MPLP–2016

SYMPOSIUM & SCHOOL FOR YOUNG SCIENTISTS

P R O G R A M

VII International Symposium

“MODERN PROBLEMS OF LASER PHYSICS”

Novosibirsk, Russia, August 22 – 28, 2016

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Organized by:

Institute of Laser Physics, SB RAS, Novosibirsk, Russia

Novosibirsk State University, Novosibirsk, Russia

Institute of Spectroscopy, RAS, Troitsk, Moscow Region, Russia

International Laser Center, M.V. Lomonosov Moscow State University, Moscow, Russia

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INTERNATIONAL ADVISORY COMMITTEE

Registration

Registration will be held from **11^{00}** am till **6^{00}** pm on Sunday, **August 21,** and from **8^{30}** am till **5^{00}** pm from **August 22** till **August 25** at the "**House of Scientists**".

For the reports presentation on the Symposium we plan to use:

- multimedia projector

- the presentation software "MS PowerPoint 2007" or "MS PowerPoint 2010", Acrobat Reader.

Accommodation

Accommodation is available in the hotel "**Golden Valley**" (rus. "**Zolotaya dolina**"). A walk from the hotel to the "House of Scientists" takes one only 5 minutes.

Representatives of the MPLP–2016 Organizing Committee
In the "House of Scientists": room no. 200
In the room no. 223 you are offered to use a personal computer with the Internet and a printer for your needs.
In the Golden Valley Hotel: room nos. 702 and 704, Phone +7 905 934 06 01 (Dmitry)

Meals

Breakfast, lunch and dinner will be served at the **House of Scientists restaurant**.
Breakfasts will be from 8^{00} am to 9^{00} am.
Lunches will be from 1^{00} pm to 2^{00} pm.
Dinners will be from 8^{00} pm to 9^{00} pm.
Welcome Party is scheduled on **August 22** at 7^{00} pm
Symposium Dinner is scheduled on **August 25** at 7^{00} pm

Cultural program

During the Symposium we plan various social events, including excursions in Akademgorodok and its museums, excursions in the city of Novosibirsk, etc. You will be offered to choose events to take part in.

School for Young Scientists

It starts on August 25 (Thursday) at 4:30 pm and continues on August 26 from 9:00 am.
Venues: The school opening at the "House of Scientists" and the next day in Novosibirsk State University (new building, room no. 3312).

Symposium Program

Monday, August 22

In the House of Scientists:

$8^{\underline{00}}$ - $9^{\underline{00}}$ Breakfast

$8^{\underline{30}}$ - $17^{\underline{00}}$ Registration

$13^{\underline{00}}$ - $14^{\underline{00}}$ Lunch

$09^{\underline{30}} – 10^{\underline{00}}$ ***Opening Speeches***

Session 1 *New trends in laser physics I*

$10^{\underline{00}} – 10^{\underline{40}}$ **G. Leuchs[1,2,3], M. Hawton[4], and L.L. Sanchez-Soto[2,5],** *[1]Department Physik, Universität Erlangen-Nürnberg, Erlangen, Germany; [2]Max Planck Institut for the Science of Light, Erlangen, Germany; [3]Department of Physics, University of Ottawa, Ottawa, Canada; [4]Department of Physics, Lakehead University, Thunder Bay, Canada; [5]Departamento de Óptica, Facultad de Física, Universidad Complutense, Madrid, Spain*

The quantum vacuum as a dielectric. The nonlinear optical properties of the vacuum are well accepted. To understand the underlying linear response, we treat the vacuum as a dielectric of virtual and polarizable particle–anti-particle pairs. This provides a relation between classical optics and particle physics and gives valuable insight into zero-point energy and the fine-structure constant.

$10^{\underline{40}} – 11^{\underline{20}}$ **S.A. Babin,** *Institute of Automation and Electrometry SB RAS, Novosibirsk, Russia & Novosibirsk State University, Novosibirsk, Russia*

New schemes and regimes of Raman fiber lasers. A review of recent results on Raman fiber lasers is presented, including cascaded generation with ultimate efficiency due to random distributed feedback in polarization-maintaining fiber, nonlinear conversion in PPLN and Bi-doped random fiber to shorter and longer wavelengths relatively, pulsed operation at active Q-switching and mode-locking, direct pumping of gradient-index fiber by multimode LDs.

$11^{\underline{20}} – 11^{\underline{40}}$ Coffee Break

Session 2 *New trends in laser physics II*

$11^{\underline{40}} – 12^{\underline{20}}$ **A.M. Zheltikov,** *Physics Department, International Laser Center, M.V. Lomonosov Moscow State University, Moscow, Russia; Department of Physics and Astronomy, Texas A&M University, College Station, USA; Russian Quantum Center, Skolkovo, Moscow Region, Russia; Kurchatov Institute National Research Center, Moscow, Russia*

Nonlinear optics in the mid-infrared: New morning. Recent breakthroughs in ultrafast photonics in the mid-IR help understand complex interactions of high-intensity mid-IR field waveforms with matter, offer new approaches for x-ray generation, enable mid-IR laser filamentation in the atmosphere, facilitate lasing in filaments, give rise to unique regimes of laser-matter interactions, and reveal unexpected properties of materials in the mid-IR range.

$12^{\underline{20}} – 13^{\underline{00}}$ **A.V. Taichenachev[1,2], V.I. Yudin[1–3], and S.N. Bagayev[1–3],** *[1]Institute of Laser Physics SB RAS, Novosibirsk, Russia; [2]Novosibirsk State University, Novosibirsk, Russia; [3]Novosibirsk State Technical University, Novosibirsk, Russia*

Recent advances in precision spectroscopy of ultracold atoms and ions

$13^{\underline{00}} –14^{\underline{00}}$ Lunch

Session 3 *Spectroscopy I*

$14^{00} – 14^{30}$ **E.M. Rasel[1], A. Kulosa[1], D. Fim[1] K. Zipfel[1], N. Jha[1], S. Rühmann[1], S. Sauer[1], M. Safranova[2], K. Gibble[3],** *[1]Institut für Quantenoptik, Leibniz Universität Hannover, Hannover, Germany; [2]Department of Physics and Astronomy, University of Delware, Newark,USA; [3]Department of Physics, Penn State University, University Park, USA*

Optical Spectroscopy of Atomic Bloch Bands. We report on optical spectroscopy of atomic Bloch bands of laser cooled magnesium atoms tunneling in an optical lattice. We show that this allows us even for shallow lattices to accurately determine the magic wavelength of the lattice, for which the energy bands of the ground and excited electronic states become identical.

$14^{30} – 15^{00}$ **A.V. Akimov[1,2,3], I.S. Cojocaru[2,4], S. Pyatchenkov[2], S. Snigirev[2,3],I. Luchnikov[2,4], E. Davletov[2,3,4], V. Tsyganok[2,4], D.N. Kublikova[2,4], V. Bushmakin[2,4], D. Sukachev[2,4], E. Kalganova[2,3], G. Vishnyakova[2,3], V.N. Sorokin[2,3],** *[1] Texas A&M University, Department of Physics, College Station, USA; [2]Russian Quantum Center, Skolkovo, Moscow Reg., Russia; [3]P. N. Lebedev Institute of Russian Academy of Sciences, Moscow, Russia; [4]Moscow Institute of Physics and Technology, Dolgoprudny, Moscow Region, Russia; [5]Harvard University, Department of Physics, Cambridge, USA*

Collisions in ultra-cold thulium atoms. Collisional properties play important role in physics of ultracold atoms and quantum simulations with such an atoms. In this contribution, we present for the first time study of the both light assisted collisions and low field Feshabach resonances for Thulium atom.

$15^{00} – 15^{30}$ **S. I. Donchenko, I. Yu. Blinov, S. N. Slyusarev,** *Federal State Unitary Enterprise "AllRussia Research Institute for Physicotechnical and Radio Engineering Measurements" (VNIIFTRI), Mendeleevo, Moscow oblast, Russia*

Optical frequency standard based on cold strontium atoms. The unsurpassed stability and high accuracy of optical clocks based on cold alkaline earth atoms make them the most attractive candidate for use in modern metrological laboratories that provide the construction of national time scales. We report on our results of realization of a strontium optical lattice clock, which is under development at VNIIFTRI as a part of GLONASS program.

$15^{30} – 16^{00}$ **M. Okhapkin, D.-M. Meier, J. Thielking, P. Glowacki, E. Peik,** *Physikalisch-Technische Bundesanstalt, Braunschweig, Germany*

Search for the low-energy isomer in ^{229}Th. Our approach to achieve an excitation of the isomer is to use two-photon laser excitation via electronic bridge processes in trapped 229Th+ and Th2+ ions. Presently, the experimental search for the laser excitation of the isomeric state in singly charged thorium is ongoing.

$16^{00} – 16^{30}$ Coffee Break

Session 4 *Cold atoms I*

$16^{30} – 17^{00}$ **C. De Rossi[1,2], R. Dubessy[1,2], K. Merloti[1,2], M. deGoër de Herve[1,2], T. Badr[2,1], A. Perrin[2,1], L. Longchambon[1,2], and H. Perrin[2,1],** *[1]Université Paris 13, Sorbonne Paris Cité, Laboratoire de physique des lasers, Villetaneuse, France; [2]CNRS, UMR 7538, Villetaneuse, France*

Probing superfluidity in a quasi two-dimensional Bose gas through its local dynamics. I will present recent results giving a direct evidence of superfluidity in a quasi two-dimensional Bose gas by observing the scissors collective excitation. This allows to identify the superfluid and thermal phases inside the gas and locate the boundary at which the BKT crossover occurs, through a novel local correlation analysis.

$17^{00} – 17^{30}$ **A. Turlapov,** *Institute of Applied Physics, Russian Academy of Sciences, Nizhniy Novgorod, Russia*

Near-field interference in a chain of fluctuating Bose condensates. Interference in a long chain of Bose condensates is observed. Spatially quasi-periodic interference pattern appears even when the phases of the condensates are uncorrelated. However, the spatial fringe period depends qualitatively on whether the adjacent condensates are in phase or not. This is used for measuring the degree of phase coherence.

$17^{\underline{30}} – 18^{\underline{00}}$ **M. Zeppenfeld, T. Gantner, R. Glöckner, M. Ibrügger, M. Koller, A. Prehn, X. Wu, S. Chervenkov, and G. Rempe,** *MPI for Quantum Optics, Garching, Germany*

Controlled molecular ensembles at cold and ultracold temperatures. Cold and ultracold molecules enable fascinating applications in quantum science. I will present our multifaceted efforts to tame polar molecules. Combining buffergas cooling with a centrifuge decelator produces intense beams of molecules at near-zero velocity. Optoelectrical Sisyphus cooling results in ultracold ensembles of formaldehyde.

$18^{\underline{00}} – 18^{\underline{30}}$ **I.M. Sokolov,** *Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia*

Light localization in cold and dense atomic ensemble. We report on results of theoretical analysis of possibilities of light strong (Andersen) localization in a cold atomic ensemble. We predict appearance of localization in dense atomic systems in strong magnetic field. We prove that in absence of the field the light localization is impossible.

$19^{\underline{00}} – 21^{\underline{00}}$ Welcome Party *(for all registered participants)*

Tuesday, August 23

In the House of Scientists:
$8^{\underline{00}}$ - $9^{\underline{00}}$ Breakfast
$8^{\underline{30}}$ - $17^{\underline{00}}$ Registration

Session 5 *Nonlinear optics*

$09^{\underline{00}} – 09^{\underline{30}}$ **Ken-ichi Ueda,** *Institute for Laser Science, Univ. of Electro-Communications, Tokyo, Japan; Institute of Laser Engineering, Osaka University, Osaka, Japan; Central Research Institute, Hamamatsu Photonics K.K., Shizuoka, Japan; TOYOTA Physical & Chemical Institute, Aichi, Japan; JST PREST, Tokyo, Japan; Institute of Applied Physics, Russian Academy of Sciences, Nizhny Novgorod, Russia*

Challenge for thermal-lens-free ceramics lasers. We try to develop two kinds of challenging techniques for thermal lens free ceramics. Combination of ring heater and isolation technique makes thermal lens free condition over the pumping area. Full transparent Yb:CaF_2-LaF_3 ceramics demonstrated 73 % slope efficiency in CW operation. This solid solution system has a potential to achieve athermal ceramic lasers in near future.

