P R O G R A M

MPLP-2021

The IX International Symposium

“MODERN PROBLEMS OF LASER PHYSICS”

and International School on Laser Physics and Photonics for Young Scientists

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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, Russia

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INTERNATIONAL ADVISORY COMMITTEE

Online invited and oral talks

For online sessions we will open uninterrupted Zoom sessions each day of the Symposium. We hope Zoom format will be kept as closely as possible to the in-person offline format. The duration of each talk will be limited to 30 minutes for invited talks and 15 minutes for conventional oral talks, including subsequent discussions.

Zoom format will use Novosibirsk time, Russia (GMT+7) as a baseline time for MPLP-2021 symposium. We will try to schedule the speakers' talks to accommodate with their local time for everyone's convenience. Additionally we will record invited and oral talks and provide access to video files for up to 6 months after the symposium with an option to delete the files earlier upon the author's request.

If you feel it will be more comfortable for you to record your talk in advance and send us the video, you are welcome to do that (ZOOM platform may be used to make this video). Contact our technical committee for more details if you need any help. In case you prefer to use a video file instead of direct ZOOM talk, at the end of your video presentation you will also be able to answer the questions via ZOOM session.

Poster session

Two poster sessions in ZOOM will be arranged during the symposium.

The poster session web page will contain information on the poster session talks, including authors information, the title of the talk, its short abstract, and the link to the file with the poster presentation for the participants to have an opportunity to get briefly familiarized with the talk, and ZOOM link to communicate with the speaker. All materials received and posted on the site will be available for up to 6 months after the symposium and can be deleted earlier upon the author's request.

Zoom sessions will be opened for each poster talk during the poster session. Using the Zoom link from the poster session web page next to the title of the report, the speaker can start a Zoom session and share his or her desktop with an open presentation for the discussion with symposium participants.

Poster reports should be prepared in "pdf" format and sent to the secretary of the symposium mplp2021@gmail.com with subject "POSTER", or via the form on the conference website http://mplp2021.laser.nsc.ru.

Symposium Program

Sunday, August 22

Novosibirsk time (*GMT+7*)

$17^{\underline{00}}$ – $17^{\underline{30}}$ ***Opening Speeches***

Session 1 *New trends*

$17^{\underline{30}}$ – $18^{\underline{00}}$ **H. Katori[1–3], I. Ushijima[1–3], M. Takamoto[2,3],** *[1]Department of Applied Physics, Graduate School of Engineering, The University of Tokyo, Bunkyo-ku, Tokyo, Japan; [2]Quantum Metrology Laboratory, RIKEN, Wako, Saitama, Japan; [3]Space-Time Engineering Research Team, RIKEN, Wako, Saitama, Japan*

Transportable optical lattice clocks to test and use gravitational redshift. We have developed a pair of transportable optical lattice clocks and conducted an 18-digit-precision frequency comparison in a broadcasting tower, TOKYO SKYTREE, to test the gravitational redshift at $(1.4\pm9.1)\times10^{-5}$. We also present a novel spectroscopic scheme that allows continuous interrogation of lattice-trapped atoms.

$18^{\underline{00}}$ – $18^{\underline{30}}$ **D. Budker,** *Helmholtz Institute, Johannes Gutenberg University, Mainz, Germany*

Physics opportunities with the Gamma Factory at CERN. The Gamma Factory (GF) is an ambitious CERN proposal for a source of photons with energies up to about 400 MeV and photon fluxes up to 10^{17} photons per second, exceeding those of the currently available gamma sources by orders of magnitude. It will open new horizons in atomic and nuclear physics and beyond.

$18^{\underline{30}}$ – $19^{\underline{00}}$ **A.V. Mitrofanov[1,2,5,6], D.A. Sidorov-Biryukov[1,2,4,5], A.A. Voronin[1,2,4], M.V. Rozhko[1,2], M.M. Nazarov[5], N.V. Erukhimova[2,7], P.B. Glek[1,2], E.E. Serebryannikov[1,2], E.F. Astashkin[1], A.B. Fedotov[1,2,4], V.Ya. Panchenko[1,5,6], A.M. Zheltikov[1–4],** *[1]Physics Department, M. V. Lomonosov Moscow State University, Moscow, Russia; [2]Russian Quantum Center, Skolkovo, Moscow Region, Russia; [3]Department of Physics and Astronomy, Texas A&M University, College Station TX, USA; [4]Kazan Quantum Center, A. N. Tupolev Kazan National Research Technical University, Kazan, Russia; [5]Kurchatov Institute National Research Center, Russia; [6]Inst. Laser and Information Technol. – Branch of FSRC "Crystallography and Photonics," Russian Acad. Sci., Shatura, Russia; [7]Moscow Physicotechnical Institute, Moscow, Russia*

Cross-range nonlinear optics with ultrashort pulses in the mid-infrared. Combined optical nonlinearity of bound and free electrons in a fast-ionizing medium driven by ultrashort, high-peak-power mid-infrared pulses gives rise to a vast variety of ultrafast nonlinear-optical scenarios, producing bright and remarkably broadband radiation whose spectrum spans over multiple frequency ranges.

$19^{\underline{00}}$ – $19^{\underline{30}}$ **G. Leuchs, E.A. Anashkina, A.V. Andrianov, T. Dirmeier, L.L. Sánchez-Soto, U. Seyfarth,** *Max Planck Institute for the Science of Light, Erlangen-Nuremberg, Germany*

Interfering the bright and the dark – a new route to implementing Kerr squeezing. We investigate new optical Kerr materials and present a method to facilitate its implementation for interferometric sensing.

$19^{\underline{30}}$ – $20^{\underline{00}}$ **Break**

Session 2 *Atomic Clocks I*

$20^{\underline{00}}$ – $20^{\underline{30}}$ **E. Peik, N. Huntemann, R. Lange, J. M. Rahm, C. Sanner, H. Shao, B. Lipphardt, Chr. Tamm, S. Weyers,** *Physikalisch-Technische Bundesanstalt, Braunschweig, Germany*

Improved limits for violations of local position invariance from atomic clocks. We report experiments with Yb^+ optical clocks and our projects towards a Thorium nuclear clock for searches for violations of Einstein's equivalence principle, like temporal variations of fundamental constants.

$20^{\underline{30}} - 21^{\underline{00}}$ **C. Carlé[1], A. Gusching[1], N. Passilly[1], I. Ryger[1], J. Millo[1], M. Petersen[1], D. Brazhnikov[2,3], M. Abdel Hafiz[1], R. Boudot[1],** *[1]FEMTO-ST, CNRS, UBFC, ENSMM, Besançon cedex, France; [2]Novosibirsk State University, Novosibirsk, Russia; [3]Institute of Laser Physics SB RAS, Novosibirsk, Russia*

Cs microcell microwave and optical frequency references at FEMTO-ST. We'll present a resume on the development of Cs microcell-based frequency references at FEMTO-ST, including microwave clocks based on coherent population trapping and optical frequency references using dual-frequency sub-Doppler spectroscopy.

$21^{\underline{00}} - 21^{\underline{30}}$ **N. Huntemann,** *Physikalisch-Technische Bundesanstalt, Bundesallee, Germany*

Optical clocks with trapped Yb^+ ions. The talk summarizes work on optical atomic clocks at PTB based on single trapped Yb^+ ions that provide two optical reference transitions. Clocks based on these transitions have been employed to improve the best limits for a violation of local Lorentz symmetry for electrons and in stringent tests of local position invariance.

$21^{\underline{30}} - 22^{\underline{00}}$ **J. Kitching,** *Time and Frequency Division, NIST, Boulder, USA*

Compact two-photon optical clock. We describe the design and performance of a compact two-photon optical clock based on a microfabricated Rb vapor cell. The optical reference achieves a short term stability below 1e-13 at one second and below 3e-14 at 100 seconds. We also describe methods to reduce the AC stark shift, which limits the clock performance at long integration times.

Monday, August 23

Novosibirsk time (*GMT+7*)

Session 3 *Atomic Clocks II*

$12^{00} – 12^{30}$ **S. Kang[1], P. Wang[1], D. Li[1,2], M. Qu[1,2], K. Liu[1,2], C. Li[1,2], W. Zhu[1,2], W. Guo[3], J. Liu[3],** *[1]Innovation Academy for Precision Measurement Science and Technology, Wuhan, China; [2]University of Chinese Academy of Sciences, Beijing, China; [3]Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology, Wuhan, China*

In-progress report of miniaturized vapor-cell Rubidium optical clock at APM. We will present our recent in-progress work on vapor-cell Rb optical clock which is considered as a potential solution for the next-generation high-performance compact atomic clocks. Our final goal is to develop a compact atomic clock that can perform like the Cesium beam clocks or even H mazers but with a size similar to Rb oscillators.

$12^{30} – 13^{00}$ **S.V. Chepurov, N.A. Pavlov, A.A. Lugovoy, S.N. Bagayev, A.V. Taichenachev,** *Institute of Laser Physics SB RAS, Novosibirsk, Russia*

Development of an optical frequency standard with a single $^{171}Yb^{+}$ ion. We report on the development of an optical frequency standard based on a single ytterbium-171 ion. The probe laser frequency is simultaneously stabilized to the transmission peak of a reference cavity and the central resonance of the quadrupole transition with a linewidth of 30 Hz. First data on the frequency stability of the standard are presented.

$13^{00} – 13^{30}$ **H. Guan, Y. Huang, K. Gao,** *Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences (formerly Wuhan Institute of Physics and Mathematics, Chinese Academy of Sciences), Wuhan, China*

Recent progress on the $^{40}Ca^{+}$ ion optical clocks. Here the recent progress on the Ca^{+} optical clocks are reported. Both the stability and the systematic uncertaitny are improved to the E-18 level. A transportable Ca^{+} clock with uncertainty of 1.3E-17 and an uptime of >75% is also built, the absolute frequency of the clock transition is then measured with uncertaity of E-16 level with this clock.

$13^{30} – 14^{00}$ **V.I. Yudin[1–3], A.V. Taichenachev[1,2], M.Yu. Basalaev[1–3], 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*

Methods for suppressing the light shift in atomic clocks based on continuous-wave spectroscopy. We develop the methods for suppressing the light shift and its fluctuations in atomic clocks based on continuous-wave spectroscopy using variation of the interrogation field intensity. By measuring the clock output at two intensity levels, error signals can be generated that stabilize a local oscillator to an unperturbed reference transition compensating the frequency shift of this transition..

