LASER OPTICS
ОПТИКА ЛАЗЕРОВ
2012

15TH INTERNATIONAL CONFERENCE ON LASER OPTICS

«LO - 2012»

Technical program

St.Petersburg, Russia

June 25-29, 2012

15th International Conference on Laser Optics

Technical Program

St.Petersburg
2012

CONTENTS

International Conference
«Laser Optics 2012»

ORGANIZED BY:

Fund for Laser Physics
Institute for Laser Physics of Vavilov SOI Corporation
European Optical Society
Ioffe Physical Technical Institute
IPG Photonics Corporation
JSC "SPC "Optical Systems and Technologies"
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St.Petersburg National Research University of ITMO
St.Petersburg State Electrotechnical University
St.Petersburg State University
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We wish to thank the following for their contribution to the success of this conference:

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of the St.Petersburg Government

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St.Petersburg National Research University of ITMO

LOMO PLC

IPG Photonics Corporation

Research Institute for Complex Testing of Optoelectronic Devices and Systems

OJC RPC "Precision Systems and Instruments"

SPIE

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Ubifrance French agency for international business development

JSC Export-Import Bank

«RITM» Magazine

«Photonika» Magazine

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Lasers in environmental monitoring

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Nonlinear Photonics, Optical Solitons and Telecommunications

Co-chairs:

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Adaptive Optics for High-Power Laser Systems

Co-chairs:

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V. Yu.Venediktov, Inst. for Laser Physics of Vavilov SOI Corp., Russia

6th International Symposium on High-Power Fiber Lasers and Their Applications

Chair:

V. Gapontsev, IPG Photonics Corporation, USA

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S. Popov, IPG Photonics Corporation, USA

2nd International Symposium on Light in Conservation of Artworks (L'ICONA 2012)

Co-chairs:

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2nd International Symposium on Lasers in Medicine

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L.Avramov, Institute of electronics, Bulgaria

6th International Conference on Laser Optics for Young Scientists (LOYS'2012)

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TOPICS FOR LO'2012

R1. Solid-State Lasers, Materials and Components

Diode pumped solid-state lasers and amplifiers • Upconversion lasers • Novel pump sources and techniques • Cavity design • High power operation • Beam quality improvements • Microchip lasers • Lasers with pulse compression • Narrow linewidth lasers • Advances in fiber lasers • Amplitude and frequency stabilization • Nonlinear frequency conversion

R2. High Power Gas Lasers

CO2/CO lasers • Iodine lasers • Slab gas lasers • Chemical lasers • Excimer lasers • Extreme-UV light sources • Advances in gas lasers

R3. Semiconductor Lasers, Materials and Applications

Novel laser structures and devices • Quantum-well, wire, and dot lasers • MID-IR, Quantum Cascade and THz lasers • Type-II quantum-well and superlattice lasers • Q-switched and Mode-locked lasers • Ultrashort pulse lasers • VCSELs and VECSELs • Lasers on silicon • Optical coherent tomography • UV/Visible diode lasers and LEDs • Multi photon imaging • Novel applications

R4. Laser Beam Control

Wavefront correction • Adaptive optics • Phase conjugation • Dynamic holography • Laser cavities • Stabilization and control of laser beam direction • Laser imaging • Coherent and non-coherent summation of laser beams • Singular laser optics

R5. Super-Intense Light Fields and Ultra-Fast Processes

Generation of high-power, super short pulses • Problems of «Fast Ignition» for the ICF • Laser plasma X-ray sources • Fast particle generation and acceleration by laser pulses • Femtosecond laser technology and applications • Physics of ultrafast phenomena • Ultrafast devices and measurements

R6. Nanophotonics and Biophotonics

Nonlinear optics of nanostructures • Spectroscopy of nanostructures • Optical power limiting • Nanoplasmonics • Photonic crystals • Nanostructures for solar energy utilization • Photodynamic processes in biology and nanophotonics • Nanoimaging and bioimaging • Biosensing

R7. Lasers in environmental monitoring

Laser remote sensing technologies and methods • Lidar techniques and measurements for atmospheric remote sensing • Oil spill and ocean monitoring • Urban remote sensing • Laser sensing for geology • Remote sensing for agriculture and ecosystems • Space-based lidars for global observation