$09^{\underline{30}} – 10^{\underline{00}}$ **G. Insero[1], C. Clivati[2], D. D'Ambrosio[2], P. de Natale[1,3], G. Santambroglio[1,2], P. G. Schunemann[4], S. Borri[1,3] and J.-J. Zondy[5],** *[1]European Laboratory for Nonlinear Spectroscopy, LENS, Sesto Fiorentino, Italy; [2]IstitutoNazionale di Ricerca Metrologica, INRIM, Torino, Italy; [3]IstitutoNazionale di Ottica, INO-CNR, Sesto Fiorentino, Italy; [4]BAE Systems, Inc., MER15-1813, Nashua, NH, USA; [5]Nazarbaev University, School of Science and Technolog (Phys. Dep.), Astana, Kazakhstan*

Mid-infrared tunable, narrow-linewidth difference-frequency laser based on orientation-patterned gallium phosphide. We present the first continuous-wave (cw) generation of mid-IR light at 5.8 microns (cold CO spectroscopy) using difference-frequency generation of 1064 nm and 1301 nm lasers with the newly developed OP-GaP (orientation-patterned Gallium Phosphide) quasi-phase-matched semiconductor, allowing to assess its optical linear and nonlinear properties.

$10^{\underline{00}} – 10^{\underline{30}}$ **F. Song,** *School of Physics, Nankai University, Tianjin, China*

Influence of energy transfer upconversion on the thermal deposition in Nd doped lasers. A theoretical model considering energy transfer upconversion (ETU) based on population dynamics on higher energy levels in LD pumped Nd:YAG laser has been developed. The ETU in different round-trip dissipative loss, the heat generation and trip dissipative loss, the heat generation and the laser cavity optimization are investigated in detail.

$10^{\underline{30}} – 11^{\underline{00}}$ **L. Isaenko, D. Kolker, V. Vedenyapin, A. Elisseev, S. Lobanov, A. Boyko, N. Kostyukova, and V. Petrov,** *Novosibirsk State University, Novosibirsk, Russia; Institute of Laser Physics SB RAS, Novosibirsk, Russia*

Wide tunable OPO at MID-IR spectral region pumped by Q-switch Nd:YAG laser. $LiGaSe_2$ (LGSe) optical parametric oscillator (OPO) pumped by compact nanosecond Nd:YAG laser was demonstrated. Wide tuning range from 4.8 up m is shown for the first time of our knowledge. The OPO to 9.9 m was demonstrated by spectral tuning range from 4.8 up to 9.90 f-rotation of LGSe element at the OPO cavity.

$11^{\underline{00}} – 11^{\underline{30}}$ Coffee Break

Session 6 *Fiber optics*

$11^{\underline{30}} – 12^{\underline{00}}$ **J.D. Harvey[1,2], P. G. Bowen[1], J. Kho[1], N. G. R. Broderick[1], M. Erkintalo[1], and R. Provo[2],** *[1]Dodd-Walls Centre for Photonic and Quantum Technologies, Department of Physics, The University of Auckland, Auckland, New Zealand; [2]Southern Photonics, Auckland, New Zealand*

Recent developments in femtosecond fibre lasers. In the normal dispersion regime, recent developments have led to the introduction and exploitation of "ANDi" or dissipative soliton lasers. This talk will review the development of these lasers which can achieve much higher pulse powers than are available using soliton fibre lasers in the anomalous dispersion regime.

$12^{\underline{00}} – 12^{\underline{30}}$ **A.Tikan[1], I. Vatnik[1,2], D. Churkin[1], A. Sukhorukov[3],** *[1]Novosibirsk State University, Novosibirsk, Russia; [2]Institute of Automation and Electrometry, Novosibirsk, Russia; [3]Nonlinear Physics Centre, Research School of Physics and Engineering, The Australian National University, Canberra, Australia*

Measurement of eigenmode excitation spectrum in synthetic photonic lattices. A method based on optical heterodyning is proposed for measuring relative optical phases of pulses circulating in a synthetic photonic lattices. The knowledge of the phases can be further used for qualitative reconstruction of an eigenmode excitation spectrum in the synthetic photonic lattice.

$12^{\underline{30}} – 13^{\underline{00}}$ **B. Nyushkov[1,2], S. Trashkeev[1,2], P. Purtov[3], D. Kolker[1,2], A. Ivanenko[1],** *[1]Institute of laser physics SB RAS, Novosibirsk, Russia; [2]Novosibirsk State University, Novosibirsk, Russia; [3]Voevodsky Institute of Chemical Kinetics and Combustion SB RAS, Novosibirsk, Russia*

Fiber-based femtosecond optical frequency comb stabilized to iodine frequency standard. A fiber-based femtosecond optical frequency comb spanning wavelengths from 1 to 2 μm was stabilized precisely to an iodine frequency standard by means of heterodyne optical phase-locked loops. It enables transfer of frequency stability across electromagnetic spectrum and implementation of compact optical clocks with $\sim 10^{-15}$ long-term instability.

$13^{\underline{00}} –14^{\underline{00}}$ Lunch

Session 7 *Nanophotonics I*

$14^{\underline{00}} – 14^{\underline{30}}$ **S.M. Arakelian, S.V. Kutrovskaya, A.O. Kucherik, S.P. Zimin*,** *Stoletovs Vladimir State University, Vladimir, Russia; *Demidov Yaroslavl State University, Yaroslavl, Russia*

Laser-induced semiconductor fractal structures with topological quantum effects. The CW-laser synthesis technique for semiconductor nanoparticles of PbTe is presented by two methods: laser modification of thin films and laser evaporation of substance in liquid. Jump conductivity has been detected under some experimental conditions of laser-induced cluster. The cluster shell model can be taken into account to explain.

$14^{\underline{30}} – 15^{\underline{00}}$ **G. Feng and S. Zhou,** *Sichuan University, Chengdu, China*

Random lasing based on doped nanocrystals. By using femtosecond laser pulses to ablate microsized targets that are dispersed in liquid media, doped nanocrystals have been successfully fabricated. The nature of the nanocrystals was characterized by SEM, TEM, EDS-Mapping, and XRD. By using the doped nanocrystals as the gain medium, random lasing has been established at room temperature.

$15^{\underline{00}} – 15^{\underline{30}}$ **E.F. Martynovich[1,2], V.P. Dresvyanskiy[1], S.V. Boychenko[1], A.L.Rakevich[1], S.A. Zilov[1], S.N.Bagayev[3],** *[1]Irkutsk Branch of the Institute of Laser Physics SB RAS, Irkutsk, Russia; [2]Irkutsk State University, Irkutsk, Russia; [3]Institute of Laser Physics SB RAS, Novosibirsk, Russia*

Investigation of single defects created in crystals by laser emission and hard radiation. Linear and nonlinear quantum trajectories of the luminescence intensity of the radiation-created single quantum systems in crystalline media, as well as the fluorescent images formed by laser scanning confocal fluorescence microscopy with time resolution, have been investigated theoretically and experimentally.

$15^{\underline{30}} – 16^{\underline{00}}$ **A.E. Afanasiev[1], P.N. Melentiev[1], A.A. Kuzin[1,2], A.Yu. Kalatskiy[1,2], V.I. Balykin[1],** *[1]Institute of Spectroscopy Russian Academy of Sciences, Moscow, Troitsk, Russia; [2]Moscow Institute of Physics and Technology, Dolgoprudny, Moscow Region, Russia*

Single photon transport by a moving atom. We have proposed and investigated for the first time an efficient way of a photon transport through a subwavelength hole by a moving atom. The transfer mechanism is based on the reduction of the wave packet of a single photon due to its absorption by the atom and its localization in a volume smaller than the nanohole size.

$16^{\underline{00}} –16^{\underline{30}}$ Coffee Break

Session 8 *Applications I (THz)*

$16^{30} – 17^{00}$ **A. Shkurinov,** *M.V. Lomonosov Moscow State University, Faculty of Physics, Moscow, Russia*

Gas, plasma and nano-cluster medium for generation of intense THz radiation

$17^{00} – 17^{30}$ **K. H. Park,** *Terahertz Basic Research Sectionr, ETRI Daejeon, 31429, KOREA*

Role of Photonics in Terahertz Technologies for Industrial Applications. In this talk, our recent studies in the field of continuous wave terahertz systems based on photonics technologies including beating sources, THz generating and detecting devices and their applications such as THz imaging and thickness measurements will be briefly reviewed.

$17^{30} – 18^{00}$ **B. A. Knyazev[1,2], E. N. Chesnokov[3], Yu. Yu. Choporova[1,2], V. V. Gerasimov[1], Ya. V. Getmanov[1], B. G. Goldenberg[1], V. V. Kubarev[1,2], G. N. Kulipanov[1], A. K. Nikitin[4], V. S. Pavelyev[5], V. M. Popik[1], T. V. Salikova[1], M. A. Scheglov[1], S. S. Seredniakov[1], O. A. Shevchenko[1], A. N. Skrinsky[1], and N. A. Vinokurov[1,2],**
[1]Budker Institute of Nuclear Physics SB RAS, Novosibirsk Russia; [2]Novosibirsk State University, Novosibirsk, Russia; [3]Institute of Chemical Kinetics and Combustion SB RAS, Novosibirsk, Russia; [4]Scientific and Technological Center for Unique Instrumentation RAS, Moscow, Russia; [5]Samara University, Samara, Russia

Recent advances in the terahertz photonics and spectroscopy at Novosibirsk free electron laser. Novosibirsk free electron laser facility has now three laser systems, which radiation spans a region from 10 to 240 micrometers. Experiments carried out at the facility during last two years will be surveyed.

$18^{00} – 18^{15}$ **O. Cherkasova[1], M. Nazarov[2, 3], A. Shkurinov[2, 4],** *[1]Institute of Laser Physics of SB RAS, Novosibirsk, 630090 Russia, [2]Crystallography and Photonics Federal Research Center, RAS, Moscow, Russia, [3]Kurchatov Institute National Research Center, pl. akad. Kurchatova 1, Moscow 123182, Russia, [4]Lomonosov Moscow State University, Moscow, 119991, Russia*

Properties of aqueous solutions in THz frequency range. Terahertz time-domain spectroscopy has been used for measuring of bovine serum albumin and glucose solutions. The transmission and the attenuated total internal reflection geometries have been combined for analyzing the dielectric properties of aqueous solutions at 0.07-2.7 THz.

$18^{15} – 18^{30}$ **Y. Zhang, B. He, X. Fu, J. Xu, and K. Zhou,** *The Key Laboratory for Special Fiber and Fiber Sensor of Hebei Province, School of Information Science and Engineering, Yanshan University, Qinhuangdao, Hebei, P.R. China*

Raman spectra combined with PSO-LSSVM algorithm to detect the content of edible harmonic oil in three groups

$18^{30} –20^{00}$ P O S T E R S E S S I O N A

$20^{00} –21^{00}$ Dinner

21^{00} CONCERT

Wednesday, August 24

In the House of Scientists:
$8^{\underline{00}}$ - $9^{\underline{00}}$ Breakfast
$8^{\underline{30}}$ - $17^{\underline{00}}$ Registration

Session 9 *Optical Clocks I*

$09^{\underline{00}} – 09^{\underline{30}}$ **N. Kolachevsky,** *P.N. Lebedev Physical Institute, Leninsky prospect 53, 119991 Moscow, Russia*

Progress in optical frequency standards: ultracold Thulium, ions, and passive resonators. We present current progress on laser frequency stabilization using high-finesse optical cavities. Compared to the room-temperature, cryogenic silicon cavities with crystalline mirrors open a unique opportunity to reach frequency instability at low 10^{-16} level.

$09^{\underline{30}} – 10^{\underline{00}}$ **T. Legero[1], D.G. Matei[1], S. Häfner[1], C. Grebing[1], R. Weyrich[1], F. Riehle[1], U. Sterr[1], W. Zhang[2], J. Robinson[2], L. Sonderhouse[2], and J. Ye[2],** *[1]Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany; [2]JILA, National Institute of Standards and Technology and University of Colorado, Boulder, USA*

Ultrastable, 10 mHz linewidth lasers based on cryogenic silicon resonators. We present two identical laser systems stabilized to single-crystal silicon resonators at 124 K. The unprecedented frequency instability of 5×10^{-17} is only limited by cavity thermal noise. The laser line width of both systems is 10 mHz corresponding to more than 100 s coherence time. We discuss applications to optical clocks.

