International Conference “Advanced Element Base of Micro- and Nano-Electronics with Using of To-Date Achievements of Theoretical Physics” 20-23 April 2021, Moscow, Russia

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Abstract

A brief description of scientific program and papers of International Conference “Advanced Element Base of Micro- and Nano-Electronics with Using of To-Date Achievements of Theoretical Physics” is presented. It is an annual conference of Moscow Region State University (MRSU).

Introduction

International Conference “Advanced Element Base of Micro- and Nano-Electronics with Using of To-Date Achievements of Theoretical Physics” is an annual conference of Faculty for Physics and Mathematics of Moscow Region State University (MRSU). MRSU is a leading Russian regional university. This conference is traditionally organized by Department of Theoretical Physics. The Department and its Head Prof. Victor Belyaev were awarded by a Grant of President of Russian Federation for Russian Leading Scientific Schools.

The conference attracted 100+ participants from many countries (Germany, Canada, Byelorussia, Pakistan, Sudan, Lebanon et al.) and 10+ Russian regions. Special session was devoted to R&D of graduate and post-graduate students.

The Conference program included sessions as follows:
1. Theoretical physics
2. Physics and application of condensed medium including such sub-sessions as
   - Liquid crystals
   - Organic electronics
   - Display devices and components
   - Quantum effects
3. Physics of plasma
4. Physical gasodynamics
5. Physics and application of dispersed media

The first talk of the plenary session was made by Prof. V. Belyaev who celebrated his 70th anniversary. He said about his 50 years long way in the science, about raising of scientific ideas and projects. Prof. V. Rudyak, Novosibirsk State Architecture Construction University, presented a new direct stochastic molecular model of transport processes in gases. Corresponding Member of RAS Prof. N. Bogolyubov Jr and Prof. A. Soldatov, Department of Mechanics, V.A. Steklov Mathematics Institute of RAS presented a talk “Low-frequency spectrum of a laser driven polar quantum emitter damped by squeezed vacuum with finite bandwidth”.

Prof. V. Chigrinov, Foshan University, China, told on-line about new photonic crystal materials and devices on the base of liquid crystals and photoanisotropic substances. The report by V. Chertopolokhov, Lomonosov Moscow State University, was “Providing of immersion effect in to-date virtual reality systems by high quality tuning of different parameters”.

The plenary session was concluded by PhD Maria Burdanova, MRSU, former post-graduate of Warwick University, UK, who told about ultrafast spectroscopy of one dimension Van-der-Waals nanomaterials.

The MRSU physicists presented a set of talks on optical properties of the liquid crystals (LC) and their nanocomposite systems. Dr. E. Vasilchikova et al. presented their investigation of polarized light propagation in wedge mesogen layers.

A few talks on the LC and other organic materials have been presented by Prof. Pozhidaev’s group of physicists from Levedev Physics Institute of RAS (LPI): “The concept of biaxial surface potential and polymer aligning layers in electro-optical cells based on helical nanostructures of ferroelectric liquid crystal” by T. Tkachenko et al., “Ferroelectric Smectic C* LC induced in mixtures of nematic LC and non-mesogenic chiral substances” by V. Barbashov et al.,
“Quadratic orientational electro-optic effect in ferrielectric LC with sub-wave pitch of the chiral structure” by A. Kuznetsov et al.

A few talks have been presented on materials of organic electronics, electro-optic materials and their physical properties: “Intermolecular interactions of layers octa-phenyl-2,3-naphthalocyaninato zinc” by D. Chausov et al.; “Influence of substituted naphthalocyanines structure on their optical properties in thin films” by A. Kazak et al.; “Diamagnetic anisotropy and rotational viscosity of 6CHBT nematic liquid crystal” by A. Kurilov et al.

A team from Institute of Chemistry of New Materials of National Academy of Sciences of Belarus, Byelorussian State University, MRSU, Kazan National Reserarch Technology University presented a talk about control of QD radiation by light beam and tuning of selective reflection of a chiral LC.

Similar objects have been investigated in G.A. Krestov Institute of Solution Chemistry of RAS. L A Antina report was “The aggregation behavior and spectral properties of β, β΄-benzil-BODIPY in Langmuir-Schaefer and poly(methyl methacrylate) thin films”.

T. Khantuleva from Saint-Petersburg State University presented specific features of fast processes in condensed media.

Many interesting talks were presented by employees of other institutions.