R8. Nonlinear photonics: fundamentals and applications

Nonlinear optical devices • Tunable, active, and nonlinear optical metamaterials • Conservative and dissipative optical solitons • Supercontinuum generation • Fiber optics and telecommunications

SY1. 6th International Symposium on High-Power Fiber Lasers and Their Applications

- High power fiber lasers for material processing applications

High power and energy fiber lasers - latest achievements • Beam delivery for fiber laser materials processing • Fiber laser beam monitoring • In process control of fiber laser processing

- Cutting and welding with kW fiber lasers

2D and 3D cutting machine concepts, limits in thickness, edge roughness, speed • Power train welding • Successful installations • Spatter and methods of its reduction • E-mobility: Aluminium and Copper welding, dissimilar joints • Remote cutting of metals with Single Mode fiber lasers • Sensors and monitors for welding and cutting

- Fiber laser cladding, sintering and heat treatment

E-manufacturing, tailored alloys, build-ups and repair Rapid Prototyping with Direct Metal Deposition

- Fiber lasers for automotive applications

Laser Spot welding tool LSS1 applications • Scanner, Robot based scanner or Flip Flop technology • The use of Aluminium and other light weight materials

- Mid power fiber laser applications

Surfaces structuring for moulds • Cleaning, preparation of surfaces for adhesive bonding • Plastic cutting and welding with Thulium lasers

- Pipe and thick section welding

Laser-plasma hybrid welding from 6mm to 40mm thickness • Laser vacuum welding • Continuous welding: sound weld bead and root • Laser cutting as edge preparation for laser welding • Record penetration in stainless steel

- Marking and engraving

Metals, plastics and semiconductors including deep engraving for visibility after paint shop • Applications in display, photovoltaics and packing industry • Micro-machining with low power and short pulse length fiber lasers

- Telecoms and Sensors

High power fiber lasers and amplifiers in communications • Advances in application of high power optical amplification to long-haul transmission and next generation passive optical networks (NGPON) • Remote intelligent sensors powered over fiber.

- Mid infra-red, 2 to 3 micron fiber lasers, processing including cutting and welding of plastics

- Visible, uv and ultrafast fiber lasers and applications

- Life Sciences, medical, surgical, food production, agricultural pest and herbal control applications of fiber lasers

TOPICS FOR LO'2012

SY2. 2nd International Symposium on Light in Conservation of Artworks (L'ICONA 2012)

- Material characterization and structural diagnostics by NDT

Laser spectroscopic techniques: Optical (LIF, LIBS, Raman) and Mass spectrometric (LMS) • Interferometric Techniques: Double exposure holography, Speckle Interferometry, and other (Optical Coherence Tomography etc.) • 3-D laser and fringe-pattern projection scanning • X-ray, particle beam, neutron diffraction and other techniques • Luminescence techniques in dating and materials characterization.

- Laser treatments in artworks conservation

Laser cleaning of stone, metals, wood, paper, parchments, painted surfaces • Laser soldering and micro-welding • Thermal stabilization • Recent advances: remote cleaning, laser pulse duration effects, and other.

- Case studies and project presentations.

Practical methodologies • European and other projects.

SY3. 2nd International Symposium on Lasers in Medicine

- Optical Biomedical Diagnostics

- Clinical Laser Applications

- Laser Tissue Interaction

- Advanced Laser Systems for Medicine

YS. 6th International Conference on Laser Optics for Young Scientists and Engineers