$10^{\underline{00}} – 10^{\underline{30}}$ **A. Nevsky, E. Wiens, and S. Schiller,** *Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany*

An ultra-stable silicon cryogenic optical resonator. We report on the characterization of a silicon optical resonator operating in the deep cryogenic regime at temperatures down to 1.5 K. The measured expansion coefficient, frequency drift and the sensitivities of the resonator to external perturbations indicate that this system should enable frequency stabilization of lasers at the low-10^{-17} level.

$10^{\underline{30}} – 11^{\underline{00}}$ **I. Ushijima[1], M. Das[2], M. Takamoto[1,2]and H. Katori[1,2,3],** *[1]RIKEN Center for Advanced Photonics, Japan; [2]Quantum Metrology Laboratory, RIKEN, Japan; [3]Department of Applied Physics, the University of Tokyo, Japan*

Cryogenic optical lattice clocks towards an uncertainty of sub-10^{-18} level. Cryogenic strontium optical lattice clocks, where the atoms are interrogated in a cryogenic environment, reduce the major source of uncertainty due to blackbody radiation below 10^{-18} level. We evaluate the next major uncertainty of higher-order lattice light shifts towards the total uncertainty of 10^{-19} level.

$11^{\underline{00}} – 11^{\underline{30}}$ Coffee Break

Session 10 *Microwave Clocks*

$11^{\underline{30}} – 12^{\underline{00}}$ **C. Affolderbach, M. Gharavipour, and G. Mileti,** *Laboratoire Temps – Fréquence (LTF), Institut de Physique, Université de Neuchâtel, Neuchâtel, Switzerland*

Double-resonance spectroscopy in Rubidium vapour-cells for high performance and miniature atomic clocks. We present our research on microwave-optical double-resonance in Rb vapour cells. High-performance and miniature atomic clocks constitute two fields of applications. Stabilized laser diodes allow the improvement of performances but also enhance the possibilities and resolution of spectroscopic studies both in continuous and pulsed mode.

$12^{\underline{00}} – 12^{\underline{30}}$ **S. Atutov,** *Institute of Automation and Electrometry SB RAS, Novosibirsk, Russia*

Antirelaxation organic coating for optical resonant experiments. We present recent results of study of polydimethylsiloxane and paraffin antirelaxation organic coatings used in various optical experiments. The implementation of a resonant cell without "reservoir effect" (that is constructed in order to maximized relaxation time of polarization of the ground state rubidium atoms) is discussed as well.

$12^{30} - 13^{00}$ **V.A. Haisler,** *A.V. Rzhanov Institute of Semiconductor Physics SB RAS, Novosibirsk, Russia; Institute of Laser Physics SB RAS, Novosibirsk, Russia; Novosibirsk State Technical University, Novosibirsk, Russia; Novosibirsk State University, Novosibirsk, Russia*

Vertical-cavity surface-emitting lasers for chip-scale atomic clocks. Vertical-cavity surface-emitting lasers (VCSELs) characteristics ensure an excellent match to requirements to emitters in new generation chip-scale atomic clocks (CSACs). The design and performance of VCSELs for CSACs will be presented and discussed in this contribution.

$13^{00} - 14^{00}$ Lunch

Session 11 *Applications II*

$14^{00} - 14^{30}$ **T. Liu, J. Jiang, and K. Liu,** *Tianjin University, Tianjin, P.R. China*

Fiber-optic pressure and temperature sensor. We present discrete and distributed optical fiber sensing research progress in Tianjin University.

$14^{30} - 14^{45}$ **H.-C. Ryu[1], J.-H. Shin[2], and K.H. Park[3],** *[1]Department of Car Mechatronics, Sahmyook University, Seoul, Korea; [2]KU-KIST Graduate School of Converging Science and Technology, Korea University, Seoul, Korea; [3]Terahertz Basic Research Section, Broadcasting-Media Basic Technology Research Group, Broadcasting-Media Research Laboratory, ETRI, Daejeon, Korea*

Electrically controllable terahertz square-loop metamaterial based on vanadium dioxide thin film. An electrically controllable square-loop metamaterial based on vanadium dioxide (VO_2) thin film was proposed in the terahertz frequency regime. The square-loop shaped metamaterial was adopted to perform roles not only as a resonator but also as a micro-heater for the electrical control of the VO_2.

$14^{45} - 15^{00}$ **I. F. Shaikhislamov, V. G. Posukh, A. V. Melekhov, E. L. Boyarintsev, Yu. P. Zakharov, P. A. Prokopov, and A. G. Ponomarenko,** *Department of Laser Plasma, Institute of Laser Physics SB RAS, Novosibirsk, Russia*

Laboratory simulation of energetic flows of magnetospheric planetary plasma. A transient interaction of interpenetrating plasma flows in dipole magnetic fields is studied in experiment with laser-produced plasma.

$15^{00} - 15^{15}$ **S. Vatnik, I.A. Vedin, V.V. Osipov, K.E. Luk'yashin, R.N. Maksimov, V.I. Solomonov, Yu.L.Kopylov, I.Sh. Steinberg, P.E. Tverdokhleb, A.A. Pavlyuk,** *Institute of Laser Physics SB RAS, Novosibirsk, Russia*

High-efficiency lasing and spectroscopy of domestic Nd:YAG and Ho:YAG ceramics. We report on spectroscopy and high-efficiency lasing of YAG ceramics synthesized at IREE (Fryazino) and IEP (Ekaterinburg). The best slope efficiency is to be 36% for 1%Nd:YAG ceramics and 40% for 1%Ho:YAG ceramics, in the latter case the emission was centered at 2090 nm. Internal losses in domestic ceramics was estimated as well.

$15^{15} - 15^{30}$ **V.I. Trunov[1], K.V. Lotov[2,3], K.V. Gubin[1], E.V. Pestryakov[1,2], S.N. Bagayev[1,2], P.V. Logachev[3],** *[1]Institute of Laser Physics SB RAS, Novosibirsk, Russia; [2]Novosibirsk State National Research University, Novosibirsk, Russia; [3]Budker Institute of Nuclear Physics SB RAS, Novosibirsk, Russia*

Laser-driven plasma wakefield electron acceleration and coherent femtosecond pulse generation in X-ray and gamma ranges. The laser wakefield acceleration (LWFA) of electrons in the capillaries and gas jet and further inverse Compton scattering of high intensity femtosecond pulses using two channel multiterawatt laser system developed in ILP SB RAS are discussed. The possibility of LWFA of electrons up to 1 GeV with sub-PW high-contrast laser pulses are analyzed.

$15^{30} - 15^{45}$ **H. Zhang[1,2], W. Feng[1,2], D. Jia[1,2], and T. Liu[1,2],** *[1]College of Precision Instrument &Opto-electronics Engineering, Tianjin University, Tianjin 300072, China, [2]Key Laboratory of Opto-electronics Information Technology (Tianjin University), Ministry of Education 300072, Tianjin, China.*

Distributed polarization coupling measurement in polarization-maintaining fibers. We present the principle, setup, data processing and experimental results on distributed polarization coupling measurements in Polarization maintaining fibers.

15^{45} – 16^{00} **D. Jia, H. Zhang, and T. Liu,** *Tianjin University, Tianjin University, P.R. China*

Detection of Physiological signals using FBG sensing techniques

16^{00} –16^{30} Coffee Break

Session 12 *Applications III (in biology and medicine)*

16^{30} – 17^{00} **S. Colombo, V. Dolgovskiy, Z. D. Grujić, V. Lebedev, A. Weis, J. Zhang,** *Physics Department, University of Fribourg, Fribourg, Switzerland*

Characterizing and imaging magnetic nanoparticles by optical magnetometry. We use optical magnetometry to measure the magnetic response M(H) of magnetic nanoparticles (MNP), yielding MNP size distributions and magnetorelaxation M(t) signals following a magnetization pulse. Atomic fluorescence recording by a CCD yields images of MNP distributions. All experiments are in view of developing biomedical imaging modalities.

17^{00} – 17^{30} **A. Apolonski and BIRD Project[1,2] ,** *[1]Ludwig Maximilian University of Munich, Germany; [2]Max Planck Institute of Quantum Optics, Garching, Germany*

21st century mid-infrared biomedical spectroscopy: conventional FTIR vs Field Resolved. I will show the current status and limitations of conventional mid-infrared Fourier Transform Infrared Spectroscopy (FTIR). In comparison to FTIR, a laser-based time-domain spectroscopy holds promise for higher sensitivity and dynamic range. Test results of the two spectrometers for bio-probes (blood serum and exhaled air) will be shown.

17^{30} – 18^{00} **A.M. Razhev,** *Institute of Laser Physics SB RAS, Novosibirsk, Russia & Novosibirsk State Technical University, Novosibirsk, Russia*

Pulsed UV laser technologies for ophthalmic surgery. It is reported on the establishment of pulsed gas discharge pumped excimer ArF (193 nm), KrCl (222 nm), KrF (248 nm) and XeCl (308 nm) lasers on the basis of He and buffer-free active media allowing high radiation output energy, pulse power, total efficiency and the development of pulsed UV laser technologies based on them for use in ophthalmic surgery.

18^{00} – 18^{30} **A. Mayorov[1], I.Yu. Zhuravleva[2], A.M. Goncharenko[1], E.V. Kuznetsova[2], D.S. Bordzilovsky[1],** *[1] Institute of Laser Physics SB RAS, Novosibirsk, Russia; [2] E.N. Meshalkin Novosibirsk Scientific Research Institute of Pathology of Blood Circulation, Ministry of Health of the Russian Federation, Novosibirsk*

Application of laser technologies in manufacture of elements of cardiovascular prosthesis. Report describes the laser technologies used in the production of the elements of bioprosthesis. Authors describe existing problems, development of the technologies for their solution and create laser system for the production. The developed technology and instrumentation provide the upgrade of bioprosthesis and improve the long-term clinical results in their application.

18^{30} –20^{00} P O S T E R S E S S I O N B

20^{00} –21^{00} Dinner

Thursday, August 25

In the House of Scientists:
$8^{\underline{00}}$ - $9^{\underline{00}}$ Breakfast
$9^{\underline{00}}$ - $17^{\underline{00}}$ Registration

Session 13 *Cold Atoms II*

$09^{\underline{00}} – 09^{\underline{30}}$ **D.A.W. Hutchinson,** *Dodd-Walls Centre, Department of Physics, University of Otago, Dunedin, New Zealand*

Ultracold atoms for simulation of many body quantum systems. Feynman famously proposed simulating quantum physics using other, better controlled, quantum systems. This vision is now a reality within the realm of ultracold atomic physics. We discuss how these systems can be used to simulate many body physics concentrating the Berezinskii-Kosterlitz-Thouless transition in 2D physics and the role of disorder.

$09^{\underline{30}} – 10^{\underline{00}}$ **A. Kolovsky,** *L.V. Kirensky Institute of Physics SB RAS, Krasnoyarsk, Russia*

Wave-packet dynamics of ultra-cold atoms in 2D optical lattices subject to synthetic electric and magnetic fields. We discuss theoretical expects of the recent experiment on dynamics of cold neutral atoms in the square optical lattice subject to synthetic magnetic and electric fields. This setup mimics the Hall physics in solids yet requires a special consideration because of extremely high values of the fields, inaccessible in the solid-state physics.

$10^{\underline{00}} – 10^{\underline{30}}$ **Bess Fang, I. Dutta, D. Savoie, N. Miélec, R. Sapam, B. Venon, C. L. GarridoAlzar, R. Geiger, and A. Landragin,** *LNE-SYRTE, Observatoire de Paris, PSL Research University, CNRS, Sorbonne Universités,UPMC Univ. Paris 06, Paris, France*

Continuous Cold-Atom Inertial Sensor with 1 nrad/s Rotation Stability. I will present the latest results from the SYRTE cold-atom gyroscope. With a joint interrogation scheme, we can record rotation signals without loss of information. We report a short-term stability of 100 nrad/s/$\sqrt{\text{Hz}}$ and a long-term stability of 1 nrad/s after several hours of integration.

