Refreshment***
16.30 - 17.00	**Ferruccio Renzoni** *Electromagnetic Induction Imaging with Atomic Magnetometers: Pushing the Boundaries*
17.00 - 17.20	**Vladimir Đoković** *Gold-riboflavin hybrid nanostrucutures as possible photodynamic therapy agents*
17.20 – 17.40	**Nikola Stojanović** *Femtosecond laser spectroscopy for Exploration of Space*
17.40 – 17.55	**Merve Ekmekçioğlu** *Properties of Multilayer ZTO/Ag/ZTO Thin Film Electrodes Deposited by Magnetron Sputtering*
17.55 – 18.10	**Petar Atanasijević** *Thermoelectric temperature control of Morpho butterfly wings used for radiation sensing*
18.10 – 18.25	**Miloš Davidović** *Combining size distribution spectrums of ambient aerosols using equivalent optical properties of nanosized particles – selected examples from the Bay of Kotor*

Chairman: Bratislav Marinković

20.00 - 20.30	**Robert Loew** *Making hot atoms interact*
20.30 - 20.50	**Predrag Tadić** *Photoplethysmogram as a source of biomarkers for AI-based diagnosis of heart failure*
20.50 - 21.10	**Gulnur Aygun Ozyuzer** *The Effect of ZTO Interlayer Between LCO and LLZO Used in All Solid State Batteries*
21.10 - 21.25	**Mirjana Stojanović** *Localized modes in linear flux dressed two-dimensional plus lattice*
21.25 – 21.40	**Nataša Bon** *The Investigation of The Central Activity and Stellar Population Parameters in Active Galactic Nuclei*
21.40 – 22.00	**Edi Bon** *Spectroscopic modeling of supermassive binary black hole orbits in active galactic nuclei*
22.00 – 22.15	**Aleksander Kovačević** *Beam modification during propagation through aqueous microalgae suspension of interest to waveguiding*

Tuesday, March 14th

Chairman: Ljupčo Hadžievski

16.00 - 16.30	***Refreshment***
16.30 - 17.00	**Vladan Vuletić** *Quantum Simulation and Computation with Neutral Atoms*
17.00 - 17.20	**Branislav Jelenković** *Squeezed light by FWM in alkali vapor – generation and application*
17.20 – 17.40	**Caterina Credi** *Straightforward integration of SERS technology within novel opto-fluidic devices for rapid liquids probing with high sensitivity*
17.40 – 18.00	**Sara Nocentini** *Temperature-controlled polymer nanopatterning for 4D tunable photonics*
18.00 – 18.15	**Jovana Petrović** *Ultra-low-loss broadband multiport optical splitters*
18.15 – 18.35	**Mehtap Ozdemir** *Optimization of Large Area Thin Films for All Solid State Electrochromic Devices*

Chairman: Ivana Drvenica

20.00 - 20.30	**Srdjan Antic** *The Role of Physics in Modern Neuroscience*
20.30 - 20.50	**Ljiljana Nikolić** *Application of optogenetics for studying neuronal activity via glial photostimulation*
20.50 - 21.05	**Katarina Milićević** *In vitro testing of genetically encoded voltage indicator ArcLightD for recording spontaneous electrical activity of cortical neurons*
21.05 – 21.25	**Dejan Pantelić** *Thermal radiation imaging of insects using lockin techniques*
21.25 – 21.40	**Vladimir Atanasoski** *Autocorrelation for denoising biomedical signals*
21.40 – 21.55	**Kolja Bugarski** *Localized modes in SSH photonic lattice in the presence of defects and local nonlinearity*
21.55 – 22.15	**Dragan Lukić** *Proposal for a new surveillance system for military vehicles and a new crew arrangement*