$14^{00} – 14^{15}$ **S.I. Donchenko, V.N. Fedotov, I.B. Noretz, V.G. Palchikov,** *National Research Institute for Physical-Technical and Radiotechnical Measurements (VNIIFTRI), Mendeleevo, 141570, Russia*

Current state and development of the State primary standard of unit of time, frequency and national time scale.

$14^{15} – 15^{00}$ **Break**

Session 4 *Quantum sensors I*

$15^{00} – 15^{30}$ **A. Shinjo, M. Baba, K. Higashiyama, R. Saito, T. Mukaiyama,** *[1]Graduate School of Engineering Science, Osaka University, Osaka, Japan; [2]Center for Quantum Information and Quantum Biology, Osaka University, Osaka, Japan*

Three-dimensional matter-wave interferometry of a trapped single ion. In this talk, we present our experimental demonstration of matter-wave interferometry of a trapped ion in a three-dimensional motion, initiated by a momentum kick in a direction diagonal to any of the trap symmetry axes. Our result makes an important step for the realization of rotation sensing using a trapped ion.

15^{30} – 16^{00} **L. Zhou[1], X. Chen[1], D. Gao[1], B. Tang[1], Z. Xiong[1], Y. Zhang[2], M. Liu[1], W.-T. Ni[1], J. Wang[1], M. Zhan[1],** *[1]State Key Laboratory of Magnetic Resonance and Atomic and Molecular Physics, Wuhan Institute of Physics and Mathematics, Innovation Academy for Precision Measurement Science and Technology, Chinese Academy of Sciences, Wuhan, China; [2]Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing, China*

United test of the equivalence principle using mass and internal energy specified atoms. We use both mass and internal energy specified rubidium atoms to jointly test the equivalence principle (EP) at 10^{-10} level with dual-species atom interferometer.

16^{00} – 16^{30} **E. Rasel,** *Institute of Quantum Optics, Hannover, Germany*

Twin-lattice interferometry. Bose-Einstein condensates make possible new concepts in atom interferometry. In this talk we present a new method based on twin-lattices allowing for interferometers featuring large-areas as well as for differential BEC interferometry and discuss anticipated performances and applications such as Sagnac interferometry.

16^{30} – 17^{00} **T. Zanon-Willette[1–3], D. Wilkowski[2–4], A.V. Taichevachev[5,6], V.I. Yudin[5–7],** *[1]Sorbonne Université, Observatoire de Paris, Université PSL, CNRS, LERMA, F-75005, Paris, France; [2]Majulab, CNRS-UCA-SU-NUS-NTU International Joint Research Unit, Singapore; [3]Centre for Quantum Technologies, National University of Singapore, Singapore, Singapore; [4]School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore, Singapore; [5]Novosibirsk State University, Novosibirsk, Russia; [6]Institute of Laser Physics, Siberian Branch, Russian Academy of Sciences, Novosibirsk, Russia; [7]Novosibirsk State Technical University, Novosibirsk, Russia*

Hyper Ramsey-Bordé matter-wave interferometry. A new generation of atomic sensors using ultra-narrow optical clock transitions are pushing quantum engineering control to a very high level of precision for applied and fundamental physics. We present a new version of Ramsey-Bordé interferometry introducing composite laser pulses to protect matter-wave interferences against phase-shift distortion.

17^{00} – 18^{00} **Break**

Session 5 *Extreme Light Fields and Nonlinear Optics*

18^{00} – 18^{30} **C.H. Nam[1,2], M. Mirzaie[1], C.I. Hojbota[1], D.Y. Kim[1], V.B. Pathak[1], C.M. Kim[1,3], J.W. Yoon[1,3], J.H. Sung[1,3], S.K. Lee[1,3], K.Y. Kim[1,2],** *[1]Center for Relativistic Laser Science, Institute for Basic Science, Korea; [2]Dept. of Physics and Photon Science, GIST, Korea; [3]Advanced Photonics Research Institute, GIST, Korea*

Ultrahigh intensity PW laser for strong field physics research. At CoReLS we have developed a 20 fs, 4 PW Ti:Sapphire laser and operated it for the investigations of strong field physics for the last five years. Recently we achieved the record-breaking laser intensity exceeding 10^{23} W/cm^2. Here the multi-PW laser system and strong field physics research at CoReLS will be presented.

18^{30} – 19^{00} **N.N. Rosanov[1], M.V. Arkhipov[2], R.M. Arkhipov[2],** *[1]Ioffe Institute, St. Petersburg, Russia; [2]St. Petersburg State University, St. Petersburg, Russia*

From few-cycle to subcycle and unipolar radiation pulses. Using the properties of the electric area - the time integral of the electric field strength - the analysis of the main properties of few-cycle and unipolar light pulses is carried out. We demonstrate the high efficiency of their impact on micro-objects and resonant media and discuss methods of generation and possible applications of such pulses.

$19^{\underline{00}} – 19^{\underline{30}}$ **G.A. Becker[1], S. Tietze[1,2], M.B. Schwab[1], R. Lötzsch[1], S. Keppler[2], M. Hornung[2], M. Hellwing[1], A. Kessler[2], F. Schorcht[2], J. Reislöhner[1], L. Bock[8], S. Kuschel[9], H. Liebetrau[1], J. Polz[1], A. Seidel[2], J.H. Bin[10], P. Hilz[2], W. Ma[11], F.-E. Brack[3,4], S. Kraft[3], M. Rehwald[3,4], H.-P. Schlenvoigt[3], K. Zeil[3], J. Hein[1], S. Rykovanov[7], S. Sävert[2], J. Schreiber[5,6], M. Zepf[2], U. Schramm[3,4], M.C. Kaluza[1,2],** *[1]Institut für Optik und Quantenelektronik, Friedrich-Schiller-Universität Jena, Jena, Germany; [2]Helmholtz-Institut Jena, Jena, Germany; [3]Helmholtz-Zentrum Dresden Rossendorf (HZDR), Dresden, Germany; [4]Technische Universität Dresden, Dresden, Germany; [5]Fakultät für Physik, Ludwig-Maximilians-Universität München, Garching, Germany; [6]Max-Planck-Institut für Quantenoptik, Garching, Germany; [7]High Performance Computing and Big Data Laboratory, Skolkovo Institute of Science and Technology, Moscow, Russia; [8]Max-Planck-Institut für Plasmaphysik, Garching, Germany; [9]Institut für Experimentalphysik, Universität Hamburg, Hamburg, Germany; [10]State Key Laboratory of High Field Laser Physics and CAS Center for Excellence in Ultra-intense Laser Science, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai, China; [11]State Key Laboratory of Nuclear Physics and Technology, and Key Laboratory of HEDP of the Ministry of Education, CAPT, Peking University, Beijing, China*

Laser-driven proton acceleration with water droplets and thin foils. In an experiment using water microdroplets as the target, the influence of the angle of incidence and an additional pre-pulse on the proton acceleration process and the plasma expansion was investigated. In another experiment with thin plastic foils, the occurrence of a ring-like pattern in the proton beam profile was characterized and explained.

$19^{\underline{30}} – 20^{\underline{00}}$ **V.I. Trunov, S.N. Bagayev, S.A. Frolov, D.O. Shvydkoy,** *Institute of Laser Physics SB RAS (ILP SB RAS), Novosibirsk, Russia*

Limitations of coherent pulse combining implementation with peak power up to multi-petawatt level. Comparative analysis of methods for achieving ultrahigh intensities by coherent combining of pulses with peak power up to multipetawatt are done. Various focusing schemes, influence of spatio-temporal coupling on peak intensity in focus, requirements for added pulses and features of low-cycle pulses formation for coherent combining are considered.

$20^{\underline{00}} – 20^{\underline{30}}$ **S. Wabnitz, F. Mangini, M. Ferraro, M. Zitelli,** *Sapienza University of Rome, Rome, Italy*

Multidimensional laser beam shaping with multimode optical fibers. We demonstrate the spatial, temporal and spectral shaping of femtosecond pulse laser beams by using multimode optical fibers. Examples include the condensation of Raman solitons and the generation of rainbow spiral beams carrying orbital angular momentum.

Tuesday, August 24

Novosibirsk time (*GMT+7*)

Session 6 *Quantum sensors II*

$12^{00} – 12^{30}$ **N. Matsumoto, S.B. Cataño-Lopez,** *Dept. Physics, Gakshuin University, Tokyo, Japan*

High Q mg-scale monolithic pendulum for quantum-limited sensing. I will talk about a high-Q mechanical oscillator. Combining this with optical spring, it is possible to realize displacement measurement with the spatial resolution of the zero point fluctuation. It can be also useful as a probe for external forces, e.g., caused by ultralight dark matter, relativistic gravity, and Newtonian gravity.

$12^{30} – 13^{00}$ **D.V. Brazhnikov[1,2], V.I. Vishnyakov[1], I.S. Mesenzova[1], S.M. Ignatovich[1], C. Andreeva[3,4], A.N. Goncharov[1,2,5],** *[1]Institute of Laser Physics SB RAS, Novosibirsk, Russia; [2]Novosibirsk State University, Novosibirsk, Russia; [3]Institute of Electronics BAS, Sofia, Bulgaria; [4]Faculty of Physics, Sofia University "St. Kliment Ohridski", Sofia, Bulgaria; [5]Novosibirsk State Technical University, Novosibirsk, Russia*

High-contrast zero-field level-crossing resonances in cesium vapors for atomic magnetometry applications. We report on a novel scheme for observing level-crossing resonances in a small Cs vapor cell. It uses two counterpropagating light waves with opposite circular polarizations, while a transverse magnetic field is scanned. The resonances can achieve an extremely high contrast-to-width ratio that is relevant for atomic magnetometry applications.

$13^{00} – 13^{30}$ **M. Petrenko, A. Pazgalev, A. Vershovskii,** *Ioffe Institute, St. Petersburg, Russia*

Optically pumped magnetic field sensors for magnetoencephalography and ultra-low field tomography. In this talk, we report on our efforts to create quantum optically pumped nonzero magnetic field sensors, characterized by a speed, sensitivity, dynamic range and compactness sufficient for both magnetoencephalography and ultra-low field tomography. Particular attention is paid to all-optical sensors that do not use radio frequency fields.