N. Klassen and big group of young researchers from Institute of Solid State Physics of RAS - described their experiments in different types of the condensed materials: deformation of organic-inorganic compositions (I. Tsebruk, A. Azhgalieva et al.), super-long nano-chains formation during evaporation of metals with a help of intensive impacts (P. Provotorov et al.), formation of strip-like vortex motion by surface gravity waves (A. Poplevin et al.), structural transformations in the system lanthanum bromide – water – electrical field (S. Vinokurov et al.), liquid nitrogen luminescence under IR excitation (P. Provotorov et al.), second sound standing waves in a medium with NPs (A. Orlova) and many other interesting results.

Some investigations have been devoted to thermal properties of different media under extremal ambient conditions including open space – diamond-like carbon coatings under cyclic temperature changes (M. Makeev, Bauman Moscow State Technical University and RUDN University), thermoelectric generator (Pakistan, post-graduate of RUDN University).
M. Frah et al. (Sudan, post-graduate of RUDN University) evaluated electromagnetic pollution index (EMPI) emitted from multiple sources and investigated a few metal coated shields to protect from the EMP.

A group by M. Sychov (Saint-Petersburg State Institute of Technology (Technical University), Russia) in collaboration with Khlopin Radium Institute (Saint-Petersburg) and Shizuoka University (Japan) synthesized and investigated new efficient and stable phosphors for electroluminescent displays (ZnS:Cu,Br radioluminescent phosphors, Ce³⁺-doped fluoride nanophosphors et al.).

A group by O. Maximova (Ulyanovsk Civil Aviation Institute) proposed a few technical solutions of thin film electroluminescent indicating devices to enhance their efficiency and manufacturing cost.

A. Abduiev from Peoples' Friendship University of Russia (RUDN University) presented a conceptual talk “Finding routes for low-temperature formation of functional metal oxide based thin films” about promising technology that can replace ITO electrodes in electro-optic and opto-electronic devices.

V. Chigrinov (Foshan University, China) and A. Kudreyko (Bashkir State Medical University, Department of Medical Physics and Informatics, Ufa) proposed to improve characteristics of optically rewritable electronic paper.

In the Sessions “Theoretical physics” and “Plasma physics” new RnD results were presented on electromagnetic wave propagation in layers of both conductors and dielectrics.

Dr. N. Zverev and a graduate student A. Zotov (both MRSU) gave a talk “Longitudinal Plasmons in a Thin Flat Conductive Film”. They described a mode allowing measure thickness of nanometer metal and semiconductor layers.

Prof. I. Kuznetsova and her disciples from P.G. Demidov Yaroslavl State University got a talk “The influence of Fermi surface anisotropy and the charge carrier surface scattering kinetics on the electrical conductivity of a thin metal film in the view of the quantum size effect”.

Associated Professor of MRSU T. Kamalov and his post-graduate students presented reports on quantum computing to create efficient algorithms.

A group by V. Popov from Northern (Arctic) Federal University in Arkhangelsk presented a few reports on flow the binary gas mixture in channels of different shape.

E. Kozhanova (Yuri Gagarin State Technical University of Saratov), I. Tkachenko (École de Technologie Superieure, Montreal, Canada) proposed a few
methods of analysis of the energy spectrum of an electron in a one-dimensional quantum well with infinitely high walls in the Al-Ga-As system using Wavelet analysis and MATLAB.

In the Session “Plasma physics” Prof. A. Bishaev, MIPT and Dr. M. Abgaryan, Moscow Aviation Institute (Technology University) investigated influence of magnetic field on jet from stationary plasma engine.

In the Session “Physics and application of dispersed media” a few talks were presented by MRSU post-graduate students. Ms. V. Askerova and her supervisor E. Kalashnikov described moving an atom by swapping places across a crystal lattice without vacancies. They proposed a model of these materials heat and mechanical properties.

Physical properties of biological objects have been investigated in a group from Semenov Federal Research Center of Chemical Physics, RAS. E. Tereshkin et al. presented a talk “Molecular dynamics of DNA-binding protein and its 2D-crystals”.

The International Conference “Advanced Element Base of Micro- and Nano-Electronics with Using of To-Date Achievements of Theoretical Physics” became very important scientific event with significant results of big importance for basic science and practical application.
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