NAZARBAYEV UNIVERSITY
School of Science and Technology

International Symposium

Green Photonics @ Nazarbayev University

29 and 30 October 2015

Physics Department

School of Science and Technology

Nazarbayev University

Astana, Republic of Kazakhstan

International Year of Light and Light-based Technologies, 2015

Program for the International Symposium "Green Photonics @ Nazarbayev University", 29-30 October 2015
Conference Hall #1022 (Block C3, GSB and GSPP building)

Time	Thursday 29 Oct	Friday 30 Oct
9:00	**Symposium Opening**: Kanat Baigarin, Vassilios Tourassis, Vassilios Kovanis, George Tsironis, and Anton Desyatnikov	**Zeinulla Zhanabaev,** Al-Farabi Kazakh National University, *Scientific base of technological processes of photovoltaics*
9:30	**Cornelia Denz**, University of Muenster, Germany *Laser induced twisted photonic lattices for information processing and organic solar cell light harvesting*	**Gabriel Molina-Terriza**, Macquarie University, Australia *Squeezing photons through nanoholes*
10:00	Coffee break	Coffee break
10:30	**Serik Kumekov**, Kazakh National Research Technical University, *The dynamics of electron-hole plasma in the semiconductor excited by high power light pulses*	**Zhandos Utegulov**, Physics Department SST NU, *Nanosecond laser-mater interaction: thermal conduction, thermal radiation, melting, ablation and ultrasonics for nuclear energy application*
11:00	**Talgat Inerbaev,** Eurasian National University, *Non-Equilibrium Dynamics of Photoexcitated Electrons in Functionalized Semiconductor Nanostructures*	**Dmitriy Afanasyev** and Niaz Ibraev**,** Karaganda State University *Plasmon-enhanced dye-sensitized solar sells*
11:30	**Anaelle Hertz,** Universite Libre de Bruxelles, Belgium *Gaussianity-dependent separability criterion for continuous-variable systems*	**Alexander Alekseev**, National Laboratory of Astana, *Study of modern organic solar cells by different methods of microscopy*
12:00	Lunch	Lunch Lab tour
13:30	**Alexander Szameit**, Friedrich-Schiller-Universität Jena, Germany *Realization of Topological Anderson Insulators*	**Vassilios Kovanis,** Physics Department SST NU, *Fast, Tunable and Low Linewidth Photonic Oscillators*
14:00	**Andrey Miroshnichenko,** The Australian National University, *Seeing the unseen: nonradiating anapole mode observed in a single dielectric nanoparticle*	**Almaz Mustafin**, Kazakh National Research Technical University, *Singular perturbation methods in coupled lasers and related systems*
14:30	**Sergei Manakov**, Al-Farabi Kazakh National University, *Improvement of GaAs Solar Cells Parameters via using of Metal-Oxide Nanoparticles*	**Jean Jacques Zondy**, Physics Department SST NU, *Continuous Wave Optical Parametric Oscillators as versatile Mid-IR tunable source*
15:00	Coffee break	Coffee break
15:30	**George Tsironis,** Physics Department SST NU, *Rogue Waves & Extreme Bending of Light in Networks of Luneburg Lenses*	**Alejandro Aceves**, Southern Methodist University, USA *Modeling dynamics and light localization in novel photonic structures*
16:00	**Oksana V. Shramkova**, University of Crete, Greece *Nonreciprocal Nonlinear Scattering by Stacked PT-symmetric Structures*	**Andrei Maimistov**, Moscow Engineering Physics Institute, *Forward and backward waves in the coupled positive-negative index waveguide arrays and bundles*
16:30	**Maksim Kozlov**, National Laboratory of Astana, *Control of Power in Parity-Time Symmetric Lattices*	**Costas Valagiannopoulos**, Physics Department SST NU, *Photonic Structures Characterized by Unboundedly Fast Energy Transfer*
17:00	**Thomas Oikonomou**, Physics Department SST NU, *Parity-Time Plasmonic Instabilities*	**Anton Desyatnikov**, Physics Department SST NU and NLPC ANU, *Pseudospin and angular momentum in photonic lattices*

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Sergey M. Manakov is Associate Professor at the Physicotechnical Dept. of Al-Farabi Kazakh National University, Almaty, Kazakhstan and Principle Research Officer in Research Institute of Experimental and Theoretical Physics. He received his PhD degree from Al-Farabi Kazakh National University in 1992. His research program is aimed at the improvement of solar cells efficiency. His field of interest is amorphous, multi -crystalline silicon and gallium arsenide solar cells. The research focus is in advancement of light trapping by using of rear reflecting contact in thin films solar cells and by utilizing nanoscale particles of metal oxides in crystalline cells. Since 2013 he is research manager of project intended for formation on thin gallium arsenide film and PV and UHF devices on intermetallic substrates with a high thermal conduction by method of molecular beam epitaxy.

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Title: Improvement of GaAs Solar Cells Parameters via using of Metal-Oxide Nanoparticles

Abstract: An efficient antireflection coating is critical for the improvement of solar cell performance via increasing of light trapping. In this paper the results of investigation of solar cells based on GaAs with thin film of silicon nitride as antireflection coating are presented. Control samples were Schottky junction solar cells fabricated from experimental GaAs solar cells by chemical etching of antireflection coating and p-type upper emitter layer and chemical deposition Au thin film on n – type GaAs surface. Frontal surfaces both p-n junction and Schottky junction solar cells were covered by of metal-oxide nanoparticles synthesized in counter flow propane-oxygen flame on the surface of nichrome wire. Nanoparticles had the characteristic size of 50-300 nm depending on synthesis conditions and were sprayed on a solar cell surface.

It is found that the metal-oxide nanoparticles have significant influence on the antireflection effect and, therefore, improve the solar cell performance. Optimum nanoparticles surface concentrations appropriated to maximal short-circuit current are determined. It is shown that the coating from metal-oxide nanoparticles increase efficiency of solar cells by to 4,7 % due to light scattering on them and increase of a number of photons absorbed in the active region of solar cell.

Keywords: gallium arsenide, Schottky barrier, solar cells, metal-oxide nanoparticles, quantum efficiency.