$13^{30} – 14^{00}$ **A.N. Goncharov[1–3], A.E. Bonert[1], V.I. Baraulya[1], M.A. Tropnikov[1], O.A. Trunova[1], D.N. Kapusta[1,2], S.A. Kuznetsov[1], O.N. Prudnikov[1,2], D.V. Brazhnikov[1,2], 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*

Cold atom interferometry: towards Mg optical frequency standard and Rb quantum sensors of inertial forces. Ultra-cold atoms and atom interferometry are widely used both in fundamental research and in various applications in metrology, geophysics and navigation. Atom interferometers based on the Ramsey-Bordé scheme and narrow single photon transitions are of great interest for the development of optical frequency standards and quantum sensors of inertial forces. In this talk we present the experimental results on stabilization of laser frequency using atom interference fringes of cold Mg atoms. A long-term frequency stability at the level of 10^{-15} is obtained at an averaging time of 10^3 s. We also report the preliminary results on a development of an atom interferometer based on stimulated Raman transitions of cold Rb atoms.

$14^{00} – 15^{00}$ **Break**

Session 7 *Cold atoms*

$15^{00} – 15^{15}$ **A.A. Kirpichnikova[1], A.V. Taichenachev[1,2], V.I. Yudin[1–3], O.N. Prudnikov[1,2], A. Kulosa[4], D. Vadlejch[4], T.E. Mehlstäubler[4],** *[1]Institute of Laser Physics SB RAS, Novosibirsk, Russia; [2]Novosibirsk State University, Novosibirsk, Russia; [3]Novosibirsk State Technical University, Novosibirsk, Russia; [4]Physikalisch-Technische Bundesanstalt, Braunschweig, Germany*

Fast and deep laser cooling of ^{172}Yb ion in a radiofrequency trap. We perform analysis of various regimes of laser cooling 172Yb ion a radiofrequency trap with use of quadruple optical transition in the presence of quench field. This give us unique opportunity to analyze and compare different regimes of laser cooling. The optimal conditions providing the deep and fast laser cooling were described.

15^{15} – 15^{30} **A.E. Afanasiev[1,2], A.A. Kortel[1,2], A.M. Mashko[1,2], P.N. Melentiev[1,2], V.I. Balykin[1,2],** *[1]Institute of Spectroscopy Russian Academy of Sciences, Moscow, Troitsk, Russia; [2]National Research University Higher School of Economics, Moscow, Russia*

Atom femto trap: experimental realization and its spectroscopic perspectives. We demonstrated optical dipole trapping using the femtosecond laser radiation. The atom's lifetime in such a trap is depended on the heating due to the high peak intencities of pulsed field. Pulse atom-field interaction changes the absorption spectrum of trapped atom. It is possible to trap the atom with a zero optical shift of a spectral line.

15^{30} – 16^{00} **X. He, K. Wang, Z. Jun, C. Sheng, P. Xu, M. Liu, J. Wang, M. Zhan,** *State Key Laboratory of Magnetic Resonance and Atomic and Molecular Physics, Wuhan Institute of Physics and Mathematics, APM, Chinese Academy of Sciences, Wuhan, China*

Coherently forming single molecules in an optical tweezer. Here, we report a novel route to coherently bind two atoms (Rb-87 and Rb-85) into a weakly bound molecule at megahertz levels by coupling atomic spins to their two-body relative motion in a strongly focused laser with inherent polarization gradients. The coherent nature is demonstrated by long-lived atom-molecule Rabi oscillations.

16^{00} – 16^{30} **Y. Guo[1], E.M. Gutierrez[2], D. Rey[1], M. de Goër de Herve[1], A. Kumar[1], T. Badr[1], A. Perrin[1], L. Longchambon[1], V.S. Bagnato[2], R. Dubessy[1], H. Perrin[1],** *[1]Laboratoire de physique des lasers, CNRS and Sorbonne Paris Nord University, Villetaneuse, France; [2]Instituto de Física de São Carlos, Universidade de São Paulo, São Paulo, Brazil*

Physics in a bubble: from supersonic rotation to the effects of dimensional reduction. I will describe recent experiments performed at LPL with a Bose quantum gas confined in a shell trap. Both result in annular gases, either in supersonic rotation along the shell surface, approaching the giant vortex state, or in levitation thanks to gravity compensation, where the ring forms due to the transverse zero-point energy.

16^{30} – 17^{00} **T. Pfau,** *Physikalisches Institut and Center for Integrated Quantum Science and Technology (IQST), Universität Stuttgart, Germany*

A dipolar supersolid and a novel microscope to probe quantum gases. We will discuss the discovery of dipolar supersolids. Upon crossing the transition to the dipolar supersolid a Goldstone mode appears, which we have observed. The existence of this mode proofs the superfluid stiffness or the so-called phase rigidity of this new state of matter.

17^{00} – 17^{30} **Break**

17^{30} – 18^{30} **P O S T E R S E S S I O N A**

Session 8 *Quantum Optics and Quantum Information*

18^{30} – 19^{00} **L.C. Kwek, L. Cao, W. Luo, Y. Wang, S. Sun, X. Wang, A.Q. Liu,** *Centre for Quantum Technologies, National University of Singapore, Singapore, Singapore*

Chip-based quantum cryptography. Quantum key distribution is a matured quantum science and technology. Recently, silicon technology has offered tremendous promise in the field for improved miniaturization of quantum key distribution through integrated photonic chips. In this presentation, we look at some of the recent advances in this area.

19^{00} – 19^{30} **I.I. Ryabtsev[1,2], I.I. Beterov[1,2], E.A. Yakshina[1,2], D.B. Tretyakov[1,2], V.M. Entin[1,2], N.V. Alyanova[2], K.Yu. Mityanin[2], I.N. Ashkarin[1,2], K.-L. Pham[3], S. Lepoutre[3], P. Pillet[3], P. Cheinet[3],** *[1]Rzhanov Institute of Semiconductor Physics SB RAS, Novosibirsk, Russia; [2]Novosibirsk State University, Novosibirsk, Russia; [3]Laboratoire Aime Cotton, CNRS, Univ. Paris-Sud, Universite Paris-Saclay, Orsay, France*

Towards quantum gates with single rubidium Rydberg atoms in an array of optical dipole traps. We present our experimental results on implementing one-qubit quantum gates with microwave transitions for two individually addressed Rb atoms in two optical dipole traps, and our theoretical results on a new scheme of three-qubit Toffoli gate based on electrically-controlled three-body Förster resonance of a new kind in Rb Rydberg atoms.

19^{30} – 20^{00} **E. Arimondo, G. Bevilacqua, T. Zanon-Willette,** *Pisa University, Pisa, Italy*

Double dressing quantum control. The addition of an oscillating field modifying strongly dressed spins enhances and enriches the system quantum dynamics. This tuning-dressed configuration introduces an extra handle for system full engineering and quantum control applications. A theoretical analysis is experimentally validated in a Cs magnetometer.

20^{00} – 20^{30} **M. Saffman[1,2],** *[1]Department of Physics, University of Wisconsin-Madison, Madison, WI, USA; [2]ColdQuanta, Inc. 111 N. Fairchild St., Madison, WI, USA*

Towards hybrid algorithms with circuit model quantum computing on a neutral atom quantum computer.

Wednesday, August 25

Novosibirsk time (*GMT+7*)

Session 9 *Atomic Clocks III*

12^{00} – 12^{15} **D. Sutyrin, A.Yu. Gribov, A.N. Malimon, R.I. Balaev, S.N. Slyusarev,** *FSUE VNIIFTRI, Mendeleevo, Solnechnogorsk district, Moscow region, Russia*

Towards optical time scale at VNIIFTRI. We demonstrate a realization of a time scale based on the optical clock at VNIIFTRI. It is formed by a hydrogen maser steered to a ^{87}Sr optical clock reference. The architecture of the time scale to be incorporated in a Russian national time scale is presented. The concept of using several optical clocks for a local time scale is discussed.

12^{15} – 12^{30} **D. Tregubov[1], A. Golovizin[1], D. Mishin[1], D. Provorchenko[1], K. Khabarova[1,2], V. Sorokin[1], N. Kolachevsky[1,2],** *[1]Lebedev Physical Institute, Moscow, Russia; [2]Russian Quantum Center, Moscow, Russia*

Search for magic wavelength near 1064 nm for thulium optical clock. We report results of an initial search for magic wavelength (MW) for 1.14μm clock transition in Tm near 1064nm. Based on measurements at 1063.9nm and 1070nm, we inferred the MW to be 1063.59(5) nm. Together with a low total clock systematic shift, Tm-based system appears to be a robust platform for a high-performance transportable optical clock.

12^{30} – 13^{00} **S.M. Ignatovich, D.V. Brazhnikov, V.I. Vishnyakov, N.L. Kvashnin, I.S. Mesenzova, M.N. Skvortsov, S.N. Bagayev,** *Institute of Laser Physics SB RAS, Novosibirsk, Russia*

Intensity shifts in CPT Resonances on the ^{87}Rb D1 line with excitation by VCSEL modulated at frequencies 3.4 GHz and 6.8 GHz. Result of investigations of the fundamental shifts in compact CPT clocks. In the experiment was used two different schemes of the excitation spectrum generation with modulation of VCSEL current at 3,4 GHz and 6,8 GHz frequencies. Improvement of the long-term instability to the level 3×10^{-13} per 1000 seconds is presented.

13^{00} – 13^{30} **M. Okhapkin, J. Thielking, J. Zander, G. Zitzer, J. Tiedau, E. Peik,** *Physikalisch-Technische Bundesanstalt, Braunschweig, Germany*

Towards direct laser excitation of the low-energy nuclear transition in ^{229}Th. The direct laser excitation of the ^{229}Th isomer is a complex task due to the current significant uncertainty in the nuclear transition energy, challenges of the laser radiation sources development in the vacuum-ultraviolet range. We are demonstrating a dedicated VUV laser system based on a four-wave mixing process in xenon.

13^{30} – 14^{00} **V. Palchikov,** *National Research Institute for Physical-Technical and Radiotechnical Measurements (VNIIFTRI), Mendeleevo, Russia*

Towards a new definition of the second in the SI based on optical atomic clocks. In this paper we will discuss in details the tentative roadmap for a new definition of the second in the SI, proposed by the Consultative Committee for Time and Frequency (CCTF) of BIPM, as well as the scientific activities of VNIIFTRI on this direction.