$10^{\underline{30}} – 11^{\underline{00}}$ **Boris Dubetsky** [via Internet, in Russian], *Hallandale, USA*

Atom interferometers' phases at the presence of heavy masses. Their use to measure Newtonian gravitational constant: Optimization, Error model, Perspectives

$11^{\underline{00}} – 11^{\underline{30}}$ Coffee Break

Session 14 *Quantum optics*

$11^{\underline{30}} – 12^{\underline{00}}$ **K. Krzyzanowska, M. Copley-May, R. Romain, C. MacCormick, and S. Bergamini,** *Departmentof Physical Science, The Open University, Milton Keynes,United Kingdom*

Quantum-enhanced protocols with mixed states using cold atoms in dipole traps. Modeling cold atoms in dipole traps we show that a register of partly mixed qubits can become a powerful resource for phase estimation protocols (DQC1) when supplied with the coherence originating from a single pure control qubit. This has important implications in the practical implementation of quantum devices.

$12^{\underline{00}} – 12^{\underline{30}}$ **I.I. Ryabtsev[1,2], D.B. Tretyakov[1,2], V.M. Entin[1,2], I.I. Beterov[1,2],E.A. Yakshina[1, 2], and C. Andreeva[3],** [1]*Rzhanov Institute of Semiconductor Physics SB RAS, Novosibirsk, Russia;* [2]*Novosibirsk State University, Novosibirsk, Russia;* [3]*Institute of Electronics, Bulgarian Academy of Sciences, Sofia, Bulgaria*

Controlling the interactions between cold Rydberg atoms by a time-varying electric field. We present the experimental and theoretical analysis of the line shapes of the Förster resonances Rb(nP)+Rb(nP)-->Rb(nS)+Rb((n+1)S) for a few cold Rb Rydberg atoms in a time-varying electric field. We have also developed schemes of two-qubit quantum gates based on adiabatic passage of the Stark-tuned Förster resonances in a swept electric field.

$12^{\underline{30}} – 13^{\underline{00}}$ **L.C. Kwek[1–4],** *[1]Centre for Quantum Technologies, National University of Singapore, Singapore; [2]Institute of Advanced Studies (IAS), Nanyang Technological University, Singapore; [3]National Institute of Education, Nanyang Technological University, Singapore; [4]MajuLab, CNRS-UNS-NUS-NTU International Joint Research Unit, UMI 3654, Singapore*

Hybrid quantum system: Superconducting resonator-Rydberg system. By considering two eigenstates near an avoided-level crossing in the DC Stark map of Rydberg atom, we proposed a feasible hybrid quantum system of a highly-excited Rydberg atom coupled strongly to a superconducting LC oscillator. We also show that different universal two-qubit logic gates can be implemented on the hybrid system.

$13^{\underline{00}} –14^{\underline{00}}$ Lunch

Session 15 *Application IV*

$14^{\underline{00}} – 14^{\underline{30}}$ **J. Belfi,** *INFN section of Pisa, Pisa, Italy*

Laser gyroscopes and their applications in fundamental physics, in metrology and in seismology. Three experiments are currently conducted by the Italian Institute of Nuclear Physics (INFN) on large frame ring laser gyroscopes. After a brief review of the state of the art in the field, I will show the performances, limitations, and perspectives of our developed prototypes for applications in fundamental physics, geophysics and metrology.

$14^{\underline{30}} – 15^{\underline{00}}$ **S. Vyatchanin,** *Faculty of Physics, M.V. Lomonosov Moscow State University, Moscow, Russia*

Speed meter based on dissipative coupling. We show that generalized dissipative optomechanical coupling enables a direct quantum measurement of speed of a free test mass. An optical detection of a weak classical mechanical force based on this interaction is proposed with sensitivity better than the standard quantum limit. The realization of dissipative coupling is discussed.

$15^{\underline{00}} – 15^{\underline{30}}$ **H.-C. Koch[1]** on behalf of the nEDM collaboration at PSI, *[1]Paul Scherrer Institut, Villigen PSI, Switzerland*

Atomic magnetometry for the neutron electric dipole moment experiment at Paul ScherrerInstitut. The nEDM experiment at PSI demands precise measurement and control of an applied magnetic field. The currently deployed ^{199}Hg co-magnetometer and Cs magnetometer array will be complemented in the future by an array of combined ^{3}He-Cs magnetometers. We explain the concepts and discuss the systems' performance with respective merits/drawbacks.

$15^{\underline{30}} – 16^{\underline{00}}$ **V. Rudenko, S. Oreshkin, S. Popov, and I. Yudin,** *Sternberg Astronomical Institute of Moscow State University, Moscow, Russia*

Cryogenic opto-acoustical gravitational wave antenna (Cryo-OGRAN). Enhancing of sensitivity of the opto-acoustical gravitational wave (GW) antenna OGRAN installed in the underground facilities of Baksan Neutrino Observatory is analyzed. Calculations are presented showing a sensitivity improving on two orders of value after a cooling the solid body acoustical part of the antenna to the nitrogen temperature.

$16^{\underline{00}} –16^{\underline{30}}$ Coffee Break

School for Young Scientists

16^{30} – 16^{40} **Opening in the House of Scientists**

16^{40} – 17^{30} **Prof. Nicolò Beverini**
Dipartimento di Fisica, Università di Pisa and INFN, sezione di Pisa, Italy
"Sagnac effect and gyroscopes"

17^{30} – 18^{20} **Prof. Sergei A. Babin**
Institute of Automation and Electrometry SB RAS, Novosibirsk, Russia
Novosibirsk State University, Novosibirsk, Russia
"New technologies of fibre optics"

19^{00} –22^{00} SYMPOSIUM DINNER

See continue of the School sessions on August 26

Friday, August 26

Sessions are held in the Institute of Laser Physics

8^{00} - 9^{00} Breakfast *(In the House of Scientists)*

Session 16 *Nanophotonics II*

09^{00} – 09^{30} **A. Plekhanov,** *Institute of Automation and Electrometry, Novosibirsk, Russia*

Spaser as novel versatile biomedical tool. Nanoplasmonics deals with collective electron excitations at the surfaces of metal nanostructures, called surface plasmons, and has numerous applications in science, technology, biomedicine. We will present recent breakthrough in application of the spaser as an ultrabrightnanolabel and an efficient theranostic agent in biomedicine.

09^{30} – 09^{45} **A. Ivanov, A. Kovalev, V. Polyakov, Yu. Rozhdestvensky, and S. Rudyi,** *ITMO University, Saint Petersburg, Russia*

Optical refrigerator for charged nanocrystals doped by Yb^{3+} ions. A model of an optical refrigerator for the charged nanocrystals is proposed. The refrigerator is composed of the RF Paul trap to capture and the optical module to cool the nanocrystal doped by Yb^{3+} ions. The feature of the proposed model is the combination of the translational and vibrational cooling of the nanocrystal in one process.

09^{45} – 10^{00} **A. Kucherik[1], S. Arakelian[1], S. Kutrovskaya[1], A. Osipov[1], T. Vartanyan[2], A. Povolotckaia[3], A. Povolotskiy[3], A. Manshina[3],** *[1]Stoletov Vladimir State University, Vladimir, Russia; [2]St.Petersburg National Research University of Information Technologies, Mechanics and Optics, St. Petersburg, Russia; [3]Saint-Petersburg State University, St.Petersburg, Russia*

Laser-induced synthesis of nanostructured metal-carbon clusters and complexes for optical application. The results of the experiments of laser metal-carbon cluster and complex synthesis are shown in this work. The obtained structures are planned to use for the registration of the SERS with the possibility of the sensitivity control in different areas of the spectra because of the changing of the initial component concentration and morphology.

10^{00} – 13^{00} Excursions to Institutes, NSU and Akadempark

13^{00} –14^{00} Lunch

Session 17 *Ultrahigh fields*

14^{00} – 14^{30} **G.G. Matvienko, A.A. Zemlyanov,** *V.E. Zuev Institute of Atmospheric Optics SB RAS, Tomsk, Russia*

The interaction of intensive femtosecond radiation with atmospheric media. We report the results of experiments and numerical simulation for multiple filamentation of terawatt femtosecond pulses of a Ti:sapphire laser on a 150-meter long air path under varied initial spatial focusing and laser output power. Formation and evolution of intense post-filamentation light channels were investigated experimentally and numerically.

14^{30} – 15^{00} **V.I.Trunov[1], S.A.Frolov[1], E.V.Pestryakov[1,2],S.N.Bagayev[1,2],** *[1]Institute of Laser Physics SB RAS, Novosibirsk, Russia; [2]Novosibirsk State National Research University, Novosibirsk, Russia*

New trends in ultrahigh intensity coherent beam combining. The new trends in coherent beam combining using parametrically amplified femtosecond pulses are discussed. The futures of multipump parametric amplifications and precise time synchronization of the set of independent pump lasers are analyzed. The optimal conditions of multibeam tight focusing for achieving extremely high intensities are investigated.

15^{00} – 15^{30} **K. Burdonov[1], A. Eremeev[1], J. Fuchs[1,2], V. Ginzburg[1], E. Khazanov[1], A. Kuzmin[1], R. Osmanov[1], S. Pikuz[3], G. Revet[1,2], A. Shaykin[1], I. Shaykin[1], A. Sladkov[1], A. Soloviev[1], M. Starodubtsev[1], and I. Yakovlev[1],** *[1]Institute of Applied Physics of the Russian Academy of Sciences, Nizhny Novgorod, Russia; [2]Laboratoire d'Utilisation des Lasers Intenses (LULI), Palaiseau, EcolePolytechnique, France; [3]Joint Institute for High Temperatures Russian Academy of Sciences, Moscow, Russia*

Laser-driven proton acceleration experiments at PW-class PEARL facility. We present the results of laser-driven proton acceleration experiments in TNSA regime at the PW-level PEARL facility. Maximum energies of accelerated protons measured by the radiochromic film (RCF) stack detector were in the range of 43.3 to 44.1 MeV and generated by 7.5 J, 60 fs laser pulse focused on the 0.8 mkm aluminum foil.

15^{30} –15^{50} Coffee Break

Session 18 *Optical Clocks II*

15^{50} – 16^{20} **V.D. Ovsiannikov[1], S.I. Marmo[1], S.N. Mokhnenko[1] and V.G. Palchikov[2,3],** *[1]Voronezh State University, Voronezh, Russia; [2]FGUP "VNIIFTRI", Mendeleevo, Moscow Region, Russia; [3]National Research Nuclear University "MEPhI", Moscow, Russia*

Higher-order effects on uncertainties of clocks of Mg atoms in an optical lattice. Operational magic frequency, intensity and polarization of a lattice wave for minimizing uncertainties of Mg clocks, arising from higher-order interactions of atoms with the magic lattice field, are determined on the basis of calculated data for nonlinear and multipole susceptibilities of individual atoms.

16^{20} – 16^{50} **S.M. Ignatovich[1], M.N. Skvortsov[1], V.I. Vishnyakov[1], D.V. Brazhnikov[1,2], and N.L. Kvashnin[1],** *[1]Institute of Laser Physics SB RAS, Novosibirsk, Russia; [2]Novosibirsk State University, Novosibirsk, Russia*

Yb:YAG/I_2 optical frequency standard at 515 nm with instability at the level 10^{-15}. We present the results of development of optical frequency standard based on Yb:YAG laser with second harmonic at 515 nm. The laser frequency is locked to the saturated-absorption resonance in a gas cell filled with molecular iodine. Final instability of the standard is 1.3×10^{-15} at 10^4 s.

16^{50} – 17^{05} **S.V. Chepurov[1], A.A. Lugovoy[1], S.N. Kuznetsov[1,2], K.M. Rumynin[1,2], M.V. Okhapkin[1,3], A.V. Taichenachev[1,2], V.I. Yudin[1,2] and S.N. Bagayev[1],** *[1]Institute of Laser Physics SB RAS, Novosibirsk, Russia; [2]Novosibirsk State University, Novosibirsk, Russia; [3]Physikalisch TechnischeBundesanstalt, Braunschweig, Germany*

Optical frequency standard with ytterbium single ion. We report on the progress in development of a highly accurate optical frequency standard based on the single ion of ytterbium-171 at the Institute of Laser Physics, Novosibirsk.