PROGRAM AT-A-GLANCE

Hotel Holiday Inn Moskovskye Vorota

		Congress Hall	Hall Petrov-Vodkin 1	Hall Petrov-Vodkin 2	Hall Petrov-Vodkin 3	Hall Deyneka1+2
Monday June 25	09:00-10:30					
	10:30-11:00	Opening of the Conference				
	11:00-13:15	Plenary See p.15				
	13:15-15:00					
	15:00-18:00					
	19:00-20:30	Welcome party				
Tuesday June 26	09:00-11:00		R3 See p.19	SY1 See p.65		YS See p.87
	11:30-13:30					
	15:00-17:00	Poster session Exhibition				
	17:30-19:30					
Wednesday June 27	09:00-11:00	Poster session Exhibition	R3 See p.27	SY1 See p.65		R6 See p.31
	11:30-13:30					
	15:00-17:00	Poster session Exhibition				
	17:30-19:30		Postdeadline	A4		
Thursday June 28	09:00-11:00	Poster session Exhibition	R5 See p.47	SY1 See p.65		R6 See p.50
	11:30-13:30					
	15:00-17:00	Poster session Exhibition				
	17:30-19:30					
Friday June 29	09:00-11:00		R1 See p.63	R8 See p.64	A3 See p.96	
	11:30-13:30					
	15:00-17:00					
	17:30-19:30					

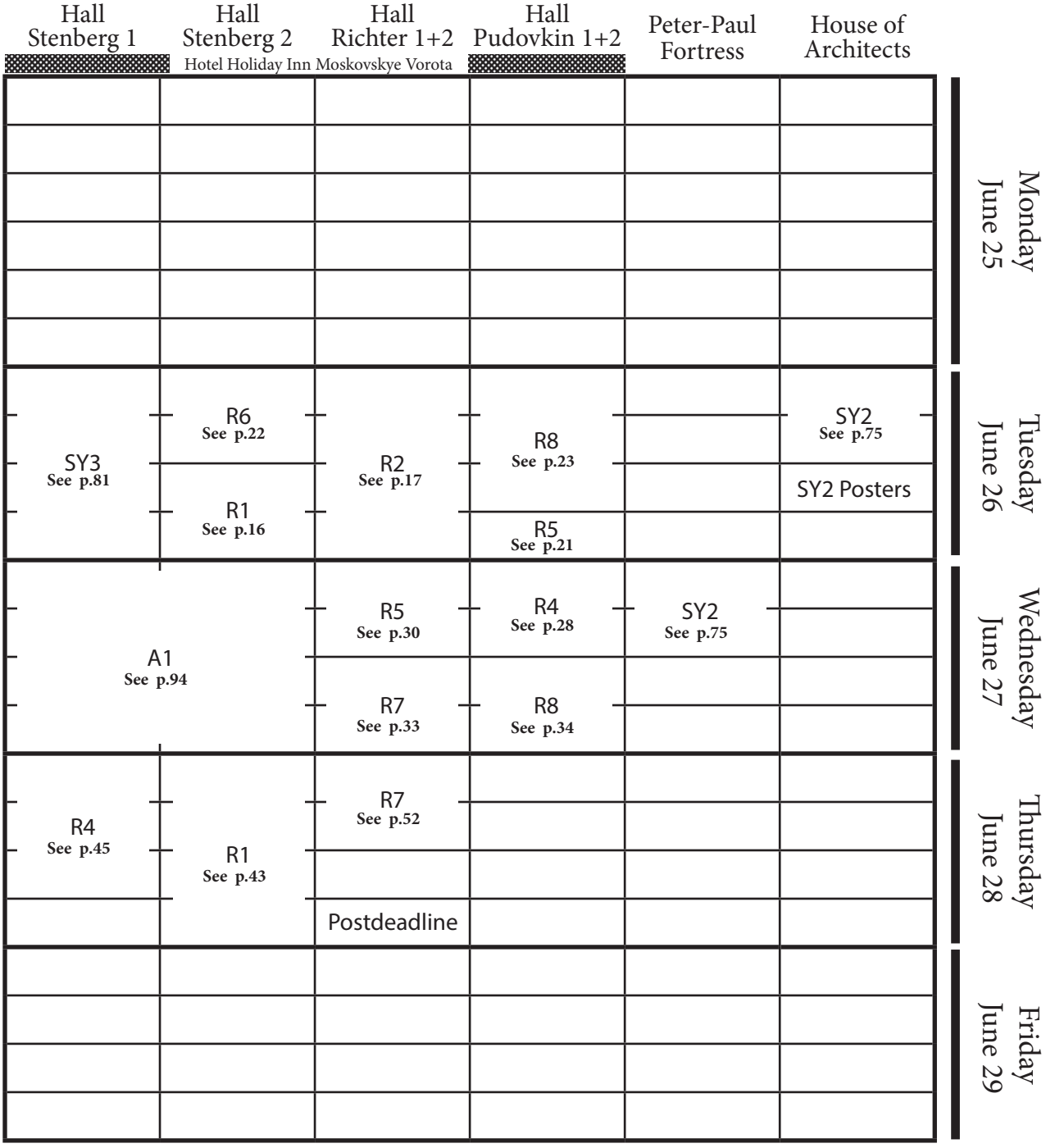
A1. Advanced laser technology in industrial applications (in Russian)
09:30, June 27th, Stenberg Hall