14^{00} – 15^{00} **Break**

Session 10 *Nanophotonics*

15^{00} – 15^{30} **N.N. Rubtsova[1], A.A. Kovalyov[1], D.V. Ledovskikh[1], V.V. Preobrazhenskii[1], M.A. Putyato[1], B.R. Semyagin[1], S.A. Kuznetsov[2], V.S. Pivtsov[2],** *[1]Institute of Semiconductor Physics, Siberian Branch of Russian Academy of Science, Novosibirsk, Russian Federation; [2]Institute of Laser Physics, Siberian Branch of Russian Academy of Sciences, Novosibirsk, Russian Federation*

Semiconductor quantum well based shutters for NIR laser mode-locking with ~GHz repetition rate. Fast semiconductor shutters based on coupled wells were designed in the search for reliable, compact and cheap key element of GHz repetition rate NIR lasers passive mode-locking. Stable 0.98 GHz repetition rate 200-fs Yb:KYW laser pulses were demonstrated for SESAM and DSAM shutters. Actual state of the art for the shutters design is considered.

$15^{30} – 16^{00}$ **Yu. Vladimirova[1–3], V. Zadkov[1,3,4],** *[1]Department of Physics, Lomonosov Moscow State University, Moscow, Russia; [2]Quantum Technology Centre, Lomonosov Moscow State University, Moscow, Russia; [3]Faculty of Physics, Higher School of Economics, Moscow, Russia; [4]Institute of Spectroscopy of the Russian Academy of Sciences, Troitsk, Moscow, Russia*

Quantum optics of quantum emitters in nanostructures. We will review effects of quantum optics of quantum emitters in nanostructures. The mechanisms by which the rates of radiative and nonradiative decay are modified are considered in the model of a two-level quantum emitter (QE) near a plasmonic nanoparticle (NP). The distributions of the intensity and polarization of the near-field around.

$16^{00} – 16^{30}$ **Yu. Kivshar[1,2],** *[1]Nonlinear Physics Center, Australian National University, Canberra, Australia; [2]ITMO University, St. Petersburg, Russia*

Metaphotonics and metasurfaces. This talk will introduce the recently emerged new field of dielectric Mie-resonant metamaterials for efficient spatial and temporal control of light by employing multipolar resonances and bound states in the continuum to achieve high values of the Q factor, with applications of these concepts to nanolasers, topological photonics, and sensing.

$16^{30} – 17^{00}$ **O.N. Prudnikov[1,2], M. Kim[3], E. S. Hwang[3], B.-H. Cheong[3],** *[1]Institute of Laser Physics SB RAS, Novosibirsk, Russia; [2]Novosibirsk State University, Novosibirsk, Russia; [3]Department of Applied Physics, Korea University, Sejong, Republic of Korea*

Guided-mode waves structure of electric and magnetic dipole resonances in metamaterials slab. The electric dipole and magnetic dipole resonances in a slab of dielectric nanostructures induced by oblique light incidence were analyzed in terms of guided-mode wave theory. We discover the structure of guided-mode wave associated with these resonances that is of interest for describing optical properties of metasurfaces.

$17^{00} – 17^{30}$ **Break**

Session 11 *Applications I* (*THz*)

$17^{30} – 18^{00}$ **H. Minamide,** *RIKEN Center for Advanced Photonics, RIKEN, Aoba-ku, Sendai, Japan*

Backward optical parametric oscillator to generate tunable terahertz waves. We newly developed advanced optical parametric oscillator which is a backward terahertz-wave parametric oscillator (BW-TPO). It has a hundred-watts peak power and wide tunability in the sub-THz wave region (< ~1 THz), which is applicable to versatile nondestructive THz-wave applications because of the compactness itself.

$18^{00} – 18^{30}$ **M. Tani[1], M. Talara[1], D. Bulgarevich[2], V.K. Mag-usara[1,3], K. Tominaga[1], M.C. Escaño[1], Ch.E. Petoukhoff[4], J. Madéo[4], D.R. Bacon[4], K. Dani[4], G. Torosyan[5], L. Scheuer[6], R. Beigang[6], E.Th. Papaioannou[7], H. Kitahara[1], J. Muldera[1], J. Afalla[1,8], T. Furuya[1], M. Nakajima[3], M. Watanabe[2],** *[1]Research Center for Development of Far-Infrared Region, University of Fukui, Fukui, Japan; [2]Research Center for Structural Materials, National Institute for Materials Science (NIMS), Tsukuba, Japan; [3]Institute of Laser Engineering, Osaka University, Suita, Japan; [4]Femtosecond Spectroscopy Unit, Okinawa Institute of Science and Technology Graduate University, Okinawa, Japan; [5]Photonic Center Kaiserslautern, Kaiserslautern, Germany; [6]University of Kaiserslautern, Kaiserslautern, Germany; [7]Institute of Physics, Martin Luther University of Halle-Wittenberg, Halle, Germany; [8]Graduate School of Pure and Applied Sciences, University of Tsukuba, Tsukuba, Japan*

Terahertz emission from spintronic Fe/Pt bilayers. An investigation on the properties of THz emission from Fe/Pt nano-meter scale spintronic heterostructure with excitation with femtosecond laser pulses is reported. The pump wavelength dependence and the influence of antenna structures are investigated. Magnetic field imaging by using the spintronic THz emission is also reported.

$18^{30} – 19^{00}$ **A. Shkurinov, A. Balakin, P. Solyankin, A. Sinko,** *Lomonosov Moscow State University, Moscow, Russia*

Nonlinear optical phenomena with terahertz pulses. In this paper, we talk about new non-linear optical phenomena involving high-intensity terahertz pulses.

$19^{\underline{00}} – 19^{\underline{30}}$ **O. Cherkasova[1,2],** *[1]Institute of Laser Physics, Siberian Branch, Russian Academy of Sciences, Novosibirsk, Russia; [2]Novosibirsk State Technical University, Novosibirsk, Russia*

The Interaction of THz radiation with molecules and cells. We discuss the problem of adequate estimation of the THz biological effects' specificity and the problem of reproducibility of the results obtained. Finally, we present new experimental data on gene sensors that can be used for THz radiation monitoring.

$19^{\underline{30}} – 20^{\underline{00}}$ **Break**

$20^{\underline{00}} – 21^{\underline{00}}$ **P O S T E R S E S S I O N B**

Thursday, August 26

Novosibirsk time (GMT+7)

Session 12 *Applications II*

$13^{00} – 13^{30}$ **F. Song, Z. Chen,** *Nankai University, Tianjin, China*

Flexible color-tunable composite for broadband response and diverse application. Multicolor flexible materials are in growing interest owing to the prominent fluorescence tunability and flexible adaptability. However, narrow band response and finite color transition limit the diverse application of multicolor flexible materials. Herein, flexible lanthanide ions-doped composite with visible-invisible light response is successful.

$13^{30} – 14^{00}$ **D.B. Kolker[1–3], I.V. Sherstov[1,2], A.A. Boyko[1,2], B.N. Nyushkov[1,3], E. Erushin[1–3], N. Kostyukova[1,2], A. Pavluck[2],** *[1]Novosibirsk State University, Laboratory of Quantum Optical Technologies, Novosibirsk, Russia; [2]Institute of Laser Physics SB RAS, Novosibirsk, Russia; [3]Novosibirsk State Technical University, Novosibirsk, Russia*

Tunable MID-IR laser sources for trace-gas analysis. For remote and local gas analysis, tunable optical parametric oscillators, as well as quantum-cascade lasers, are currently used as laser sources. This paper presents experimental gas analytical systems and prototypes of operating devices based on quantum cascade lasers and optical parametric oscillators.

$14^{00} – 14^{15}$ **N. Kostyukova, E.Y. Erushin, A.A. Boyko, D.B. Kolker,** *Novosibirsk National Research State University, Novosibirsk, Russia*

Near-degenerate narrowband tunable MgO:PPLN OPO generating radiation with wavelength of 2.1 μm. We demonstrate a near-degenerate narrowband tunable optical parametric oscillator (OPO) based on MgO:PPLN crystal with a tuning range from 2050 to 2117 nm for signal wave and 2140-2209 nm for idler wave. The OPO was pumped by a nanosecond Nd:YAG laser at 1064 nm. The conversion efficiency reaches 10%.

$14^{15} – 15^{00}$ **Break**

Session 13 *Laboratory space plasma physics with lasers I*

$15^{00} – 15^{30}$ **I.F. Shaikhislamov[1], Y.P. Zakharov[1], V.G. Posukh[1], V.A. Terekhin[2],** *[1]Institute of Laser Physics SB RAS, Novosibirsk, Russia; [2]Russian Federal Nuclear Center All-Russian Research Institute of Experimental Physics, Sarov, Russia*

Laser experiments to model plasma releases in the Earth magnetosphere: past, present and unsolved problems. The review of extensive laboratory research to model and understand the physics of plasma cloud expansion in magnetic field at conditions characteristic of active experiments in near Earth space conducted in 80-s and 90-s, and continued up to present times. Analysis of outstanding problems and what can be done in near future.

$15^{30} – 16^{00}$ **J. Fuchs[1], W. Yao[1,2], A. Fazzini[1], S.N. Chen[3], K. Burdonov[1,2], P. Antici[4], J. Béard[5], S. Bolaños[1], A. Ciardi[2], R. Diab[1], E.D. Filippov[6,7], S. Kisyov[3], V. Lelasseux[1], M. Miceli[8], Q. Moreno[9,10], V. Nastasa[3], S. Orlando[8], S. Pikuz[6,11], D.C. Popescu[3], G. Revet[1], X. Ribeyre[9], E. d'Humières[9],** *[1]LULI - CNRS, CEA, UPMC Univ Paris 06: Sorbonne Université, Ecole Polytechnique, Institut Polytechnique de Paris - F-91128 Palaiseau cedex, France; [2]Sorbonne Université, Observatoire de Paris, Université PSL, CNRS, LERMA, F-75005, Paris, France*; *[3]ELI-NP, "Horia Hulubei" National Institute for Physics and Nuclear Engineering, RO-077125, Bucharest-Magurele, Romania; [4]INRS-EMT, 1650 boul, Lionel-Boulet, Varennes, QC, J3X 1S2, Canada; [5]LNCMI, UPR 3228, CNRS-UGA-UPS-INSA, Toulouse, France*; *[6]JIHT, Russian Academy of Sciences, Moscow, Russia; [7]IAP, Russian Academy of Sciences, Nizhny Novgorod, Russia*; *[8]INAF–Osservatorio Astronomico di Palermo, Palermo, Italy*; *[9]University of Bordeaux, Centre Lasers Intenses et Applications, CNRS, CEA, UMR 5107, F-33405 Talence, France; [10]ELI-Beamlines, Institute of Physics, Czech Academy of Sciences, Dolni Brezany, Czech Republic; [11]NRNU MEPhI, Moscow, Russia*

Laboratory evidence for proton energization by collisionless shock surfing.