17^{05} –17^{25} Coffee Break

Session 19 *Cold atoms III*

17^{25} – 17^{55} **A.N. Goncharov[1,2,3], A.E. Bonert[1], D.V. Brazhnikov[1,2], O.N. Prudnikov[1,2], M.A. Tropnikov[1], A.V. Taichenachev[1,2], S.N. Bagayev[1,2],** *[1]Institute of Laser Physics SB RAS, Novosibirsk, Russia; [2]Novosibirsk State University, Novosibirsk, Russia; [3]Novosibirsk State Technical University, Novosibirsk, Russia*

An optical frequency standard based on ultracold magnesium atoms. This paper presents the recent experimental and theoretical results and perspectives on development of an optical frequency standard based on ultra cold magnesium atoms with relative frequency uncertainty and long term stability at the level of $\Delta\nu/\nu < 10^{-16}$.

17^{55} – 18^{10} **O.N. Prudnikov[1,2], D.V. Brazhnikov[1,2], A.V. Taichenachev[1,2], V.I. Yudin[1,2,3], and A.N. Goncharov[1,2,3],** *[1]Novosibirsk State University, Novosibirsk, Russia, [2]Institute of Laser PhysicsSB RAS, Novosibirsk, Russia, [3]Novosibirsk State Technical University, Novosibirsk, Russia*

Deep sub-Doppler cooling of Mg in MOT formed by light waves with elliptical polarization. We study laser cooling of Mg atoms on $^3P_2$–$^3D_3$ transition. For deep sub-Doppler laser cooling we suggest to use light field configuration formed by waves with elliptical polarization (ε-θ-ε*). This configuration allows reaching temperatures 10 times lower then well known σ^+-σ^- light field. Field parameters for stable MOT are discussed here.

18^{10} – 18^{25} **Elena Kuznetsova[1,2] , Seth T. Rittenhouse[3] , Hossein R. Sadeghpour[4], Susanne F. Yelin[4,5,6],** *[1]Institute of Applied Physics, Nizhny Novgorod, Russia; [2]Rzhanov Institute of Semiconductor Physics SB RAS, Novosibirsk, Russia; [3]Department of Physics, United States Naval Academy, Annapolis, USA; [4]ITAMP, Harvard-Smithsonian Center for Astrophysics, Cambridge, USA; [5]Department of Physics, University of Connecticut, Storrs, USA; [6]Department of Physics, Harvard University, Cambridge, USA*

Rydberg atom mediated non-destructive readout of rotational states of polar molecules and indirect molecular interactions. We propose a non-destructive readout of populations of single molecule/molecular array rotational states relying on charge-dipole interaction between molecular dipoles and a Rydberg atom. We also analyze indirect interaction between polar molecules mediated by their interaction with Rydberg atoms.

18^{25} – 18^{35} ***Closing remarks***

20^{00} –21^{00} Dinner

Friday, August 26

School for Young Scientists Continues

In the Novosibirsk State University, new building, room no. 3312

$09^{00} – 09^{50}$	**Prof. David Hutchinson** *Dodd-Walls Centre, Department of Physics, University of Otago, Dunedin, New Zealand* "A brief history of Bose-Einstein condensation of ultracold gases"
$10^{00} – 13^{00}$	*Excursions to Institutes, NSU and Akadempark*
$13^{00} – 14^{00}$	Lunch Time
$14^{00} – 14^{50}$	**Prof. Boris Knyazev** *Novosibirsk State University & Budker Institute of Nuclear Physics SB RAS, Novosibirsk, Russia* "Beams with angular orbital momentum: a step into the terahertz range"
$14^{50} – 15^{40}$	**Prof. Boris Vainer** *Novosibirsk State University, Novosibirsk, Russia* "Lasers and infrared thermography: harmony, mutual assistance and reciprocal gain"
$15^{40} – 16^{00}$	Coffee Break
$16^{00} – 16^{50}$	**Prof. Valentin Rudenko** *M.V. Lomonosov Moscow State University, Sternberg Astronomical Institute, Moscow, Russia* "First registration of gravitational waves by using the large laser interferometers with suspended mirrors"
$16^{50} – 17^{50}$	**Prof. Jean-Jacques Zondy** *School of Sciences & Technology, Nazarbaev University, Astana, Kazakhstan* "Continuous-wave Optical Parametric Oscillators: Theory and Applications"
$17^{50} – 18^{10}$	Coffee Break
$18^{10} – 19^{10}$	**Prof. Jean-Jacques Zondy** *School of Sciences & Technology, Nazarbaev University, Astana, Kazakhstan* "Optimally-coupled cw Intracavity Second-Harmonic Generation in solid-state lasers ring lasers: Observation of cascaded Kerr-lens modelocking"

Poster Sessions A

Topics: Applications of laser radiation; Fiber optics; Nanophotonics; Ultrahigh laser fields

No. ***Applications of laser radiation***

A 1 **Kun Liu, L. Yu, J. Jiang, T. Wang, M. Xue, T. Liu**
Investigation of mixed gas sensing based on fiber ring intracavity absorption laser. Aiming at the requirement of monitoring gas pollutants in real time in the fields of industrial production and environmental protection, we investigate the gas sensing technique based on fiber laser intracavity absorption spectroscopy.

A 2 **Zhenyang Ding, D. Yang, T. Liu, Y. Du, K. Liu, Y. Zhou, Z. Xu, J. Jiang**
Distributed strain and temperature discrimination using two types of fiber in OFDR. We present a simple and effective method to achieve a distributed strain and temperature discrimination using two types of fiber by a Rayleigh backscattering spectra (RBS) shifts in optical frequency domain reflectometry (OFDR).

A 3 **Haofeng Hu, T. Liu, B. Huang**
Polarimetric imaging in complex environments. In this report, we present our results of polarimetric imaging in underwater environment and in the uneven illumination environment, which shows that polarimetric imaging can effectively decrease the influence of the environment on the detection effect.

A 4 **Weihong Bi, Y. Xing, X. Fu, G. Fu**
Mechanism and experimental study on the detection of diesel oil in the mixture of kerosene and diesel oil with long period fiber grating

A 5 **Xinghu Fu, H. Xie, G. Fu, W. Bi**
Research on cladding mode resonance sensing characteristics based on triple cladding quartz specialty fiber

A 6 **S.S. Popova**
Terahertz vibrations in intracellular media. In intracell media it is need to distinct inhomogeneous distribution of thermal energy and non-equilibrium energy levels distribution. Frohlich condensation leads to coherent vibrations excitation without local restrictions and distribution of absorbed energy can strongly differ from implicitly presume thermal equilibrium.

A 7 **V.A. Kostin, I.D. Laryushin, A.A. Silaev, N.V. Vvedenskii**
Terahertz and mid-infrared radiation from gas ionized by two-color laser pulses. Based on the ab initio quantum-mechanical and semiclassical calculations, we show that gas ionization by two-color laser pulses can provide efficient generation of terahertz and mid-IR radiation with frequency which can be controlled by tuning the frequencies of optical field components.

A 8 **V. Fedorov**
Bioeffects of terahertz radiation is base for new application in medicine. Review of experimental data about terahertz influence on DNA conformation, gene activity, mutations, polymorphism, epigenetic processes, functional properties in single cells, microorganisms, agricultural plants, insecta and mammalians.

A 9 **V. Fedorov, N. Weisman, E. Nemova**
Terahertz radiation influence on dynamics of achieving the adult state in offspring of irradiated parent Drosophila. Terahertz radiation induces an increase in survival and life span of adult males and females of Drosophila compared with the control. In the first generation of progeny of exposed mothers a survival of males (but not females) in the first half of life is increased significantly compared with the control.

A10 **D. Churkin, A. Razhev, E. Kargapol'tsev, O. Ermakova, I. Iskakov, V. Chernykh**

UV excimer laser system for ab-externo surgery open-angle glaucoma. In the report the UV laser apparatus for open angle glaucoma surgery is presented. Laser emission (λ = 308 nm) is delivered to the work surface by a special optical fiber and it provides to surgeon to variate of power density in wide range. Ab-externo surgery method allows operation conducting with high efficiency and minimal trauma.

A11 **D. Churkin, A. Razhev, E. Kargapol'tsev**

Emission amplification on the transitions B→X (λ = 353 nm) of XeF* molecules in pulsed inductive discharge. Results of experimental investigation of XeF* molecules emission spectral and temporal characteristics of in pulsed inductive discharge are presented. In experiments the amplification on transition B→X (λ = 353 nm) of XeF* molecules is observed. Methods of generation regime achievement on this transition in pulsed inductive discharge are discussed.

A12 **E.S. Kargapoltsev, A.M. Razhev, D.S. Churkin**

New near-infrared laser lines of the gas-discharge pumped atomic Xe I-, Ar I- and Kr I-lasers. The results of an experimental study of spectral, energy and temporal data of pulse discharge multi-wavelength Ar I, Kr I and Xe I high-pressure lasers with pulse energy up to 30 mJ are presented. The twelve new near-infrared atom transition laser lines at Ar I, Xe I and Kr I ranging from 1,48 to 4,06 μm are reported by us for the first time.

A13 **E.S. Kargapoltsev, A.M. Razhev, D.S. Churkin**

Gas-discharge pumped excimer lasers on binary gas mixtures as a powerful UV source. Spectral, energy, temporal data research of gas-discharge excimer ArF, KrCl, KrF, XeCl lasers are presented. Powerful UV laser radiation on binary gas mix without of any conventional buffer gas was obtained. Lasers realized by excitation of gas mix Ar:F_2, Kr:BCl_3, Kr:F_2, Xe:BCl_3. Output pulse energy up to 170 mJ and pulse power 24 MW are obtained.

A14 **A. Kuchyanov**

Highly sensitive and fast response ammonia sensor. We have implemented a highly sensitive and fast response (100 ms) ammonia sensor based on Fabry-Perot interferometer and total internal reflection of a light in opal like silica film.

A15 **N. Lazareva, A. Kuznetsov, E. Martynovich**

Spatial-modulation method for studying of quantum systems orientation in crystalline media. The theory of the effect of spatial modulation of luminescence of anisotropic crystals under laser excitation was developed. The correspondence between the modulation depth and orientation of the dipole moments of quantum transitions has been established. The new method of determining the orientation of quantum systems has been developed and tested.

A16 **S.L. Mikerin, A.I. Plekhanov, A.E. Simanchuk, A.V. Yakimansky**

Exitation of a broadband terahertz radiation by femtosecond laser pulses in poled nonlinear optical polymers. Reported on the use of new nonlinear optical polymer material based on polyimide with chromophore DR-13 for generating terahertz pulses. A short THz pulses (a few field oscillations) are excited through an optical rectification in 1-μm-film with amplitude per unit of thickness 200 times greater than in the ZnTe crystal with a thickness of 500 μm.

A17 **L. Alexandrov, M. Emelin, M. Ryabikin**

Probing the rotational dynamics of polar molecules using laser-induced THz wave generation. An all-optical method for probing the orientation of polar molecules is proposed. In the proposed scheme, the field-free rotational wave packet created by the pump pulse is probed by measuring the ionization-induced THz signal caused by an asymmetry of the molecules, whose magnitude strongly depends on the degree of orientation of the sample.

A18 **V.N. Tishchenko, Y.P. Zakharov, I.F. Shaikhislamov, A.G. Berezutski, E.L. Boyarintsev, A.V. Melekhov, A.G. Ponomarenko, V.G. Posukh, P.A. Prokopov**

Mechanism merging of waves produced by laser plasma pulses in magnetic tube. In the experiment, on the KI-1 facility, revealed a new effect: the periodic flash of laser plasma in the magnetic field creates a stream of rotating plasma, which contain torsional Alfvén (performed for the first time) and slow magnetosonic wave.

A19 **N.D. Goldina**

Metal – dielectric interferometer for sensor applications by frustrated total internal reflection. Numerical analysis of the angular and spectral characteristics of the reflecting metal–dielectric interference structure at an angle of incidence greater than the critical is proposed. The influence of parameters of the metal and dielectric layers on the sensor sensitivity is discussed.