A2. French innovations in the field of optics and photonics (in French and Russian)
11:30, June 26th, Levinson Lounge.

A3. Nanostructured materials in industry and medicine (in Russian)
09:00 June 29th, Petrov-Vodkin 3 Hall

A4. Trends in scientific publishing.
17:30 June 27th, Petrov-Vodkin 2+3 Hall

PROGRAM AT-A-GLANCE



ThR1-p04

Tu = Tuesday,
We = Wednesday,
Th = Thursday,
Fr = Friday.

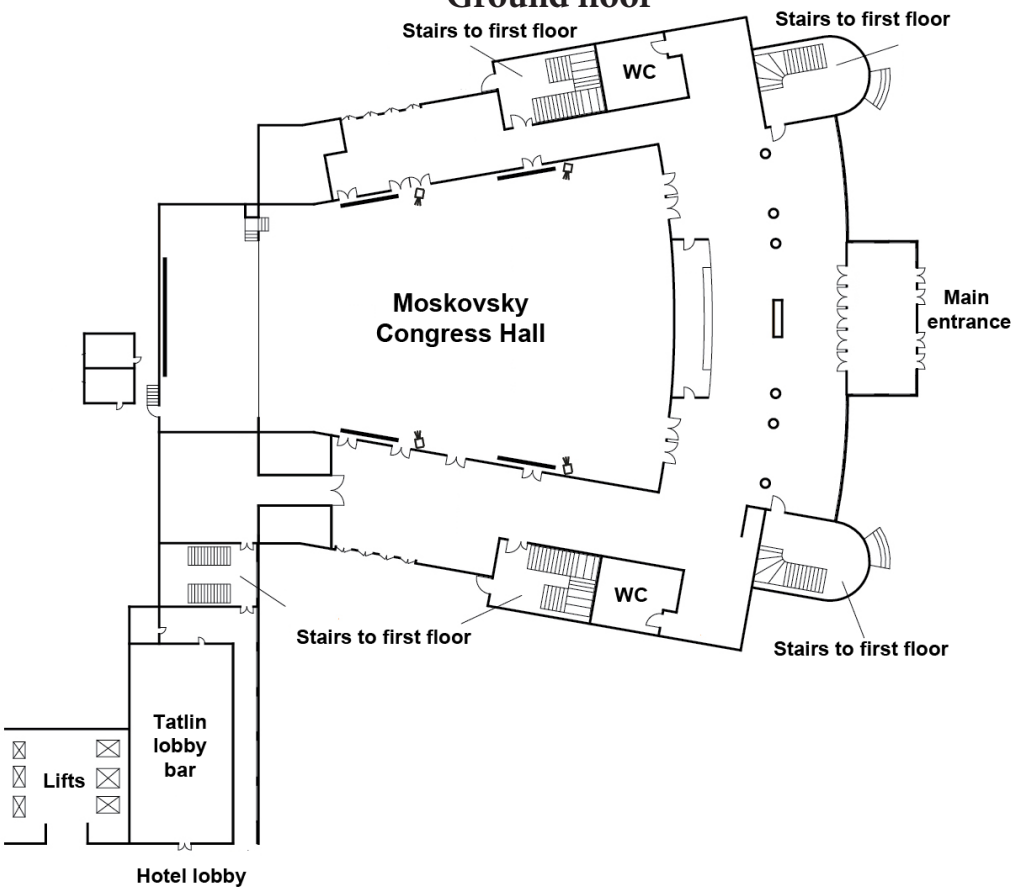
Paper number

For Posters Only

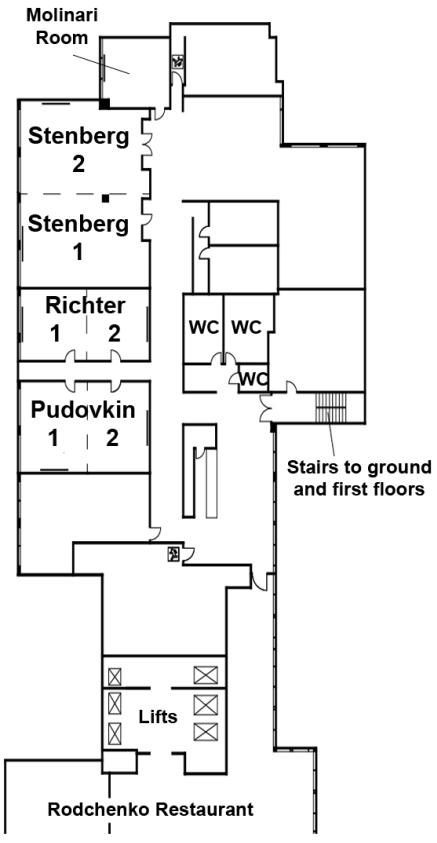
Session code

Holiday Inn Moskovskie vorota

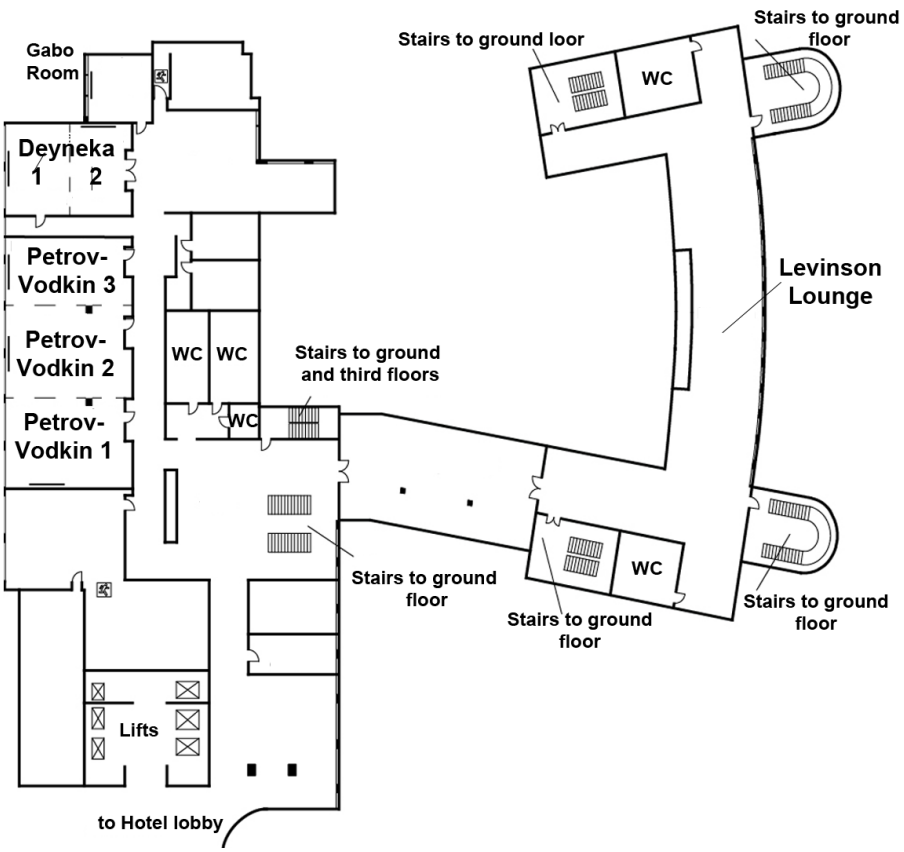
Ground floor



Second floor



First floor



June 25
Monday

CONGRESS HALL

PLENARY SESSION

10.30-11.00

OPENING OF THE CONFERENCE

V.N. Vassil'yev; St.Petersburg National Research University of ITMO, Russia

MoPL-01 Plenary **11:00-11:45**

THREE-PORT OPERATION OF TRANSISTOR LASER AND PHOTON ASSISTED TUNNELING SIGNAL MIXING

M. Feng and N. Holonyak, Jr.; Univ. of Illinois at Urbana-Champaign; United States

Employing quantum-wells (QWs) and cavity reflection, we re-invent the transistor with "stimulated" recombination process and realize a unique three-terminal laser. The recombination lifetime can be reduced to ~ 23 ps, thus, laser bandwidth can be realized toward 100 GHz. A tunnel junction is incorporated at collector for voltage-controlled modulation via intracavity photon assisted tunneling. Signal mixing is demonstrated by the nonlinear coupling at the base with base current and collector voltage modulations.

