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Program of the 15th All-Russian Scientific Conference

with International Participation

**“Physics of Ultracold Atoms – 2021”**

**Organizers: Institute of Laser Physics SB RAS, Institute of Semiconductor Physics SB RAS,** **Institute of Automation and Electrometry SB RAS, Novosibirsk State University**

20-22 December 2021, in the form of on-line Zoom-sessions,   
organized by the Institute of Laser Physics SB RAS, Novosibirsk, av. Lavrentieva 15 B

Conference website: [ultracoldatoms2021.laser.nsc.ru](http://www.ultracoldatoms2021.laser.nsc.ru)

**Monday, 20 December 2021**

**All data below are given for Novosibirsk time zone = GMT+7**

1345 – 1400 **Connecting remote participants to the Zoom session**

**Optical frequency standards based on ultracold atoms and ions**

***Chairman: Alexey Taichenachev***

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| **1400 – 1420** | **Opening ceremony** |
| **1420 – 1450** | Piet O. Schmidt  *1QUEST Institute, Physikalisch-TechnischeBundesanstalt, Braunschweig, Germany;*  *2Institute for Quantum Optics, Leibniz University Hannover, Germany*  **Highly Charged Ion Optical Clocks to Test Fundamental Physics** |
| **1450 – 1520** | Anastasia V. Semenko  *Russian Metrological Institute of Technical Physics and Radio Engineering (VNIIFTRI), Mendeleevo, Moscow region, Russia*  **Study of “clock” laser systems for mobile optical frequency standard based on ultracold Yb atoms** |
| **1520 – 1550** | Tanja E. Mehlstäubler  *1Physikalisch-Technische Bundesanstalt, Braunschweig*  *2Leibniz Universität Hannover, Hannover*  **Optical clock spectroscopy in multi-ion systems** |
| **1550 – 1620** | Nikita A. Pavlov  *Institute of Laser Physics SB RAS, Novosibirsk Russia*  **Detection and compensation of excess micromotion in single-ion optical frequency standard** |
| **1620 – 1650** | Artem A. Golovizin  *Lebedev Physical Institute RAS, Moscow, Russia*  **Compact vacuum system for the second optical clock based on thulium atoms** |

**Nonlinear laser spectroscopy - 1**

***Chairman: Denis Brazhnikov***

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| **1700 – 1730** | Valeryi I. Yudin  *1Institute of Laser Physics, Novosibirsk, Russia;*  *2Novosibirsk State University, Novosibirsk, Russia*  **Spectroscopic effects nonlinear in atomic density due to free motion of atoms in a gas** |
| **1730 – 1800** | Igor L. Glukhov  *Voronezh State University, Voronezh, Russia*  **Using photoionization cross sections to determine the contributions of the continuum to blackbody-induced shifts and broadening of the energy levels of Rydberg atoms** |
| **1800 – 1830** | Boris B. Zelener  *Joint Institute for High Temperatures RAS, Moscow, Russia*  **Strong interparticle interaction in ultracold plasma and dense hot gas of atoms** |
| **1830 – 1900** | Thomas Zanon-Willette  *1Sorbonne Université, Observatoire de Paris, Paris, France;*  *2MajuLab, CNRS-UCA-SU-NUS-NTU International Joint Research Unit, Singapore;*  *3Centre for Quantum Technologies, National University of Singapore, Singapore*  **Towards composite laser pulses spectroscopy of the 88Sr clock transition: the good, the bad and the ugly …** |