A20 **Yu.P. Zakharov, A.G. Ponomarenko, V.A. Terekhin, E.L. Boyarintsev, A.V. Melekhov, V.G. Posukh, P.A. Prokopov, K.V. Vchivkov**

Simulation by laser plasma blobs of the coronal mass ejection impact onto Earth's magnetosphere at presence of interplanetary quasi-perpendicular shock. In the recent simulative experiments at KI-1 facility, with Magnetosphere Model (MM, around magnetic dipole in H^+-plasma flow) and oblique ejection of high-energy blob of Laser Plasma (LP) onto MM, we first study an effect of two-fold compression of MM by LP at presence of Collisionless Shock (CS). CS-generation by LP was studied by hybrid model.

A21 **A.E. Medvedev, G.N. Grachev**

Generation of a laser-plasma ion flow in a microwave cavity. Laser plasma occupy an ever greater place in practical applications. In this paper, a possibility of using microwave-range electric energy to accelerate ions of optical pulsating discharge laser plasma for non-vacuum surface-treatment technologies is considered.

A22 **S. Panov, M. Parushkin, V. Semibalamut, Yu. Fomin, Yu. Rybushkin**

Laser deformography and earthquake precursors. A review of the main features of the dynamics of deformation processes regularly manifested on the eve of strong regional earthquakes is a result of many years of observations using the laser strainmeter developed in the Institute of Laser Physics and mounted in geophysical test site "Talaya" Baikal region.

A23 **S. Panov, M. Parushkin, V. Semibalamut, Yu. Fomin, A. Rybushkin, S. Tokmoldin, V. Klimenov**

The three-channel laser strainmeter for geophysical research. Heterodyne laser strainmeter with a relative sensitivity of $\sim 10^{-14}$, band of recorded frequencies is up to 1 kHz, measuring base is up to 300 m is described. The measuring system is intended for monitoring of the stress-strain state of the Earth's crust in the underground mines.

A24 **P. Prokopov, Yu. Zakharov, V. Tishchenko, I. Shaikhislamov, V. Posukh, A. Melekhov, A. Ponomarenko, E. Boyarintsev**

Laboratory simulations of Alfven waves via collisionless interaction of laser plasma injected in magnetized background plasma. Laser plasma cloud, which propagates along external magnetic field inside magnetized background plasma, generates perturbation having signs of Alfven wave: current along the magnetic field and corresponding circular magnetic fields. Presumably it created by magnetic laminar mechanism of collisionless interaction of interpenetrating plasma flows.

A25 **V. Sobolev, E. Utkin, G. Kashcheeva, A. Shcherbachenko**

Vibration measurement based on modulation of laser radiation. Amplitude modulated laser light scattered by moving object carries a Doppler frequency shift of the modulating signal. On the basis this effect has been developed and experimentally tested measurement technique of vibration at a distance of some 10 m.

A26 **I.R. Khayrulin, V.A. Antonov, Y.V. Radeonychev, O.A. Kocharovskaya**
Compression of waveform of Mössbauer γ-ray photon in optically deep vibrating recoilless resonant absorber. We discuss the possibilities to (a) transform the waveform of a Mössbauer gamma-ray photon into a pulse train in an optically deep vibrating recoilless resonant absorber, and (b) increase the peak detection probability of the photon over the value achieved in the proof-of-principle experiment [F. Vagizov et al., Nature 508, 80 (2014)] considerably.

A27 **V. Demin, T. Smirnova, V. Borisov, G. Grachev, A. Smirnov, M. Chomyakov**
Synthesis and characterization of carbon nitride films produced in plasma powerful optical pulsating discharge. New method of laser plasma deposition with activation precursors of plasma powerful optical pulsating discharge in high velocity gas stream Ar and vapour of acetonitririle as precursor was employed for synthesis carbon nitride films on stainless steel substrate. A new form carbon nitride, predicted early in literature, was produced.

Fiber optics

A28 **F. Song, YangYang Ren, M. Feng**
Passive synchronization of erbium and ytterbium doped fiber Q-switching lasers induced by 1530 nm laser pulses in common graphene saturable absorber. We demonstrate an all-optical Q-switcher based on graphene saturable absorber (GSA). Due to the cross absorption modulation (XAM) effect in graphene, we can change the transmittance of signal light periodically by introducing a train of laser pulses into graphene.

A29 **Weihong Bi, P. Jiang, Y. Qi , Y. Wu, X. Fu, G. Fu**
Study of theoretical model and spectrum characteristics of photonic crystal fiber superimposed grating

A30 **Vishwatosh Mishra, E. A. Zlobina, S. I. Kablukov, S.P. Singh, S. K. Varshney, S. A. Babin**
Continuous-wave fiber optic parametric oscillators: impact of dispersion inhomogeneities. We have numerically studied the effect of longitudinal fluctuation of fiber dispersion on the continuous-wave FOPO threshold for both the polarization maintaining (PM) and non polarization maintaining (non-PM) FOPO and found that the threshold increases significantly with the decrease of anti-Stokes wavelength, consistent with our experiments.

A31 **A.Tikan, I. Vatnik, D. Churkin, A. Sukhorukov**
Measurement of eigenmode excitation spectrum in synthetic photonic lattices. A method based on optical heterodyning is proposed for measuring relative optical phases of pulses circulating in a synthetic photonic lattices. The knowledge of the phases can be further used for qualitative reconstruction of an eigenmode excitation spectrum in the synthetic photonic lattice.

A32 **A. Pankov, I. Vatnik, D. Churkin, A. Sukhorukov**
Localized eigenmodes in mesh synthetic photonic lattices. Eigenmodes and dispersion curves in different configurations of synthetic photonic lattices are studied numerically. Eigenmodes localized on borders between areas with different optical potential are found. Stability of these eigenmodes against potential disturbances of different type is studied.

A33 **A. Komarov, A. Dmitriev, K. Komarov, F. Sanchez**
Fiber laser with hybridization of passive mode locking and undamped regular spikes. On basis of numerical simulation we have investigated the novel regime of fiber lasers for which passive mode locking is realized simultaneously with regular undamped spikes. The obtained results are of great interest to a generation of reproducible stable high-energy pulses.

A34 **D.S. Kharenko, A.E. Bednyakova, E.V. Podivilov, M.P. Fedoruk, S.A. Babin**

High-power femtosecond all-fiber oscillators: limitations and new possibilities. Energy of chirped dissipative solitons (DS) formed in fiber lasers grows with cavity lengthening until it exceeds a threshold of stimulated Raman scattering forming a noisy Raman pulse. Further scaling is possible by mode-field diameter increase or introducing a weak feedback and generation of coherent Raman DS. Both possibilities are investigated.

A35 **B.V. Poller, A.V. Britvin, A.V. Povazhaev, A.B. Poller, E.N. Chesnokov**

Experimental characteristics of polymer terahertz photonic crystal fiber for laser control. The article presents the formation variant of periodic structures using the assembly of polymer waveguides to generate a photonic crystal fiber.The presented experimental characteristics for polymer terahertz photonic crystal waveguides of various configurations for laser control.

Nanophotonics

A36 **Aihua Zhou, F. Song, Y.D. Han, W.J. Zhao, D.D. Ju**

Near-infrared quantum cutting in Tb^{3+} and Yb^{3+} co-doped glass containing Ag nanoparticles. We demonstrate Tb^{3+}, Yb^{3+} and Ag co-doped glass. Due to the localized surface plasmon resonance, we can enhance luminescence. The electric field distributions of Ag NPs are emulated by FDTD solutions software.

A37 **F.A. Benimetskiy, A.I. Plekhanov, A.S. Kuchyanov, R.G. Parkhomenko, T.V. Basova**

Experimental realization of surface plasmon laser. This work presents the experimental realization of surface plasmon laser for visible and near IR region based on hybrid nanoparticles with gold core or nanorod with a different aspect ratio surrounded by a silica dye-embedded shell. We have experimentally studied spasing in such structures using the methods of spectroscopy, AFM, NSOM.

A38 **S. Kutrovskaya, A. Kucherik, S. Arakelian, A. Osipov, T. Vartanyan, T. Itina**

Optical properties of quasi-organized bimetallic clusters obtained by laser-assisted colloidal deposition. We have presented both the experimental and modeling data on the optical properties of nanostructured bimetallic films. The possibility of the formation of the surface array of gold and silver nanoparticles with controlled morphology is demonstrated. The optical properties of the films are found to depend on the film morphology.

A39 **A.A. Lyamkina, K. Schraml, A.K. Bakarov, M. Kaniber, S.P. Moshchenko**

Hybrid structures with InAs/AlGaAs quantum dots strongly coupled to plasmonic bowtie nanoantennas. Deterministically integrating semiconductor quantum emitters with plasmonic nano-devices paves the way towards chip-scale integrable photonics technologies. Here, we demonstrate strongly enhanced light-matter coupling of single near-surface InAs quantum dots integrated into electromagnetic hot-spots of sub-wavelength sized metal nanoantennas.

A40 **L.S. Basalaeva, Yu.V. Nastaushev, F.N. Dultsev, N. V. Kryzhanovskaya**

Tunable multicolored generation using silicon nanopillars. Silicon nanopillars (Si NPs) have a unique capability of manipulating and controlling light on a nanoscale. In this study, we investigate the optical properties of Si NPs. Electron beam lithography and reactive ion etching are used for the formation of ordered Si NP arrays. Tunable color generation from vertical silicon nanorods is demonstrated.

A41 **A.A. Lyamkina, L.S. Basalaeva, S.P. Moshchenko**

Coupling of monolithically integrated quantum dots to V-groove based plasmonic nanostructures. Coupling of monolithically integrated quantum dots (QDs) to plasmonic nanostructures formed in chemically etched V-grooves is theoretically investigated. Such geometry allows to form pyramid-like nanoantennas and plasmonic waveguides in a close proximity to QDs. The hybrid structure is optimized to enable strong exciton-plasmon interaction.

A42 **A. Osipov, S. Arakelian, A. Evlukhin, S. Kutrovskaya, A. Kucherik**

Laser synthesis of a silicon nanoparticle in liquid. The obtaining of new allotropic forms of carbon is the fundamental problem, which develops because of the modern nanotechnology achievements. It is shown, that the controlling of the laser experimental parameters can be resulted in the obtaining of the different types of carbine structures.

Ultrahigh laser fields

A43 **G.V. Kuptsov, V.V. Petrov, V.A. Petrov, A.V. Kirpichnikov, A.V. Laptev, E.V. Pestryakov**

The design of ultrabroadband parametric amplifier for multiterawatt femtosecond laser system with 1 kHz repetition rate. The calculation of ultrabroadband parametric amplifier based on nonlinear borate crystals for multiterawatt femtosecond laser system with high repetiton rate has been carried out. A near-gaussian gain profile with a ~20% dip near the center is proposed to optimize the amplified supercontinuum spectral shape.

A44 **D.V. Apeksimov, A.A. Zemlyanov, A.N. Iglakova, A.M. Kabanov, O.I. Kuchinskaya, G.G. Matvienko, V.K. Oshlakov, A.V. Petrov**

Post-filament light channels. Presents the results of experimental studies of spatial characteristics post-filament light channels formed in the propagation of a single pulse of Ti:Sapphire femtosecond laser in the air. The dynamics of post-filament light channels along a distance of propagation of the laser beam are studied.

A45 **D.V. Apeksimov, A.A. Zemlyanov, A.N. Iglakova, A.M. Kabanov, O.I. Kuchinskaya, G.G. Matvienko, V.K. Oshlakov, A.V. Petrov**

Multiple filamentation of terawatts laser pulses with different diameters at the atmospheric path. Results of experiments on controlling the position and length of the filamentation zone of femtosecond laser pulses at atmospheric path length 110 m using different initial spatial focusing and defocusing. The obtained distribution of filaments along the filamentation zone, measured dependence the length of the filamentation zone of the numerical a…

A46 **A.V. Laptev, E.V. Pestryakov, V.V. Petrov, G.V. Kuptsov, V.A. Petrov, A.V. Kirpichnikov**

The investigation of thermal effects in Yb:YAG multipass amplifier of high power femtosecond laser system. In this work we investigated thermal lens and features of cooling system in diode-pumped multipass amplifier based on Yb:YAG crystal for femtosecond terawatt-class laser system. The results were used for optimization of the beam parameters.