16^{00} – 16^{30} **M. Starodubtsev[1], K. Burdonov[1,2], A. Soloviev[1], R. Zemskov[1], M. Gushchin[1], J. Fuchs[2],** *[1]Institute of Applied Physics, Russian Academy of Sciences, Nizhny Novgorod, Russia; [2]LULI - CNRS, CEA, UPMC Univ Paris 06: Sorbonne Université, Ecole Polytechnique, Institut Polytechnique de Paris, France*

Laboratory modeling of protostellar jet formation in diverging poloidal magnetic field. Topology of high-speed plasma flows interacting with non-uniform poloidal magnetic fields has been studied in laser-plasma laboratory experiments aimed to model protostellar jets. The conditions for the formation of collimated plasma jets has been demonstrated.

16^{30} – 17^{00} **K. Burdonov[1–3], C. Argiroffi[4,5], J. Beard[6], S. Bolanos[1], R. Bonito[4], S.N. Chen[7], A. Ciardi[2], E. Filippov[5,8], T. Giannini[9], M. Gushchin[3], S. Orlando[4], S. Pikuz[8,10], G. Revet[1], M. Romanova[11], A. Soloviev[3], M. Starodubtsev[3], W. Yao[1,2], R. Zemskov[3], J. Fuchs[1],** *[1]LULI - CNRS, CEA, UPMC Univ Paris 06 : Sorbonne Université, Ecole Polytechnique, Institut Polytechnique de Paris - F-91128 Palaiseau cedex, France; [2]Sorbonne Université, Observatoire de Paris, PSL Research University, LERMA, CNRS UMR 8112, F-75005, Paris, France; [3]IAP, Russian Academy of Sciences, Nizhny Novgorod, Russia; [4]INAF - Osservatorio Astronomico di Palermo, Palermo, Italy; [5]Department of Physics and Chemistry, University of Palermo, Palermo, Italy; [6]LNCMI, UPR 3228, CNRS-UGA-UPS-INSA, Toulouse, France; [7]ELI-NP, "Horia Hulubei" National Institute for Physics and Nuclear Engineering, 30 Reactorului Street, RO-077125, Bucharest-Magurele, Romania; [8]Joint Institute for High Temperatures, RAS, Moscow, Russia; [9]INAF - Osservatorio Astronomico di Roma, Monteporzio Catone, Italy; [10]National Research Nuclear University "MEPhI", Moscow, Russia; [11]Department of Astronomy, Cornell University, Ithaca, NY 14853, USA*

Laboratory modelling of matter accretion using laser-driven plasma coupled with a strong magnetic field source. We use high power laser interactions and strong magnetic field generation in the laboratory to study accretion phenomena in young stellar objects. Our recent experimental results include study of the asymmetry induced upon matter accretion with an oblique angle, and a modelling of the RT instability-caused accretion in the equatorial plane.

17^{00} – 17^{10} **Short break**

Session 14 *Laboratory space plasma physics with lasers II*

17^{10} – 17^{40} **D. Bisikalo,** *Institute of Astromony RAS, Moscow, Russia*

Gas dynamics of plasma envelopes of hot exoplanets. An overview is presented of the latest advances in studies of the gasdynamics of plasma envelopes of exoplanets. Special attention is paid to hot Jupiters - gas giants, the mass of which is comparable to the mass of Jupiter, while the semi-major axis of the orbit is less than 0.1 AU.

17^{40} – 18^{10} **A. Divin[1], I. Shaikhislamov[2], M. Rumenskikh[2], I. Zaitsev[1],** *[1]St. Petersburg State University, Physics Department, St. Petersburg, Russia; [2]Institute of Laser Physics, Laser Physics Department, Novosibirsk, Russia*

Three-dimensional Particle-in-Cell (PIC) simulations of minimagnetosphere formation in the KI-1 experiment. The interaction of plasma flow with a strong magnetic produces a plasma cavity, the magnetosphere. A series of laboratory experiments were carried out on the KI-1 facility to investigate minimagnetosphere properties. We compare KI-1 experiment results with the numerical 3D Particle-in-Cell simulations performed by the kinetic code iPIC3D.

18^{10} – 18^{40} **A. Sladkov, S. Bolaños, J. Fuchs, R. Smets,** *Institute of Applied Physics RAS, Russia*

Three-dimensional numerical modeling of magnetic reconnection in laser-induced high energy density plasmas. The work presents the numerical study of the magnetic reconnection (MR) process in laser-induced high energy density plasmas, and provides a comparison with experimental data. We study the process of collision of two strongly magnetized HED plasma flows both containing a MG-level magnetic fields driven by two high-power nanosecond laser beams.

18^{40} – 19^{10} **V. Horny, L. Gremillet, J. Fuchs,** *LULI-CNRS, CEA, UPMC Univ Paris, France*

Investigation of the prospects for achieving nucleosynthesis of heavy elements in the laboratory. Intense, ultra-short neutron pulses can be generated at 1-PW-class laser facilities. We present PIC simulations of proton acceleration, coupled with Monte Carlo calculations of the spallation process in high-Z converters. The path to investigate neutron capture processes under conditions relevant to heavy nucleosynthesis in the Universe is opened.

19^{10} – 19^{20} **Short break**

19^{20} – 19^{40} **F. Fiuza,** *SLAC National Accelerator Laboratory, California, USA*

Electron acceleration in laboratory-produced turbulent collisionless shocks. Collisionless shocks are ubiquitous in space and astrophysical plasmas and are known to be important for magnetic field amplification and particle acceleration. While the theory of diffusive shock acceleration (DSA) is well established, the details of particle injection into DSA remain a long-standing puzzle, particularly for electrons.

19^{40} – 20^{10} **D. Kumar, H. Bohlin, F-E. Brack, M. Cervenak, T. Chodukowski, J. Cikhardt, J. Dostal, R. Dudzak, J. Hubner, W. Huo, S. Jelinek, D. Klír, F. Kroll, M. Krupka, M. Krus, T. Pisarczyk, Z. Rusiniak, U. Schramm, T-H. Nguyen-Bui, S. Weber, A. Zaras-Szydlowska, K. Zeil, T. Schlegel, V. Tikhonchuk,** *Johns Hopkins University*

Radiative characterization of a laser driven shock. Laser driven shock experiments provide important insights into shock structures in astrophysics. Detailed plasma characterization is important for a quantitative comparison and scaling of such experiments to astrophysical scenarios. In this talk, I will focus on novel filtered X-ray imaging which was used to characterize the plasma temperature.

20^{10} – 20^{40} **D.B. Schaeffer[1], W. Fox[1,2], D. Haberberger[3], R.K. Follet[3], G. Fiksel[4], C.K. Li[5], J. Matteucci[1], K. Lezhnin[1], A. Bhattacharjee[1,2], D.H. Barnak[3], S.X. Hu[3], K. Germashewski[6],** *[1]Princeton University, Princeton, New Jersey, USA; [2]Princeton Plasma Physics Laboratory, Princeton, New Jersey, USA; [3]Laboratory for Laser Energetics, University of Rochester, Rochester, New York, USA; [4]University of Michigan, Ann Arbor, Michigan, USA; [5]Massachusetts Institute of Technology, Cambridge, Massachusetts, USA; [6]University of New Hampshire, Durham, New Hampshire, USA*

Laboratory studies of laser-driven, high-Mach-number magnetized collisionless shocks. We present results from experiments and simulations on the formation of collisionless shocks created through the interaction of a supersonic laser-driven magnetic piston and magnetized ambient plasma. A fast, high-Mach-number shock is observed and key steps in the formation of collisionless shocks are measured.

20^{40} – 20^{45} **Closing Remarks**

Friday, August 27

Novosibirsk time (*GMT+7*)

International School on Laser Physics and Photonics	
$13^{\underline{30}}$ – $14^{\underline{00}}$	**Opening Speeches**
$14^{\underline{00}}$ – $15^{\underline{00}}$	**Dmitry Budker** *Helmholtz Institute, Johannes Gutenberg University, Mainz* **Lecture: "In search of ultralight bosonic dark matter"**
$15^{\underline{00}}$ – $16^{\underline{00}}$	**Prof. Masahiko Tani** *Research Center for Development of Far-Infrared Region University of Fukui, Japan* **Lecture: "Nonlinear Optics for THz wave generation and detection"**
$16^{\underline{10}}$ – $17^{\underline{20}}$	**Young Scientists Session 1** **(3x20 min talks)**

Saturday, August 28

Novosibirsk time (*GMT+7*)

$14^{\underline{00}}$ – $15^{\underline{00}}$ **Prof. Alexey Zheltikov,**
Lomonosov Moscow State University, Russia
Lecture "Ultrafast cross-range nonlinear optics"

$15^{\underline{10}}$ – $16^{\underline{10}}$ **Young Scientists Session 2**
(3x20 min talks)

$16^{\underline{20}}$ – $17^{\underline{00}}$ **Young Scientists Session 3**
(2x20 min talks)

Poster Sessions A

(All Topics)

A 1 **K.A. Barantsev, A.S. Kuraptsev, A.N. Litvinov, I.M. Sokolov**

Features of the combined effect of atomic motion and hyperfine splitting of the excited state on the resonance of coherent population trapping in a rarefied gas and in cells with antirelaxation wall-coating. We investigated the combined effect of atomic motion and hyperfine splitting on the shape of the CPT resonance in a rarefied gas. It is shown that in the presence of a hyperfine structure of an excited level and the motion of atoms leads to a light shift of the CPT resonance. An analytical expression for this shift is obtained for individual velocity.

A 2 **G. Voloshin, A. Litvinov, K. Barantsev**

Research of the shape and shifts of the resonances of coherent population trapping, detected by the Ramsey method, in an optically dense medium with a nonzero temperature. In this work, a mathematical model of the interaction of bichromatic pulsed laser radiation with an optically dense medium of four-level atoms with a nonzero temperature is constructed. The results of numerical calculations based on this model were analyzed for the shape and frequency shifts of the resonances of coherent population trapping.

A 3 **E. Baklanov, P. Pokasov, A. Taichenachev**

About calculation of the ground-state energy of the helium atom. Two versions of the numerical calculation of the ground state energy of the helium atom are compared. First, the nonrelativistic Schrödinger equation with a fixed nucleus is solved, and then the perturbation theory is used. Another version solves this problem exactly. Comparison shows that the calculation error by perturbation theory is 94 kHz.