**Laser Cooling- 1**

***Chairman: Pavel Chapovsky***

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| **1910 – 1930** | Oleg N. Prudnikov  *1Institute of Laser Physics, Novosibirsk, Russia;*  *2Novosibirsk State University, Novosibirsk, Russia*  **Simultaneous fast and deep laser cooling of ions in a radio frequency trap in the Lamb-Dicke regime** |
| **1930 – 2000** | Vladislav Pavlov  *1Russian Metrological Institute of Technical Physics and Radio Engineering;*  *2Lomonosov Moscow State University;*  *3Russian Quantum Center*  **Application of the self-injection locked diode lasers for a laser cooling system of a rubidium fountain** |
| **2000 – 2020** | Roman Ya. Il’enkov  *Institute of Laser Physics SB RAS, Novosibirsk, Russia*  **Magneto-optical trap for lithium-6 atoms formed by waves with elliptical polarization** |
| **2020 – 2050** | Vladislav V. Tsyganok  *Russian Quantum Center, Skolkovo, Moscow Region, Russia*  **Optical lattice for thulium atoms at a wavelength of 1064 nm** |

**Tuesday, 21 December 2021**

945 – 1000 **Connecting remote participants to the Zoom session**

**Nonlinear laser spectroscopy - 2**

***Chairman: Ilya Beterov***

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| **1000 – 1030** | Alexander A.Mamrashev  *Institute of Automation and Electrometry SB RAS, Novosibirsk, Russia*  **Conversion of nuclear spin isomers of water molecules in vibrationally excited states** |
| **1030 – 1100** | Pavel L. Chapovsky  *1Institute of Automation and Electrometry SB RAS, Novosibirsk, Russia;*  *2Institute of Laser Physics SB RAS, Novosibirsk, Russia*  **Continuous OPO for mid-IR diapason** |
| **1100 – 1130** | Vladimir A. Tomilin  *1Institute of Automation and Electrometry SB RAS, Novosibirsk, Russia;*  *2Novosibirsk State University, Novosibirsk, Russia*  **New scheme of hybrid atomic-optical quantum gyroscopy: basic formalism and estimates of quantities** |
| **1130 – 1200** | Alexander A. Chernenko  *Institute of Semiconductor Physics SB RAS, Novosibirsk, Russia*  **Magnetic coherence effects in saturated absorption spectra on transitions with the angular momentum J=1/2 and J=1 levels in copropagating waves** |

**Laser cooling- 2**

***Chairman: Maxim Basalaev***

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| **1210 – 1230** | Anna A. Kirpichnikova  *Institute of Laser Physics SB RAS, Novosibirsk, Russia*  **Development of approaches to the problem of laser cooling of 6Li atoms in a monochromatic field with elliptical polarization** |
| **1230 – 1300** | Vladimir S. Melezhik  *1Joint Institute for Nuclear Research, Dubna, Russia;*  *2Dubna State University, Dubna, Russia*  **New mechanism for sympathetic cooling of atoms and ions in atomic and hybrid ion-atom traps** |
| **1300 – 1320** | Darya A. Skvortsova  *1Institute of Semiconductor Physics SB RAS, Novosibirsk, Russia;*  *2Novosibirsk State Technical University, Novosibirsk, Russia*  **Optimization of magnetic fields in a magneto-optical trap** |
| **1320 – 1340** | Gulnara A. Vishnyakova  *Lebedev Physical Institute RAS, Moscow, Russia*  **Highly stable laser system based on an external cavity made of monocrystalline silicon with GaAs/AlGaAs mirrors** |

1445 – 1500 **Connecting remote participants to the Zoom session**

**Microwave frequency standards**

***Chairman: Maxim Basalaev***

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| **1500 – 1530** | Andrei N. Litvinov  *Peter the Great St. Petersburg Polytechnic University, Saint-Petersburg, Russia*  **Features of the combined effect of atomic motion and hyperfine splitting of the excited state on the CPT resonance lineshape in a rarefied gas and in finite-size cells with an antirelaxation wall coating** |
| **1530 – 1600** | VyacheslavN.Baryshev  *Russian Metrological Institute of Technical Physics and Radio Engineering (VNIIFTRI), Mendeleevo, Moscow region, Russia*  **Rubidium microwave frequency standard based on pulsed optical pumping technique with 2.5×10–13τ–1/2 frequency instability** |
| **1600 – 1630** | KonstantinA.Barantsev  *Peter the Great St. Petersburg Polytechnic University, Saint-Petersburg, Russia*  **Features of optical pumping of alkali atoms under conditions of breaking electron-nuclear bond in collisions** |
| **1630 – 1700** | Gavriil V. Voloshin  *Peter the Great St. Petersburg Polytechnic University, Saint-Petersburg, Russia*  **Study of the effect of temperature on the shape and shifts of coherent population trapping resonances detected in optically dense media of alkali atoms by the Ramsey method** |