MoPL-02 Plenary **11:45-12:30**

LASER-TISSUE INTERACTION AT TISSUE OPTICAL CLEARING: ENHANCED IMAGING AND THERAPY

Valery V. Tuchin; Saratov State Univ., Inst. of Precise Mechanics and Control RAS, Russia; Univ. of Oulu, Finland;

In this lecture optical clearing of different tissues will be analyzed in the framework of receiving of more precise and valuable information from reflectance spectroscopy, polarization measurements, Raman spectroscopy, confocal microscopy, and optical coherence tomography (OCT), as well as from nonlinear spectroscopies, such as two-photon fluorescence and second harmonic generation (SHG).

MoPL-03 Plenary **12:30-13:15**

NEW HORIZONS OF FIBER LASERS

Valentin Gapontsev; IPG Photonics; United States

IPG Photonics have recently extended the power level for single and multimode mode fiber lasers to new highs. We will discuss these breakthroughs and future trends, along with the impact this will have on a number of important industrial applications. In addition a review of the world wide acceptance of Fiber lasers will be provided.

R1. Solid-State Lasers and Nonlinear Frequency Conversion

TuR1-01 Invited **15:00-15:30**

NOVEL HIGH-POWER AND HIGH-EFFICIENCY DIODE-PUMPED Tm:Lu_2O_3 CERAMICS LASERS AT 2.1 μm AND THEIR NONLINEAR FREQUENCY CONVERSION