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Chairman: Dušan Božanić

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17.00 - 17.20	**Yasemin Demirhan** *Terahertz Metamaterials and Multispectral Terahertz Plasmonic Detectors*
17.20 – 17.40	**Željko Šljivančanin** *Computational modeling of magnetism induced in nonmagnetic 2D materials*
17.40 – 17.55	**Nurcin Karadeniz** *The Characterizations of Thin Film Filters for Far UVC 222 nm Excimer Lamps*
17.55 – 18.10	**Milica Nedić** *Impact of the vortex distortion phase on the efficiency of lasing zero-mode*
18.10 – 18.25	**Nikola Vuković** *Modeling of optical properties of novel terahertz photonics quantum well heterostructures*

Chairman: Aleksander Kovačević

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20.20 - 20.40	**Theo Scholtes** *A compact pump-probe optically pumped magnetometer system with different valence state*
20.40 - 20.55	**Jonas Hinkel** *Optically pumped magnetometer aiming for highest accuracy*
20.55 - 21.10	**Tim Kügler** *Functionalization of microfabricated cesium vapor cells for optically pumped magnetometers*
21.10 – 21.25	**Marija Ćurčić** *Response of a scalar Mx magnetometer to the transverse modulation of magnetic field*
21.25 – 21.40	**Aleksandra Milenković** *Affordable VCSEL diode laser for high resolution spectroscopy of cesium D1 line*
21.40 – 21.55	**Miloš Subotić** *Frequency Estimating Device for Optically Pumped Magnetometer*
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"Photoelectron" Spectroscopy by Electron Impact: Scattered and Ejected Electrons

Bratislav P. Marinković

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Contact: B. Marinkovic (bratislav.marinkovic@ipb.ac.rs)

Abstract. Scattering experiments, as well as corresponding theory, have played an important role in uncovering the nature of physical, chemical and biological phenomena at the atomic and molecular level. Through the interactions of the impinging quantum particles, either photons, electrons, ions or any other well characterized entity, with the target, it has been possible to gain knowledge on internal structure or dynamics of the system. Using lasers [1] or synchrotrons [2] as sources of well-defined photons (frequency, polarization) one can provide a detailed understanding of complex system. But nothing less useful could be electrons as projectile particles used instead of photons [3]. Nevertheless, electrons are considered as multipole interacting particle, there are certain conditions when they behave as dipoles (analog to photons) [4]. A quantitative relationship between fast electron impact and the absorption of electromagnetic radiation had been established, showing that fast electrons at the optical limit (i.e., $K^2 \rightarrow 0$, K ' momentum transfer), could make quantitative "optical" measurements in which the energy loss, ΔE, simulates the "photon" energy. Using conventional techniques of electron energy loss spectroscopy at high impact energies absorption spectra have been obtained for both valence shell [5] and inner shell [6] electrons. Especially it is interesting an interplay (interference) between scattered and ejected electrons [7].

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Analysis of the photoelectron energy spectra at resonant two-photon ionization of hydrogen atom by intense short laser pulses

Nenad S. Simonović, Duška B. Popović, Andrej Bunjac
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Abstract. We study theoretically the Rabi flopping of the population between the ground and excited 2p states of the hydrogen atom, induced by intense short laser pulses of different shapes and of carrier frequency ω = 0.375 a.u. which resonantly couples the two states, and effects of this dynamics in the energy spectra of photoelectrons produced in the subsequent ionization of the atom from the excited state. It is found that, for Gaussian, half-Gaussian and rectangular pulses, characterized by the same pulse area, the final populations take the same values and the spectra consist of similar patterns (see Fig. 1) having the same number of peaks and approximately the same separation between the prominent edge (Autler–Townes) peaks [1]. These facts disprove the hypothesis proposed in earlier studies with Gaussian pulse [2], that the multiple-peak pattern appears due to dynamic interference of the photoelectrons emitted with a time delay at the rising and falling sides of the pulse, since the hypothesis is not applicable to either a half-Gaussian pulse that has no rising part or a rectangular pulse whose intensity is constant.