A 4 **A. Semenko, D. Sutyrin, G. Belotelov, S. Slusarev**

Towards to Ytterbium compact optical clock. We present a current states of the transportable Yb optical clock. At this moment the vacuum chamber and optical frequency distribution scheme are built, as well as a more compact vacuum chamber with a conical mirror. We obtained a blue MOT with both chambers. For optical frequency stabilization we use a unique system based on ULE cavities.

A 5 **S.N. Atutov, V.A. Sorokin**

Effects of size and dimension in optic relaxation in Rb vapor. We report on an experiment in which the fluorescence decay time of 5P levels of Rb atoms in a coated vapor cell exceeds several of milliseconds that many orders of magnitude longer than normal decay time of excited of rubidium atoms.

A 6 **I. Mesenzova, S.M. Ignatovich, R. Boudot, D.V. Brazhnikov, M.N. Skvortsov**

Application of directly modulated diode laser and polarimetric technique to observation of sub-Doppler resonances in small Cs vapor cell. A possibility of using 4.6 GHz directly modulated DBR laser to observe sub-Doppler resonances under counterpropagating light beams is studied. To increase a signal-to-noise ratio, the polarimetric technique is proposed for registering the resonance. The results can be implemented in developing a miniaturized optical frequency standard.

A 7 **A.M. Mikhailov, R. Boudot, D.V. Brazhnikov**

Analytical theory of dual-frequency sub-Doppler spectroscopy of alkali-metal atoms. Sub-Doppler resonances in alkali-metal vapors under counterpropagating dual-frequency light beams are studied. The developed theoretical model of the light-atom interaction has allowed us to obtain explicit and compact analytical solutions for the resonance lineshape. The results can be useful for developing a miniature optical frequency standard.

A 8 **N. Pavlov, S. Chepurov, O. Prudnikov**

Ion trap with reduced sensitivity that caused by RF heating. The aim of this work is to design an ion trap with minimal influence of parasitic RF fields. We describe experiments with single ion heating rate in Paul trap to characterize current design of ion trap (with cone endcap electrodes). Simulations of other ion trap design was carried out to show shielding advantage for parasitic RF field suppression.

A 9 **D.S. Chuchelov, S.A. Zibrov, M.I. Vaskovskaya, E.A. Tsygankov, V.V. Vassiliev, V.L. Velichansky**

Magnetic field dependence of Ramsey fringes of coherent population trapping in lin||lin configuration. We study the influence of magnetic field on Ramsey fringes of the coherent population trapping resonance in lin||lin configuration. We observe periodic signal-change accompanied with inversion of the central resonance. The signal oscillation is the result of the interference of the two CPT resonances, whose splitting increases with magnetic field.

A 10 **R.Ya. Ilenkov, A.A. Kirpichnikova, O.N. Prudnikov**

MOT for ^{6}Li atoms formed by waves with elliptical polarization. We consider possibility of sub-Doppler laser cooling of 6Li atoms. Hyperfine splitting of the upper levels is much smaller than their natural width, which does not make it possible to distinguish a closed optical transition and use the results of the known theories of laser cooling. Creation of an adequate theoretical model is important.

A 11 **K. Barantsev, A. Litvinov, A. Pazgalev, A. Vershovskii**

Optical pumping of alkali metal atoms in buffered gas cell for different decay rates of the nuclear spin. In the problem of pumping of atomic spin by circularly polarized light, the models of complete mixing of populations in an excited state are usually used. In our work we analyze the pumping when only electron spin collapses during collisions, but nuclear spin is conserved. We compare it with the situation of complete mixing in an excited state.

A 12 **I. Krasionov, L. Il'ichov**

Noise-based quantum optical gyrometry. A promising design of a quantum optical gyrometer is proposed. The scheme is based on Mach-Zehnder interferometer. The input state of the radiation is a two-mode squeezed vacuum. The main properties are investigated including the possibility of attaining the Heisenberg limit in the accuracy of measuring the angular velocity of the interferometer.

A 13 **N. Emelianov, S. Chizhov, I. Kuznetsov, O. Palashov**

High average and peak power thin-rod laser amplifiers based on broadband Yb-doped materials. Application of broadband Yb-doped materials (Yb:CaF2, Yb:YLF, Yb:YAG/Yb:GGG combination) in the high average and peak power femtosecond laser amplifiers with the thin-rod active element geometry was investigated. Some specific aspects of the thermal lens and amplified spontaneous emission effects in these amplifiers were researched.

A 14 **V.F. Zakharyash, V.M. Klement'ev, E.A. Titov**

Process of forced on the mode locking in a semiconductor laser with an external cavity. Adjust brifly theory of process synchronization modes of semiconducted laser when frequency modulate generator near intermodes. Shown up, that in the process of sinchroninization the modes occure phase locking, from which wave dispertion into among impulses aspire to zero. Adduce results primery experiments by variant regimes.

A 15 **S.M. Vatnik, I.A. Vedin, M.D. Kolker, A.A. Pavlyuk**

High-efficiency mini-slab laser based on Tm-doped double tungstate crystal. We report on highly-efficient room-temperature lasing in 5at.%Tm:KLu(WO4)2 mini-slabs side-pumped by a 35W diode bar. QCW (duty cycle ~14%) output power of 1.47 W at 1908 nm has been demonstrated with optical and slope efficiencies being of 33 and 43%, respectively.

A 16 **A.A. Tyutrin, R. Wang, E.F. Martynovich**

Synthesis of luminescent carbon quantum dots by plasma method. Carbon quantum dots (CQDs) were synthesized by plasma treatment of glucose at atmospheric pressure and room temperature. The spectral-kinetic properties of the synthesized CQDs were studied using a MicroTime 200 confocal scanning luminescence microscope. CQDs have a wide emission spectrum in 400-750 nm range at excitation in the 375 - 530 nm range.

A17 **N.N. Rubtsova, S.A. Kochubei, E.B. Khvorostov, V.A. Reshetov**

Collision anisotropy parameters determined from collision-induced photon echo. Collision anisotropy parameters were extracted from the comparison between experimental data on conventional photon echo kinetics and collision-induced photon echo kinetics. Both photon echoes were generated at the 0-1 transition of 174Yb atoms diluted by buffer gases He, Ne, Ar, Kr, Xe. Anisotropy parameters are increasing with the buffer mass.

A18 **A. Kuraptsev**

Light propagation in a random three-dimensional ensemble of point scatterers in a waveguide. Light transport in a disordered ensemble of resonant atoms placed in a waveguide is found to be very sensitive to the sizes of cross section of a waveguide. We have shown that the nature of radiation transfer changes from Anderson localization regime in a single-mode waveguide to a traditional diffuse transfer in a multi-mode one.

A19 **G.N. Nikolaev, S.L. Mikerin**

Theoretical bases of combined nonlinear optical demodulator-amplifier for broadband microwave photonics systems. Our demodulator is based on the use of a strong light pump wave along with a signal modulated light wave. The demodulator is linear in terms of the modulation signal, which makes it possible to obtain a demodulated signal without harmonic distortion. The modulator conversion efficiency and signal gain increase with increasing microwave baseband.

A20 **P.A. Statsenko, M.N. Khomyakov**

Numerical simulation in the diffraction approximation of laser radiation interaction with a stream of microparticles. In laser cladding, the interaction processes between the laser radiation, a microparticle flow and a substrate play a key role. The developed model takes into account the effect of diffraction on the microparticles of the powder. The results obtained using this model are compared with models of other authors.

A21 **N. Nikolaev, A. Mamrashev, V. Antsygin, D. Ezhov, D. Lubenko, V. Svetlichnyi, Yu. Andreev, V. Losev**

The optical properties of a nonlinear crystal of bismuth triborate in the terahertz range. The absorption coefficient and refractive index of bismuth triborate (BiB3O6, BIBO) have been studied by the Terahertz Time-Domain Spectroscopy at 300 and 77K. A prospect of BIBO to be used as THz radiation source is discussed.

A22 **A. Rybak, V.D. Antsygin, A.A. Mamrashev, N.A. Nikolaev**

Temperature dependence optical properties of KTP crystals in the terahertz range. On a TDS optical properties of the KTP were measured at temperature range +150° C …-195° C. Refractive indices and absorption coefficients were calculated for all temperatures. The dispersion of the refractive index components was approximated in the form of the Sellmeier equations. The thermo-optical coefficients were calculated and the temperature.

A23 **D. Serdyukov, T. Goryachkovskaya, I. Meshcheryakova, O. Cherkasova, V. Popik, S. Peltek**

Escherichia coli cell-based fluorescent biosensors in the study of gene expression under terahertz irradiation. An approach to study the effect of terahertz radiation from a laser source on the expression of individual genes using bacterial fluorescent biosensors is developed in the work. Several biosensors were obtained and the possibility of quantitative determination of the radiation-induced gene activity in living cells has been demonstrated.

A24 **O.N. Shevchenko, N.A. Nikolaev, K.A. Kokh**

Detection of THz waves in GaSe:S crystals by femtosecond radiation with a wavelength of 1.5 microns. Terahertz wave detection of femtosecond laser pulses on the wavelength 1.5 mkm in GaSe50-xSx (x=0, 0.015, 0.06, 0.08, 0.11) crystals was studied. The optimal degree of doping of the GaSe crystal with sulfur elements in the amount of 6 % is determined. The nonlinearity coefficients for GaSe:S crystals are calculated fot the first time.

A25 **M. Baronskiy, A. Kostyukov, V. Snytnikov**

Spectroscopic properties of CrO_x/Al_2O_3 nanopowders synthesized by cw CO_2 laser vaporization. The submission presents the results of photoluminescence spectroscopy and UV-Vis DRS studies of nanosized CrOx/Al2O3 powders, obtained by cw CO2 laser vaporization in various atmospheres (Ar, O2, H2). The spectroscopic data such as PL, PLE, DRS spectra for different Cr species (Cr3+, Cr6+) which are located in alumina matrix were obtained.

A26 **N.Y. Kostyukova, E.Y. Erushin, A.A. Boyko, D.B. Kolker, D.V. Badikov, V.V. Badikov**

Investigation of the nonlinear refraction of a barium chalcogenide crystal. The experimentally measured data of the nonlinear refractive index of the BaGa2GeSe6 crystal at a wavelength near half the band edge for e- and o-polarization is presented. The Z-scan measurements were performed with Q-switched nanosecond Nd:YLF laser at 1.053 μm at different radiation intensities and pulse repetition rates.

A27 **M.A. Zhilin, A.I. Karapuzikov, A.A. Markelov**

Numerical simulation of RF transmission line of waveguide CO_2-laser with experimental verification. In this paper, three numerical models of the RF transmission line are considered: a model with certain elements, a model taking into account the properties of a long line, and a model taking into account the properties of a long line and a return conductor, modeled using the theory graphs.