O.L. Antipov[1], A.A. Novikov[1], S.Yu. Golovkin[1], A.P. Zinoviev[1], A.A. Lagatskii[2], V.S. Shiryaev[3], S.S. Balabanov3; 1-Inst. of Applied Physics RAS, Russia, 2-School of Physics and Astronomy, Univ. of St Andrews, UK, 3-Inst. of High-Purity Substances RAS, Russia; Russia

The presentation is an overview of our investigations of the lasers based on the novel Tm:Lu2O3 ceramics with diode pumping at 810 nm. CW, Q-switched and mode-locking oscillations at around 2.1 mcm were demonstrated. The nonlinear frequency conversion of the 2.1-mcm radiation was also studied.

TuR1-02 **15:30-15:45**

OPTIMIZATION OF CW AND Q-SWITCHED 2.1-μm LASERS BASED ON A NOVEL TM:LU_2O_3 CERAMICS WITH 810-NM DIODE PUMPING

A.A. Novikov, O.L. Antipov, S.Yu. Golovkin, A.P. Zinov'iev; Inst. of Applied Physics RAS; Russia

2.1 μm CW and Q-switched laser oscillators based on a novel Tm:Lu2O3 ceramics under direct diode pumping at 810 nm were investigated. The output power up to 40 W with optical-to-optical efficiency of 35% was demonstrated in CW-Regime. The average power of the Q-switched radiation reached 15 W, and peak power 30 kW.

TuR1-03 **15:45-16:00**

230 FS MODE-LOCKED THULIUM DOPED FIBER LASER BASED ON NONLINEAR AMPLIFYING LOOP MIRROR

M.A. Chernysheva, A.A. Krylov, P.G. Kryukov, E.M. Dianov; Fiber Optics Research Center RAS; Russia

We present a mode-locked thulium-doped fiber laser in a sigma configuration with the intracavity and external group velocity dispersion control generating 230 fs near transform- limited soliton-like pulses at 1860-1930 nm with 106 mW average output power.