A47 **M. Zavyalova, A. G. Verkhogliad, M. F. Stupak**

Ablation of optical transparent materials using picosecond laser pulses. We present experimental results of the different processes that can give from focusing an ultrafast laser light in the picosecond regime on a host of transparent materials, e.g., a silica, a silica glass and dielectric films.

A48 **G. Grachev, A. Dmitriev, I. Miroshnichenko, A. Smirnov, V. Tischenko**

Spectrum and localization radius of intense sound produced by a powerful repetitively pulsed laser radiation. Optical pulsating discharge produced by powerful repetitively pulsed laser radiation with frequency ~100 kHz is unique sound source: frequency range from infrasound to ultrasound, one or more harmonics of ultrasound, localization radius and spectrum structure control by changing the pulse repetition frequency.

A49 **V.A. Petrov, G.V. Kuptsov, V.V. Petrov, A.V. Laptev, A.V. Kirpichnikov, E.V. Pestryakov**

Numerical investigation of laser amplification of near transform-limited broadband pulses. The model allows evaluating the simultaneous interaction of all pulse spectral components with a solid-state gain medium. The comparison between proposed model and well-known Frantz-Nodvik model is presented. The results were used for the development of high power femtosecond laser system with high repetition rate.

A50 O. Meshkov, M. Emelin, M. Ryabikin

Control of the electron dynamics in atomic ionization by an ultrashort two-color laser pulse for enhanced ultrahigh-order harmonic generation. We will present the theoretical results demonstrating the possibility to significantly enhance the efficiency of mid-IR driven ultrahigh-order harmonic generation in gases using an optimized ultrashort two-color laser waveform. The mechanism for the enhanced harmonic yield will be explained in terms of the peculiarities of photoelectron dynamics.

A51 V.S. Kazakevich, P.V. Kazakevich, P.S. Yaresko, D.A. Kamynina

Microstructures with negative radius of curvature obtained by laser ablation in ethanol method with follow chemical etching. Micro and nanostructuring of metals and alloys surfaces by subnanosecond laser radiation in the ethanol was considered. The resulting surfaces with micro and nanostructures were subjected to chemical etching. Microstructures with a negative radius of curvature were obtained.

Poster Session B

Topics: Spectroscopy and metrology; Ultracold atoms; Nonlinear optics; Quantum optics and information; Ultrahigh laser fields and attosience; Complex media

No. ***Spectroscopy and Metrology***

B1 **S. Li, X. Peng, Z. Lin, H. Wang, H. Guo**
Laser pumped ^{4}He magnetometer with light shift suppression. We report a laser-pumped 4He atomic magnetometer with light shift suppression through the atomic sensor itself. It is shown that light shift leads to the atomic alignment to orientation conversion (AOC) effect. The effect causes the signals different. We use the difference to suppress the light shift.

B2 **I. Popkov, S. Khripunov, D. Radnatarov, S. Kobtsev, V. Andryushkov, M. Basalaev, M. Balabas**
Effect of temporal delay in formation of coherent population trapping resonance in ^{87}Rb under dynamic excitation. In this study we experimentally investigate the dependency of the delay upon different parameters. It was found out that the delay depends upon the modulation parameters of the frequency difference between two laser fields and doesn't depend upon relaxation properties of Rb vapor cell.

B3 **A. Isakova, N. Golovin, K. Savinov, A. Dmitriev**
The laser pumping rubidium frequency standard. As known, lasers with the frequency modulation near the half of the clock transition for pumping of the CPT resonance are used. The comb of the dependence of amplitude sidebands vs. frequency modulation was observed for the first time. We suppose, the comb envelope width is limited by resonator length uncertainty due to diffraction grating.

B4 **A.V. Kirpichnikov, V.V. Petrov, G.V. Kuptsov, A.V. Laptev, V.A. Petrov, V.I. Trunov, E.V. Pestryakov**
Stabilization of kilohertz solid-state laser system parameters for high harmonic generation experiments. A carrier-envelope offset phase (CEP) stabilization of 1 kHz 30 fs solid-state laser system based on master oscillator-multipass amplifier chain was developed with achieve of ~0.17 radian residual instability. The application of this system for high harmonic generation is discussed.

B5 **E.G. Saprykin, A.A. Chernenko, A.M. Shalagin**
Self-saturation of two- and three-level nondegenerate transitions in spectroscopy of the unidirectional waves. Spectroscopic phenomena caused by self-saturation of transitions in a method of the probe field of unidirectional waves in two and three level system (Λ-and V-type of transitions) are investigated analytically and numerically. Specifics manifestations of self-saturation effect in case of unidirectional waves are found.

B6 **E.G. Saprykin, A.A. Chernenko, A.M. Shalagin**
Influence of spontaneous emission on working transition to the sign and structure of the nonlinear absorption resonance of two-level system in spectroscopy of the unidirectional waves. It is shown analytically and numerically as for motionless and moving atoms, that shape of nonlinear resonance of two-level system in spectroscopy of unidirectional waves transforms from dip in peak at changing of ratio between relaxation constants Γ_m ,Γ_n and A_{mn} values. Physical reasons of such change of resonance form are determined.

B7 **E.G. Saprykin, A.A. Chernenko, A.M. Shalagin**
Resonances of electromagnetically induced transparency and electromagnetically induced absorption in spectra of magnetic scanning on transition with J=1. Physical processes forming spectra of saturated absorption and magnetic scanning resonances (EIT and EIA) on transitions with state moments J=1 are investigated numerically. It is shown that at opposite and unidirectional laser waves determining process is the level magnetic coherence induced on lower atom state.

B 8 **E. Baklanov, P. Pokasov**

Two-photon absorption at the $2^1S–2^3S$ Forbidden Transition of Helium. We study two-photon absorption at the $2^1S–2^3S$ transition of helium. We have found the way to observe two-photon absorption at the $2^1S–2^3S$ transition.

B 9 **A. Golovizin, E. Kalganova, D.Tregubov, G. Vishnyakova, D. Sukachev, K. Khabarova3, V. Sorokin, N. Kolachevsky**

Cold Thulium atoms spectroscopy in optical dipole trap. Spectroscopy of cold Thulium atoms is of interest due to it's large magnetic moment 4 mB in the ground state, and (ii) existence of narrow 1.6 Hz line width transition suitable for realization of a frequency standard. We demonstrate deep laser cooling of Tm as well as effective atoms recapture into optical lattice at 532 nm and 806 nm.

B 10 **A. Dmitriev, E. Baklanov, N. Golovin, S. Grigoryva**

Stabilisation of a femtosecond frequency standard using a Michelson interferometer. We propose an optical frequency standard based on a femtosecond laser, in which the shift of the frequency comb is controlled using a Michelson interferometer.

B 11 **A.K. Dmitriev, N.N. Golovin, N.Zh. Altynbekov, A.A. Isakova**

The error of meter standard due to diffraction divergence and wavefront curvature. The influence of diffraction divergence and wavefront curvature of the of monochromatic Gaussian light beam on the error of meter standard implemented by the Michelson interferometer is studied. Conditions for the maximum of signal-to-noise ratio and the minimum error of meter standard for different cross sections of the beam waist were found.

B 12 **D. Lazebny, D. Brazhnikov, A.Taichenachev, V. Yudin**

Polarizational dependence of recoil-induced resonances. Method of nondestructive control of cold atoms in magneto-optical trap based on recoil-induced resonances is widely used, We investigate dependence of recoil-induced resonances on arbitrary polarization of pump and probe fields. We provide two cases of dependences: for free atoms and for atoms in working magneto-optical trap.

B 13 **D.V. Brazhnikov, A.S. Novokreshchenov, A.V. Taichenachev, V.I. Yudin, Ch. Andreeva, V.M. Entin, I.I. Ryabtsev, S.M. Ignatovich, N.L. Kvashnin, V.I. Vishniakov, M.N. Skvortsov**

Ultrahigh-quality enhanced absorption resonance based on the coherent population trapping in a vapour cell with antirelaxation coating of walls. Resonances of electromagnetically induced absorption in the Hanle configuration have been stadied theoretically and experimentally. It has been shown that the new scheme of observation allows obtaining the nonlinear signal with ultrahigh contrast (> 85 %) and narrow width (~ kHz).

B 14 **A. Novokreshchenov, D. Brazhnikov**

Detailed theoretical study of the new resonance in the saturated-absorption spectroscopy of atomic vapours. *We consider the effect of dual-shaped saturated-absorption resonance discovered several years ago by our colleagues from the Lebedev Physical Institute RAS. It has good prospects for laser frequency stabilization, but it has not been studied enough. We analyze the influence of spatial harmonics of atomic polarization as well as light polarizations.*

B 15 **M. Tropnikov, A. Bonert, D. Brazhnikov, A. Goncharov**

Precision spectroscopy of cold magnesium atoms localized in a magneto-optical trap. In this paper, the results of experimental research aimed at creation of the optical frequency standard based on cooled and localized in a magneto-optical trap Mg atoms are presented. Characteristics of laser system related to the frequency stability and the results of high resolution spectroscopy of clock $^1S_0–^3P_1$ transition for Mg are presented.

B 16 **K. Barantsev, A. Litvinov, E. Popov**

Control the propagation of radiation spectrum and correlations in optically dense gas by the microwave field. We present the theory of propagation of the broadband quasiresonance radiation in optically dense gas at room temperature in the presence of closed excitation contour. Under these conditions the partially coherent light can increase its coherence after passing the medium. Also, spatial oscillations of intensity can appear inside the medium.

B17 **D. Primakov, P. Pokasov, S. Bagayev**

Absorptive optical bistability in an active interferometer. The paper is dedicated to investigations of transmission regimes of an interferometer of Fabry-Perot type with saturated amplifying and absorbing media inside. The influence of saturation type of the absorbing medium on forming nonlinear transmission regimes of such interferometer is considered in details.

B18 **A. Pazgalev, P. Petrov, T. Vartanyan**

Blue rubidium fluorescence in an extremely thin cell. An Extremely Thin Cells (ETC) with sub-micrometer size are proved to be the valuable tools for study the atom-to-surface interactions. We report a high-resolution spectroscopy of rubidium-85 excited states in ETC. The numerical calculations are presented as well.

B19 **D. Kovalenko, M. Basalaev, V.I. Yudin**

Optimization of stabilization regimes of the optical frequency standards based on resonant two-level atoms. The presentation is devoted to the submission of the results obtained by the research of the dependence of the slope of the first-harmonic signal on modulation parameters of the laser frequency, Rabi frequency and the reference signal phase for two-level atomic system in spontaneous relaxation model by using of the density matrix formalism.

B20 **M.Yu. Basalaev, V.I. Yudin, A.V. Taichenachev**

Atomic spectroscopy in periodic fields. Using the density matrix formalism, we prove the existence of the periodic steady-state for an arbitrary periodically driven system described by linear dynamic equations. The presented derivation simultaneously contains a simple and effective computational algorithm, which automatically guarantees a full account of all frequency components.

B21 **V.I. Yudin, A.V. Taichenachev, M.Yu. Basalaev, T. Zanon-Willette**

Synthetic frequency protocol in the Ramsey spectroscopy. We develop an universal method to significantly suppress probe-induced shifts in any types of atomic clocks using the Ramsey spectroscopy. The frequency shifts can be suppressed considerably below a fractional level of 10^{-18} practically for any optical atomic clocks.

Ultracold atoms

B22 **I.L. Glukhov, E.A. Nikitina, V.D. Ovsiannikov**

Shifts and broadening of Rydberg states in ions of the group IIb elements. The rates of blackbody-radiation-induced transitions from excited nS-, nP-, nD- and nF-states into bound states and into continuum of the group IIb ions Zn^+, Cd^+ and Hg^+ at temperatures up to 3000 K are calculated and analytical approximations are proposed for evaluating numerically the temperature dependence of Rydberg-level widths and shifts.