A28 **I.N. Nemov, A.G. Kuznetsov, A.A. Wolf, S.I. Kablukov, S.A. Babin**

Highly-reflecting fiber Bragg gratings for multimode fiber Raman lasers. We report on inscription, characterization and application of UV-inscribed fiber Bragg gratings as a highly-reflecting mirror in multimode fiber Raman laser cavity in combination with output couplers based on UV- or fs-inscribed FBG, Fresnel reflection or random Rayleigh feedback in wavelength and power range 950~1120 nm and 1~400 W, respectively.

A29 **A.V. Britvin, B.V. Poller, A.B. Poller, N.V. Shakhov**

Characteristics of the method of laser monitoring with segmented reflectors and UAVs for flood forecasting. Forecasting the flood situation in river basins depends on the completeness of information on snow reserves and the intensity of snow melting. The report proposes methods for collecting data on snow depth in remote areas by means of laser scanning of measuring rulers with retroreflectors using UAVs.

A30 **S.A. Shvetsov, A.S. Zolot'ko, G.A. Voronin, A.V. Emelyanenko, P.A. Statsenko, S.I. Trashkeev**

Light beam interaction with the nematic liquid crystal film deposited onto absorbing substrate. Nonlinear optical response of a nematic liquid crystal (NLC) with a free surface is studied experimentally and numerically. The light beam causes the local heating and temperature gradient inside of NLC, resulting in the elastic deformation of director field. In addition, the deformation of the NLC surface within the illuminated area is observed.

A31 **M. Efimov, A. Chibranov, M. Rumenskikh, A. Berezutsky, V. Posukh, P. Trushin, Yu. Zakharov, I. Miroshnichenko, I. Shaikhislamov**

Laboratory experiments of modeling the magnetosphere in hot Jupiters. This paper shows the results the interaction of plasma flows in an experiment modeling the interaction of stellar wind with magnetosphere of hot Jupiter. The new element was a flow of laser plasma from the body of the dipole, which simulated the supersonic escape of upper atmosphere of hot Jupiter.

A32 **A. Chibranov, A. Berezutsky, M. Efimov, Y. Zakharov, I. Miroshnichenko, V. Posukh, M. Rumenskikh, I. Shaikhislamov, P. Trushin**

Laboratory modeling of a field-aligned currents system generated by a flow of inner magnetospheric plasma. Experiments simulating the generation of strong field-aligned currents (FAC), which are closed at the planet's poles are presented in this paper. The experimental results demonstrate that the plasma flow expanding in the dipole magnetic field generates strong FAC inside the magnetosphere.

A33 **M.S. Rumenskikh, A.A. Chibranov, M.A. Efimov, A.G. Berezutsky, V.G. Posukh, Yu.P. Zakharov, E.L. Boyarintsev, I.B. Miroshnichenko, P.A. Trushin, A.V. Divin, I.F. Shaikhislamov**

Laboratory modeling of various modes of interaction of the solar wind with lunar magnetic anomalies. The study of the space plasmas and the processes occurring in the space environment is a rather complex task. One of the processes well suited for laboratory modeling is the study of mini-magnetospheres formed by the Solar wind around the areas of local magnetization of the lunar surface, the so-called Lunar magnetic anomalies.

A34 **Yu.P. Zakharov, V.P. Neznamov, V.A. Terekhin, I.F. Shaikhislamov, V.G. Posukh, P.A. Trushin, A.A. Chibranov, A.G. Berezutsky, M.S. Rumenskikh, M.A. Efimov**

On the opportunity of Laser Plasma simulation of Plasma Jets formation in moderate magnetic fields ~ kGs. Today a lot of various experiments with Laser-Produced Plasmas LPP, done at very-high magnetic fields (up to 20 MG) are used to study the physics of space Jets formation and its propagation. We discuss the opportunity and present the first results of new-type simulative Jet-experiments with LPP at KI-1 facility of ILP at moderate magnetic field ~kG.

A35 **G. Vishnyakova, K. Kudeyarov, E. Chiglintsev, D. Kryuchkov, N. Zhadnov, K. Khabarova, N. Kolachevsky**

Open-air link for the ultra-stable optical frequency signal transfer. We have developed the 17 m open-air link for ultrastable optical frequency transfer. The frequency instability caused by air turbulence is reduced by more than 3 orders of magnitude in terms of active noise compensation scheme and reaches 1.7e-19 at 1000 s. The link contribution to inaccuracy is decreased by more than 400 times and equals 5e-20.

Poster Session B

(All Topics)

B 1 **V.I. Vishnyakov, A.O. Makarov, S.M. Ignatovich**

Coherent population trapping resonances in cesium filled glass cells fabricated by induction welding. The possibility of using induction welding for spectroscopic cells is demonstrated. This approach makes it possible to improve the optical quality of windows, increase the repeatability of fabrication, and simplify the creation of spectroscopic cells filled with vapors of alkali metals.

B 2 **K. Savinov, A. Dmitriev, A. Krivetsky**

CPT resonances in multifrequency field. CPT resonances in the emission of a diode laser, the injection current of which is modulated simultaneously by microwave and VHF signals, are recorded. Interval between resonances is equal to half of the VHF modulation frequency.

B 3 **M.I. Vaskovskaya, E.A. Tsygankov, D.S. Chuchelov, S.A. Zibrov, V.V. Vassiliev, V.L. Velichansky**

Dependence of the CPT resonance frequency on the buffer gases pressure in atomic mini-cells. We studied the light shift of the frequency of coherent population trapping (CPT) resonance in small 87Rb cells for different pressures of buffer gases. We demonstrated experimentally and theoretically that the suppression of the shift becomes impossible when a critical value of the total pressure is exceeded.

B 4 **E.G. Saprykin, A.A. Chernenko**

Effects of magnetic coherence on transitions with level momenta J = 1/2 and J = 1 in unidirectional wave spectroscopy. On the basis of analytical and numerical solutions of equations for the density matrix, the physical processes forming the spectra of saturated absorption resonances at atomic transitions with full level momenta J = ½ and J = 1 under action of two linearly polarized unidirectional laser wave fields of arbitrary intensity are studied.

B 5 **E. Chiglintsev, K. Kudeyarov, N. Zhadnov, G. Vishnyakova, D. Kryuchkov, K. Khabarova, N. Kolachevsky**

Infrared ultrastable laser based on crystalline reference cavity. We develop a pair of ultrastabile laser systems on the wavelength of 1550 nm based on cryogenic crystalline silicon Fabry-Perot cavities with AlGaAs coatings to reduce thermal noise. Such system may reach fractional instability of 10^{-16}. The latest results such as frequency drift and other nuances will be discussed.

B 6 **K. Barantsev, A. Litvinov**

Peculiarities of autobalanced Ramsey spectroscopy of CPT resonance in optically dense medium. In our work we investigate CPT resonance in atomic ensemble with finite optical thickness detected by autobalanced method for microwave atomic clocks. We analyze light shifts of the CPT resonance which appear due to finite lifetime of the low frequency atomic coherence and absorption of the reading pulse in an optically dense medium.

B 7 **V.I. Yudin, M.Yu. Basalaev, D.V. Kovalenko, A.V. Taichenachev, S.N. Bagayev, J.W. Pollock, A Hansen, W.R. McGehee, J. Kitching**

Spatially inhomogeneous light shift of the coherent population trapping resonances. For the resonance of CPT, we investigate the dependence of the light shift on the power taking into account the spatially inhomogeneous transverse profile of the laser beam. It is shown that the Gaussian profile leads to a substantially nonlinearity of this dependence.

B 8 **A.O. Makarov, D.V. Brazhnikov, C. Andreeva, A.N. Goncharov**

High-contrast magneto-optical resonances in rubidium vapor cell under counterpropagating light waves. Level-crossing resonances in a buffered rubidium vapor cell are studied under counterpropagating linearly polarized waves. The large resonance contrast up to 40% has been observed under the relatively low temperature of the cell (< 60°C). The minimum FWHM observed is 2 mG (200 nT). The considered scheme can be applied to atomic magnetometry.

B 9 **D. Provorchenko, A. Golovizin, D. Tregubov, D. Mishin, N. Kolachevsky**

Magneto-optical trap of thulium atoms in compact system for transportable optical clock. We developed a compact vacuum system for a transportable thulium optical clock. We demonstrated loading of up to 13 million atoms into a magneto-optical trap in this setup. The measured loading rate and long atoms lifetime indicate its applicability for optical clock operation.

B 10 **M. Tropnikov, A. Bonert, A. Goncharov, S. Kuznetsov, V. Baraulya, D. Brazhnikov, O. Prudnikov, A. Taichenachev, S. Bagayev**

Optical frequency standard based on ultracold magnesium atoms: current status and future prospects. The results of experimental studies aimed at the creation of an optical frequency standard based on ultracold magnesium atoms with a relative uncertainty of $\Delta\nu/\nu = 10E{-}16$ are presented. Frequency stability of $1{\cdot}10E{-}15$ is obtained at an averaging time $\tau = 10E3$ s while stabilizing 'clock' laser to Ramsey-Bordé resonances of Mg atoms in a MOT.

B 11 **A.A. Kirpichnikova, R.Ya. Il'enkov, O.N. Prudnikov**

Laser cooling limits for ^{6}Li atoms in monochromatic field with elliptical polarization. We study laser cooling of ^{6}Li atoms in monochromatic fields for different polarization configurations taking into account hyperfine structure. Deep cooling can be achieved in lin-lin configuration resonance to D2 line. s+-s- configuration is noted to result in cooling to higher temperatures. Perspective of elliptical polarizations was analyzed.

B 12 **I.V. Balakireva, I.Yu. Blinov, N.P. Khatirev**

Optical WGM resonator sensor of Earth gravity acceleration. We present a construction of the optical whispering gallery mode (WGM) resonator gravimeter. The sensitive element of the device is a resonator, placed on a cantilever, which moves with the change of gravity, variating the distance with coupling element. The gravity acceleration is measured by the change of the resonator eigenmode parameters

B 13 **A. Markelov, A. Karapuzikov, E. Nekhorosheva**

Numerical modelling of the spectral composition of the small-size CO_2 laser radiation. A numerical model has been designed for computing the spectral composition of CO_2 laser radiation. The input parameters of this model are the characteristics of the active medium and the laser cavity. The result of a numerical calculation is the dependence of the radiation wavelength on the cavity length.