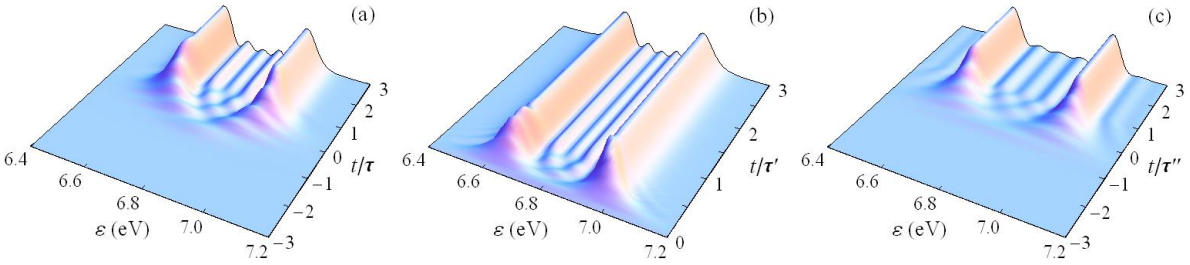

Figure 1. Time evolution of the photoelectron energy distribution (in arbitrary units) during the photoionization process of the hydrogen atom by: (a) Gaussian pulse, (b) half-Gaussian pulse and (c) rectangular pulse of carrier frequency ω = 0.375 a.u. and peak intensity of 12.917 TW/cm^2 at which the atom completes five Rabi cycles during the pulse.

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Analysis of the dynamic RF projection phase in True Scalar Cs Magnetometers

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Abstract. A true scalar magnetometer (TSM) is one where the phase is independent of the magnetic field orientation and instead depends on the modulus only. We analyzed a magnetometer consisting of a paraffin-coated glass cell filled with CS vapor where the RF field is parallel to the light propagation direction while oscillating at Larmor frequency [1]

The magnetometer was applied in the measurement of small magnetic field components orthogonal to the main field direction. Experimental measurements of the RF projection phase show significantly different behavior in cases where the transversal field component is perpendicular to the RF field and when it is in the plane formed by the main magnetic and the RF fields. For the "in-plane" case the RF projection phase doesn't show any perturbation on changing the intensity or field direction, while the "perpendicular" case shows significant peaks and slow relaxations under the same circumstances.

This phenomenon was initially explored through numerical simulations with a model that shows good agreement with experimental results and later backed with analytical calculations of the Bloch equation for this case in Cartesian spin components. The equations were solved analytically by moving into a rotating frame of reference and applying the Rotating Wave Approximation (RWA) and the disambiguation of the remaining solution terms by the significance of their contribution. The results show a simplified picture of the described problem but capture the qualitative behavior well. The measurements, numerical solution and the analytical approach will all be presented in a wholesome description and analysis of the described phenomenon.

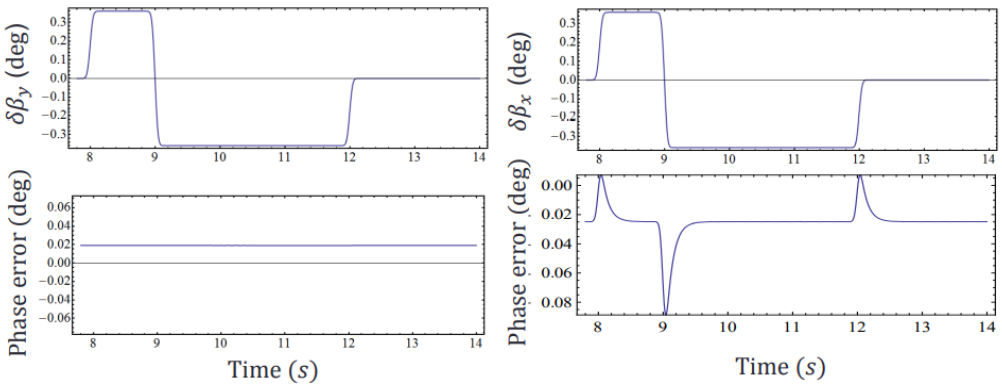

Figure 1. Two different field geometries considered for the DC transverse magnetic field scans. Left: The "in-plane" case with constant phase error, Right: The "perpendicular" case with phase error perturbations.

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