**Quantum informatics with ultracold atoms and ions - 1**

***Chairman: Roman Il’enkov***

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| **1710 – 1730** | Pavel Betleni  *1Institute of Semiconductor Physics SB RAS, Novosibirsk, Russia;*  *2Novosibirsk State University, Novosibirsk, Russia*  **Analysis of optical systems for the implementation of two-qubit valves with rubidium atoms** |
| **1730 – 1750** | Farouk Ahmed  *1Novosibirsk State University, 630090, Novosibirsk, Russia*  *2Al-Azhar University, Cairo, 11884, Egypt*  **Parallel implementation of CNOT gates via heteronuclear interaction of Rydberg atoms** |
| **1750 – 1810** | Oleg Chuikin  *Novosibirsk State Technical University, Novosibirsk, Russia*  **Application of the transition operator for calculating the spectral density and transition probabilities in a two-qubit system** |
| **1810 – 1830** | Ivan Ashkarin  *1Institute of Semiconductor Physics SB RAS, Novosibirsk, Russia;*  *2Novosibirsk State University, Novosibirsk, Russia*  **Three-particle Foerster resonances of a new type in disordered ensembles of Rydberg atoms** |

**Quantum informatics with ultracold atoms and ions - 2**

***Chairman: Leonid Il’ichev***

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| **1840 – 1910** | Eugene Demler  *Institute for Theoretical Physics, Wolfgang-Pauli-Str. 27, ETH Zurich, 8093 Zurich, Switzerland*  **Using quantum simulators to solve real world problems: quantum assisted NMR inference** |
| **1910 – 1940** | Igor I. Ryabtsev  *1Institute of Semiconductor Physics SB RAS, Novosibirsk, Russia;*  *2Novosibirsk State University, Novosibirsk, Russia*  **Implementation of one-qubit quantum operations with two rubidium atoms in two individually addressable optical dipole traps** |
| **1940 – 2010** | Pavel L. Sidorov  *Lebedev Physical Institute RAS, Moscow, Russia*  **Influence of coherent effects on the reliability of the operation of entangling ionic qubits using ultrafast laser pulses** |
| **2010 – 2040** | Leonid V. Gerasimov  *1Quantum Technology Center of M. V. Lomonosov Moscow State University, Moscow, Russia;*  *2Peter the Great St. Petersburg Polytechnic University, Saint-Petersburg, Russia*  **Dynamics of two spin qubits in optical dipole traps** |
| **2040 – 2110** | David Wilkowski  *Nanyang Technological University, Singapore*  **Zitterbewegung Dynamics in 2D Synthetic Non-Abelian Gauge Fields** |
| **2110 – 2130** | Ilya Semerikov  *Lebedev Physical Institute RAS, Moscow, Russia*  **Four-qubit ion-based quantum computer on qu-quarts** |