B 14 **G.V. Kuptsov, V.A. Petrov, A.V. Laptev, A.O. Konovalova, A.V. Kirpichnikov, V.V. Petrov**

Wavefront distortions and gain dynamics in high power laser amplifier. The dependencies for gain and optical path difference of the amplified radiation are modelled for Yb:YAG disks with high power diode pump and non-uniform volumetric dopant distribution in active media. The results allow one to optimize the parameters of cryogenically cooled laser amplifiers with high power diode pumping.

B 15 **D. Makarov, A. Kharlamova**

X-ray diffraction analysis at the second harmonic. It is well known that when X-ray ultrashort laser pulses (USPs) are scattered by various polyatomic objects, a diffraction pattern arises, which can be used to determine the structure of the object. In the theory of scattering of X-ray ultrashort pulses, it is usually assumed that such scattering occurs at a frequency close to the carrier frequency.

B 16 **V.A. Petrov, G.V. Kuptsov, A.V. Laptev, A.O. Konovalova, A.V. Kirpichnikov, V.V. Petrov**

The model of laser amplification process in Yb:YAG active media at low temperatures. To study a complicated character of thermal and amplification processes in case of Yb:YAG active medium at low temperatures the three-dimensional non-stationary model based on balance equations and the thermal conductivity equation was enhanced by wavelength dependencies of active medium properties.

B 17 **A.P. Torbin, A.K. Chernyshov, M.I. Svistun, P.A. Mikheyev**

Study of Ne:He plasma of a periodically pulsed discharge for optically pumped rare gas laser. We present the first results of experiments with optically pumped rare gas lasers, employing Ne metastable atoms. They include Ne* number density and temperature measurements in active medium, as well as lasing experiments to determine pumping threshold in a transverse pumping configuration using a narrow band pulsed dye laser as a pump.

B18 **A. Nashivochnikov, A. Kostyukov, M. Rakhmanova, V. Snytnikov**

Synthesis of $ZrO_2:Eu^{3+}$ nanopowders using a cw CO_2-laser and investigation of their luminescent properties depending on the concentration of europium. A series of ZrO_2:xEu nanopowders (x = 0.04 – 6.85 wt.%) with a particle size of about 10 ± 4 nm was obtained by CO_2 laser vaporization technique. According to XRD data the samples contain mainly the tetragonal phase of ZrO_2. The obtained nanoparticles exhibit intense red luminescence with an absolute quantum yield of up to 18%.

B19 **G.N. Nikolaev**

Analysis of a high-frequency nonlinear optical modulator based on a traveling wave for microwave photonics systems. A high-frequency nonlinear optical modulator based on a traveling modulation wave for microwave photonics systems is theoretically investigated. The conditions for its most effective work have been determined. On the basis of this, recommendations were formulated for the choice of a nonlinear medium and the design of the modulator.

B20 **A. Kostyukov, A. Nashivochnikov, M. Rakhmanova, V. Snytnikov**

Luminescence performance of laser synthesized $Al_2O_3:Eu^{3+}$ nanophosphors depending on synthesis conditions. $Al_2O_3:Eu^{3+}$ nanophosphors were synthesized by laser vaporization technique in a flowing mixture of Ar/He and O^2. Hypersensitive transition dominates in the spectrum and is responsible for the red emission. The obtained chromaticity coordinates and absolute QY (~ 14%) indicate the possibility of using red nanophosphors based on $Al^2O^3:Eu^{3+}$.

B21 **D.E. Genin, E.I. Lipatov, E.N. Tel'minov, M.A. Shulepov, V.G. Vins, A.P. Yeliseev**

Superluminescence in diamonds, containing NV-centers. In our work we observed superluminescence in diamonds, containing NV-centers in negative charge state. The phenomenon was observed in so-called phonon wing of luminescence spectra, at the wavelength near 718 nm. Diamond samples were pumped by pulsed laser radiation at 532, 575 and 560 nm.

B22 **A.V. Britvin, B.D. Borisov, B.V. Poller, A.B. Poller, M.S. Khairetdinov, A.S. Khokhryakov**

Highly sensitive detection of infrasonic oscillations in the atmosphere using synchronous laser lines with a frequency standard. One of the important directions in the problems of modern acousto-optics is considered - acousto-optic interaction at infra-low frequencies. The paper considers an approach to increase the sensitivity of laser lines to acousto-optical conversion at infra-low frequencies through the use of modern small-sized frequency standards.

B23 **V.V. Shelkovnikov, S.L. Mikerin, A.E. Simanchuk, P.A. Chubakov, S.V. Korotaev, N.A. Orlova, V.N. Berezhnaya, I.Yu. Kargapoloava, R.A. Ischenko, N.D. Ryazanov**

New organic nonlinear optical materials based on polycarbonate films with dendronized polyfluorotriphenylpyrazoline-dicyanoisophorone chromophores. New nonlinear optical materials based on polycarbonate and polyfluorotrifenylpyrazoline-dicyanoisophorone dyes with arylsulfonyl dendron substituents were obtained. The materials have high time and temperature stability and exhibit d33 up to 80 pm/V at a chromophore concentration of $3 \cdot 10^{20}$ cm^{-3}.

B24 **A. Gribanov, G. Nikolaev, M. Mosin, D. Yakovin, M. Yakovin**

Fluorescence quantum efficiency of $Ti^{3+}:Al_2O_3$ at cryogenic temperatures and excitation by laser diodes. Temperature dependences of the fluorescence of a titanium-sapphire crystal excited by radiation with λ=507 nm and 454 nm was measured. It was measured for the first time that the quantum efficiency of fluorescence equals to (117 ± 5) % at T=77 K when the crystal is excited by radiation with λ=454 nm.

B25 **R.A. Taziev, E.F. Martynovich**

Luminescence of single-color centers in $LiF:Mg^{2+}$ crystals. Color centers have been found in which luminescence is observed in the region λmax = 800 nm in crystals grown in a reducing atmosphere. An assumption was made about the nature of the centers with a lifetime of 26.84±0.15 ns based on knowledge about the formation of various types of color centers.

B26 **E. Belskaya, P. Bokhan, P. Gugin, D. Zakrevsky**

A numerical simulation of lasing at ion thallium transitions in a Ne-Tl mixture upon excitation by an electron beam generated in an open discharge. In the work Belskaya E.B. et al. Atmospheric Ocean. Opt., 33, 424 (2020) lasing on several Tl II transitions was investigated with pumping a Ne + Tl gas-vapor mixture by an electron beam. In this work we performed a numerical simulation of the Tl II levels populations and output lasing power. Calculation results were compared with the experiments.

B27 **A. Chernova, D. Bordzilovskiy**

Selection of optimal coherent light sources for Fizeau interferometers. In this work presents a comparative analysis of coherent light sources such as mercury lamps which currently being produced and can be used in Fizeau interferometer. And the use of 532nm laser as a light source for this type of interferometer.

B28 **E.F. Nemova, O.P. Cherkasova, G.G. Dultseva**

Effect of terahertz radiation on intermolecular interactions of albumin under aerobic and anaerobic conditions. Effect of THz radiation on coupling between albumin molecules under aerobic and anaerobic conditions is assessed through an EPR-quantified procedure. THz-induced rearrangements are found to affect hydrogen bonding network causing an increase in the rate of bimolecular interactions. Molecular mechanism of the observed effect is considered.

B29 **I. Sherstov, V. Vasiliev**

SF_6 laser photo-acoustic gas analyzer with 10 decades range. Photo-acoustic laser gas analyzer with concentration range from ~0.1 ppb to 100% SF6 has been developed. The use of a gas-filled cell for normalizing the differential PA-detector absorption signals practically minimizes the error in measuring the SF6 concentration due to the spontaneous tuning of the CO2 laser radiation wavelength near 10.6 μm.

B30 **N.D. Goldina**

Spectral characteristics of metal - dielectric interferometer. To synthesize a new multipath interferometer with narrow bands in reflected and transmitted light, in contrast to the Fabry-Perot interferometer, where the interference patterns of reflection and transmission are additional, a composition of a thin metal layer and a Fabry-Perot interferometer was used.

B31 **A.G. Berezutsky, V.N. Tishchenko, I.B. Miroshnichenko, Yu.P. Zakharov, I.F. Shaikhislamov**

Controlling the type and intensity of low-frequency waves generated by laser plasma clots in a force tube of magnetized plasma. Experiments on the KI-1 facility and calculations on clusters have shown that the method of resonant interaction of clots with magnetized plasma makes it possible to control the type, frequency, and intensity of quasi-stationary waves. Separate generation of Alfvén, whistler, slow magnetosonic waves or their combination is possible.

B32 **A. Medvedev, P. Pinaev, A. Smirnov, G. Grachev**

Plasma creation with complementary laser and microwave plasmatron. In order to optimize the conditions for obtaining diamond films, a reactor has been created that can operate in three modes: microwave, laser, and complementary (laser and microwave) plasmatron. Since the simultaneous microwave and laser action on the gas is of both fundamental and practical interest, the result of such action is studied in detail.

B33 **Yu.P. Zakharov, V.A. Terekhin, I.F. Shaikhislamov, V.G. Posukh, P.A. Trushin, A.A. Chibranov, A.G. Berezutsky, M.S. Rumenskikh, M.A. Efimov**

Spherical clouds of laser-produced plasma to model 3D-dynamics of artificial plasma releases at near-Earth space. We present the design and first results of new type model experiments – with the Clouds of Laser Plasma (CLP) of spherical form, typical for plasma bunches in space experiments on Barium Releases. Such CLP were created at KI-1 facility ILP by 4-beams laser irradiation (of 1 cm plastic target) and were used to model AMPTE release in magnetosphere

B34 **S.N. Bagaev, A.G. Berezutsky, E.L. Boyarintsev, Yu.G. Golovachev, G.N. Grachev, L.R. Dmitrieva, Yu.P. Zakharov, Yu.I. Zetser, I.B. Miroshnichenko, V.G. Posukh, A.G. Ponomarenko, A.L. Smirnov, V.N. Tishchenko, A.A. Chibranov, I.F. Shaikhislamov**

Conversion of repetitively pulsed laser radiation into a low-frequency waves in gases and magnetized plasma. The method of resonant interaction of laser clots with matter, proposed at the ILP SB RAS, makes it possible to generate different types of low-frequency waves: infra-ultrasound in gases, and waves in a magnetized plasma that carry an intense pulse, angular momentum and electromagnetic radiation in a narrow force tube. Review of the main results.