B23 **R.Y. Ilenkov, O.N. Prudnikov, A.V. Taichenachev, V.I. Yudin**

Laser cooling of atoms on weak optical transitions. For investigation of two-level atoms laser cooling was developed an quantum calculation method with taking into full account recoil effects and localization of atoms. The study of quantum regimes showed the presence of complex two-structural momentum distributions are not described by the quasi-classical approach based on the Fokker-Planck equation.

B24 **O.I. Berdasov, S.A. Strelkin, A.Yu. Gribov, A.A. Galyshev , K.Yu. Khabarova, N.N. Kolachevsky, S.N. Slyusarev**

Laser cooling and trapping of strontium atoms. Deep laser cooling of strontium atoms allows to decrease Doppler effect, to localize atoms and to increase interaction time between clock laser and atoms, which is important for precision spectroscopy. We present our work on cooling and trapping strontium atoms to the optical lattice within high performance optical atomic clocks creation.

B25 **I. Semerikov, I. Zalivako, A. Borisenko, T. Shpakovky, V. Sorokin, K. Khabarova, N. Kolachevskiy**

Many-particle losses in a linear Paul trap. Lifetime of hot ion cloud in a linear Paul trap is measured to be 1.7 s. Numerical simulation of the ion dynamic in the trap was performed. It was shown that for number of ions from 10 to 15 the main loss mechanism is similar to evaporation.

Nonlinear optics

B26 **Dandan Ju, S.J. Liu, W.J. Cui, F.F. Song, Feng Song**

Influence of energy transfer upconversion on high power Nd:YAG laser by calculating the population distributions. A theoretical model of the influence of ETU effects based on population dynamics on higher energy level in laser diode end-pump Nd:YAG crystal laser to study has been developed. We get the analytic solution and the relationship between the thermal power due to ETU and the incident power taking into account the higher energy levels

B27 **D. Genin, E. Lipatov, D. Grigor'ev**

Impulse photoconductivity of diamond at low temperature. In our work we investigated the photoconductivity of diamonds in the temperature range 90-300 K. Non-equilibrium charge carriers were generated by irradiation of the samples by KrCl*- or KrF*-laser. The photoconductivity increased 2-2.5 times at low temperatures, in the same conditions the electron-hole liquid was observed in our samples.

B28 **A.M. Vyunishev, V.G. Arkhipkin**

Non-collinear second harmonic generation in two-dimensional nonlinear optical superlattices. Non-collinear second harmonic generation under nonlinear Raman-Nath diffraction is studied theoretically and experimentally. Different kinds of two-dimensional nonlinear optical superlattices are considered. Analytical expressions and numerical results are obtained for the process under study and compared with experimental data.

B29 **A.N. Panchenko, N.A. Panchenko, D.A. Sorokin, M.I. Lomaev**

Efficient lasing in the IR, UV and VUV in run-away electron preionized discharges. Run-away electron preionized discharge (REP DD) was applied for excitation of gas lasers. Ultimate efficiency of non-chain HF(DF) and N_2 lasers was achieved. New operation modes of N_2 laser were found. F_2, ArF, KrF, XeF laser were developed which parameters are comparable with those obtained in convenient transverse discharge.

B30 **B. Nyushkov, S. Trashkeev, P. Purtov, D. Kolker, A. Ivanenko**

Light guiding in a fiber-coupled liquid crystal. Light guiding in a fiber-coupled nematic liquid crystal (NLC) was explored. Self-confinement of a propagating laser beam results from light-induced reorientation of NLC molecules. Strong optical coupling (loss ~1 dB) of single-mode fibers separated by NLC was achieved despite large fiber spacing. This suggests novel NLC-based fiber-optic elements.

B31 **M. Arsenteva, V. Dresvyansky, S. Zilov, A. Rakevich, O. Buhtsooge, E. Martynovich**

Laser fluorescent polarization defects microscopy in optical materials. The proposed microscopy technique is based on the derivation of information from the degree of polarization of the light radiation, depending on the mutual orientations of the excitation light wave electrical vector, of the crystal axes, and of the observation direction. A mathematical technique that allows analyzing quantum transitions.

B32 **V.G. Arkhipkin, S.A. Myslivets, P.S. Pankin**

Control of light-pulse propagation in electromagnetically induced grating using additional driving field. Theoretically studied propagation of a weak light pulse in electromagnetically induced grating (EIG) in the presence of an additional control field in four-level atoms of N-type. It is shown that one can effectively control the reflection (transmission) of EIG. All-optical switching of the reflected and transmitted pulse is demonstrated.

B33 **A.V. Kuznetsov, N.L. Lazareva, E.F. Martynovich**

The software package for simulating the characteristics of photoluminescence anisotropic crystals. Based on semi-classical theory of the vector interaction of laser radiation with matter it has developed a software package for modeling of spatial, angular and modulation characteristics of photoluminescence of anisotropic crystals. The package is designed for the analysis of fluorescent phenomena, as well as the development of new applications.

B34 **A.E. Simanchuk, S.N. Atutov, S. L. Mikerin, A.I. Plekhanov, V.A. Sorokin, A.V. Yakimansky, N.A. Valisheva**

Nonlinear optical properties of poled chromophore-doped polyimides and electro-optical devices based on them. We present the results of experimental investigation of nonlinear optical response and EO properties of the original chromophore-containing polyimides. We have also experimentally demonstrated the electro-optic modulation properties of the phase modulator based on the studied materials.

B35 **S.M. Vatnik, I.A. Vedin, P.F. Kurbatov, A.A. Pavlyuk**

CW laser performance of diode pumped 5%Tm:KLu(WO$_4$)$_2$ crystals. We report on a high-efficiency room-temperature thin-disk lasers based on the monoclinic 5%Tm:KLuW crystal, epitaxial layer and composite structure 5%Tm:KLuW/KLuW. The output spectra and oscillation performances of various types of thin-disk active elements are comparatively studied.

B36 **D. Kolker, N. Kostyukova, A. Boyko, A. Pronyushkina, B. Nyushkov, S. Trashkeev, V. Shur**

Wide aperture PPLN structures for cascade MID-IR OPO intravavity pumping. We are reporting about investigation of 3 mm aperture periodically polled lithium niobate (PPLN) structures for intracavity MID-IR pumping. Exclusive PPNL structures at multigrating, fan-out and multi fan-out configuration were prepared at "Labfer LTD". The cascade MID-IR OPO was demonstrated recently by our group with MBI collaboration.

B37 **S.A. Kuznetsov, V.S. Pivtsov**

Highly efficient tapered diode-pumped Yb:KYW laser. Record high differential efficiency (53.2%) and full optical efficiency (48%) for a multimode diode-pumped Yb:KYW laser have been achieved. Preliminary results of investigations with a distributed Bragg reflector tapered diode laser pumping have been obtained. The characteristics of the laser and methods for improving its efficiency are discussed.

B38 **A.E. Kokh, N.G. Kononova, A.B. Kuznetsov, K.A. Kokh, A. Maillard, R. Maillard, E. Pestryakov**

A new nonlinear optical crystal $Nd_kY_lLa_mSc_n(BO_3)_4$ (k+l+m+n=4). The new noncentrosymmetric NdkYlLamScn$(BO_3)_4$ (NYLSB) crystal with huntite like structure were grown by TSSG method using LiBO2–LiF-solvent. Linear and nonlinear optical parameters of crystal material and spectroscopic properties of Nd-ion in NYLSB were investigated and compared with one in Nd:YAl3$(BO_3)_4$ crystal.

B39 **M. Merzliakov, V. Kouhar, G. Malashkevich, E. Pestryakov**

Characterization of Er^{3+}/Yb^{3+}- and Yb^{3+}- doped tungsten tellurite glasses. Gain properties of the active media were derived from absorption and emission spectra. Measured decay time and suggested kinetic model of level populations allow us to estimate pump threshold. The Yb- and Er/Yb-doped W-Te-glasses appear to be highly promising materials for fiber and integrated optical amplifiers and lasers as well as bulk devices.

Quantum optics and information

B40 **V. Kurochkin, A. Miller, A. Sokolov, A. Kanapin, Y. Kurochkin**

Quantum key distribution between two buildings in Moscow via telecom fiber. In this work we present first in Russia demonstration of city based quantum key distribution in telecom optical fiber. The optical fiber length is 30,6 km. Sifted key generation rate is 1.8 kbit/s and QBER is 4.5-5.5 %. We take into account the neighbor fiber lines effect on the QBER and methods of increase of the signal/noise ratio.

B41 **V.A. Tomilin, L.V. Il'ichov**

Elementary spectroscopic effects in a cat-state field. We present a theoretical study of the simple radiating systems (2- and 3-level atoms) interacting with cat-state light fields, i.e. fields that are quantum superpositions of two Glauber coherent states. Resonance fluorescence and probe-pump schemes are investigated, and remarkable difference from the well-known spectroscopic results is reported.

B42 **I.I. Beterov, M. Saffman, E.A. Yakshina, D.B. Tretyakov, V.M. Entin, S. Bergamini, E.A. Kuznetsova, I.I. Ryabtsev**

Förster resonances in rubidium and cesium atoms for Rydberg blockade, entanglement and quantum gates. We study Forster resonances in rubidium and cesium for implementation of two-qubit quantum gates with ultracold neutral atoms. We have calculated interspecies Rydberg-Rydberg interaction strengths for entanglement generation. We have developed the schemes of two-qubit quantum gates based on adiabatic passage of the Stark-tuned Forster resonances.

B43 **D.B. Tretyakov, A.S. Pleshkov, A.V. Kolyako, I.I. Ryabtsev, I.G. Neizvestny**

Countermeasure to a time-shift attack in fiber-optic quantum key distribution systems. We have proposed and experimentally demonstrated a countermeasure to the time-shift attack. This attack exploits the detection-efficiency mismatch in the time domain between two single-photon detectors of a quantum key distribution system. The experiments were carried out with an autocompensated two-way fiber-optic experimental setup.

B44 **G.N. Nikolaev**

Paradox of photons discontinuous trajectories being located by means of "weak measurements" in the nested Max-Zehnder interferometer. Intriguing behavior of photons in an interferometer is registrated [Phys. Rev. Lett. 111, 240402 (2013)]. Authors concluded that `The photons do not always follow continuous trajectories'. We show that the results can be clearly explained by means of ordinary electrodynamics. So, there is no need for `discontinuous trajectories' of photons.

Ultrahigh laser fields and attosience

B45 **V.A. Antonov, T.R. Akhmedzhanov, Y.V. Radeonychev, A. Morozov, A. Goltsov, M.O. Scully, S. Suckewer, O.A. Kocharovskaya**

Attosecond x-ray plasma laser via modulation of active medium by IR laser field. Modern x-ray plasma lasers produce relatively high energy pulses (several mJ) in the 4-100 nm wavelength range but with rather long sub-picosecond duration. We show the possibility to generate dramatically shorter pulses up to hundreds of attoseconds via modulation of an upper lasing state by a moderately strong external IR field.

B46 **A.S. Emelina, M.Yu. Emelin, R.A. Ganeev, M. Suzuki, H. Kuroda, V.V. Strelkov**

High harmonic generation in gases with two-color crossed laser fields: theory and experiment. We have shown both experimentally and theoretically that the yield of harmonics can be significantly increased in case of two-color laser pump with crossed polarizations of the components. Our theoretical studies clarify the origin of this enhancement and explain strong dependence of the yield on the gas species.

B47 **A.S. Emelina, M.Yu. Emelin, M.Yu. Ryabikin**

Effect of magnetic field of mid-IR laser pulse on the spectral shape of high harmonics produced in gases. It is shown that the magnetic field of mid-IR laser pulse affects not only the amplitude, but also the shape of the spectrum of generated harmonics. It is also demonstrated that the electron magnetic drift does not play a negative role only; in some cases it has a positive effect, enabling one, for example, to produce subattosecond keV waveforms.

B48 **S.A. Frolov, V.I. Trunov, E. V. Pestryakov**

Extremely broadband femtosecond laser source based on parametric amplification in the mid-infrared. Nonlinear optical schemes for generation of high-power femtosecond pulses in the mid-IR range using multiterawatt laser system developed in the ILP SB RAS are presented and discussed. It is shown that in our facility cascaded parametric amplification of idler wave enables generation of a set of wideband femtosecond pulses in the range of 1-12 μm.