**Wednesday, 22 December 2021**

945 –1000 **Connecting remote participants to the Zoom session**

**Quantum sensors**

***Chairman: Igor Ryabtsev***

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| **1000 – 1030** | Andrei P. Derevianko  *University of Nevada, Reno, USA*  **Quantum sensor networks as exotic field telescopes for multi-messenger astronomy** |
| **1030 – 1100** | Denis V. Brazhnikov  *1Institute of Laser Physics SB RAS, Novosibirsk, Russia;*  *2Novosibirsk State University, Novosibirsk, Russia*  **A review of pump-probe configurations for observing high-contrast level-crossing resonances in small low-temperature alkali-metal vapor cells for atomic magnetometry applications** |
| **1100 – 1130** | AnatolyE. Bonert  *Institute of Laser Physics SB RAS, Novosibirsk, Russia*  **Interference of cold atoms: magnesium optical frequency standard and rubidium quantum gravimeter** |
| **1130 – 1200** | Irina S. Mesenzova  *Institute of Laser Physics SB RAS, Novosibirsk, Russia*  **Comparison of VCSEL and DBR laser and polarimetric method for observing sub-Doppler resonances in a small cell with Cs vapor** |
| **1200 – 1230** | KonstantinS.Kudeyarov  *1Lebedev Physical Institute RAS, Moscow, Russia;*  *2Russian Quantum Center*  **Phase-sensitive laser interferometry for geopotential measurement** |
| **1230 – 1250** | Christina Andreeva  *Institute of Electronics BAS, Sofia, Bulgaria*  **Application of all-optical magnetometry for detection of weak magnetic fields generated by current-carrying metallized track** |

1345 – 1400 **Connecting remote participants to the Zoom session**

**Matter waves**

***Chairman: Pavel Chapovsky***

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| **1400 – 1430** | Ron Folman  Ben-Gurion University of the Negev, Beer Sheva, Israel  **Matter-wave interferometers on the atom chip** |
| **1430 – 1500** | Anton E. Afanasiev  *1Institute of Spectroscopy of the Russian Academy of Sciences, Moscow, Troitsk, Russia;*  *2National Research University Higher School of Economics, Moscow, Russia*  **Single-layer atomic chip for continuous cooling of atoms** |
| **1500 – 1530** | AlexeyV. Akimov  1Texas A&M University, TAMU 4242, College Station, TX 77843, USA;  2Russian Quantum Center, Business Center “Ural”, Skolkovo, Moscow, Russia;  3Sensor Spin Technologies, Moscow, Russia  **State depended losses of thulium atom in the optical dipole trap operation at 532 nm** |
| **1530 – 1600** | Gediminas Juzeliūnas  *Institute of Theoretical Physics and Astronomy,Vilnius University, Vilnius, Lithuania*  **Subwavelength Optical Lattices** |
| **1600 – 1630** | Vladimir A. Khlebnikov  *Russian Quantum Center, Skolkovo, Moscow Region, Russia*  **Temperature behavior of Fano-Feshbach resonances of ultracold polarized thulium** |
| **1630 – 1700** | Filippo Levi,  *Istituto Nazionale di Ricerca Metrologica (INRIM), Turin, Italy*  **The Italian Quantum Backbone: a fiber infrastructure for metrology sensing and quantum communications** |

**Quantum Fermi and Bose gases**

***Chairman: Alexey Taichenachev***

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| **1710 – 1740** | Andrey R. Kolovsky  *1Kirensky Institute of Physics SB RAS, Krasnoyarsk, Russia;*  *2Siberian Federal University, Krasnoyarsk, Russia*  **Conductivity theory with cold Bose atoms in optical lattices or the open (dissipative) Bose-Hubbard model** |
| **1740 – 1810** | Andrey V. Turlapov  *1Institute of Applied Physics RAS, Nizhny Novgorod, Russia;*  *2Russian Quantum Center, Skolkovo, Moscow Region, Russia*  **Prospects for p-superfluidity in dysprosium gas** |
| **1810 – 1840** | Kwon Ze Don  *1Institute of Semiconductor Physics SB RAS, Novosibirsk, Russia;*  *2Novosibirsk State University, Novosibirsk, Russia*  **Anderson localization in two-dimensional electron-hole system** |
| **1840 – 1900** | **Post deadline contribution**  Maxim Nesterenko  *Institute of Laser Physics SB RAS, Novosibirsk, Russia*  **Narrow-line lasers: current status and prospects** |
| **1900 – 1910** | **Closing ceremony** |
| **2000 – 2200** | **On-line conference dinner** |