TuR1-04 Invited **16:00-16:30**

FREQUENCY DIVIDE-AND-CONQUER APPROACH TO PRODUCING OCTAVE-WIDE MID-INFRARED FREQUENCY COMBS

K.L. Vodopyanov; Stanford Univ.; United States

I will talk about a new technique for extending the frequency combs to the highly desirable but largely inaccessible mid-IR spectral range, based on subharmonic optical parametric oscillation (OPO) - a reverse of second harmonic generation - where the frequency comb of a pump laser is transposed to its half frequency and simultaneously spectrally broadened, thanks to the enormous parametric gain bandwidth at the OPO degeneracy. Using ultrafast fiber lasers as a pump, we produce octave-wide frequency combs in the 2.5 - 6 micron range with up to 40% quantum efficiency. The frequency comb is phase-locked to the pump laser and has other intriguing coherence properties. I will also talk about applications in ultra-sensitive molecular spectroscopy.

TuR1-05 Invited **16:30-17:00**

HIGH-EFFICIENT TUNABLE LASERS BASED ON Cr:ZnSe AND Cr:CdSe CRYSTALS WITH PULSE-PERIODIC PUMPING

O.N. Eremeykin[1,2], A.P. Savikin[1], A.S. Egorov[1], K. Yu. Pavlenko[1], E.M. Gavrishchuk[2], S.S. Balabanov[2], S.A. Rodin[2]; 1-Lobachevsky Nizhny Novgorod State Univ.; 2-Devyatykh Inst. of Chemistry of High-Purity Substances RAS; Russia

The results of characteristics study of lasers based on a diffusion Cr-doped CdSe crystal and CVD-ZnSe pumped by Q-switched diode-pumped Tm:YLF-laser at 1908 nm are presented. Spectral and power characteristics were investigated. The lasing properties dependency on active medium and selective cavity parameters were under research.

- COFFEE BREAK -

TuR1-06 **17:30-17:45**

DESIGN OF HIGH ENERGY OPCPA FOR 10PW CLASS SYSTEMS ON LARGE APERTURE LBO CRYSTALS

X. Zeng; Science and Technology on Plasma Physics Laboratory; China

A multi-petawatt laser system based on OPCPA was designed with LBO crystals serving as the final amplification stage. The front-end system and pre-amplifiers system of the 10-PW laser system have been developed. The maximum OPA output energy is greater than 6J,and the conversion efficiency is greater than 20%.

TuR1-07 **17:45-18:00**

DESIGN OF OPTICALLY SYNCHRONIZED CPA PUMPING AND OPCPA CHANNELS OF FEMTOSECOND DIODE-PUMPED Yb-LASER SYSTEM

V.V. Petrov, E.V. Pestryakov, V.I. Trunov, S.A. Frolov, A.V. Kirpichnikov, M.A. Merzliakov, A.V. Laptev, K.V. Polyakov; Inst. of Laser Physics SB RAS; Russia

Development of laser system based on the amplification of femtosecond pulses of master Yb:Y2O3 ceramic laser with beam splitting to two channels is discussed. There are OPCPA-channel of parametric amplification of femtosecond laser seed in LBO crystals and optically synchronized with it CPA-channel based on cooled to cryogenic temperatures diode-pumped Yb-laser media, forming the picosecond pulses to pump parametric amplifiers of OPCPA-channel.

TuR1-08 **18:00-18:15**

INTRACAVITY PULSE SHORTENING THROUGH NONLINEAR POLARIZATION EVOLUTION IN THE ERBIUM-DOPED CNT MODE-LOCKED SOLITON FIBER LASER

D.S. Chernykh[1], A.A. Krylov[1], M.A. Chernysheva[1], A.A. Ogleznev[1], E.M. Dianov[1], E.D. Obraztsova[2], N.R. Arutunan[2], A.S. Pozharov[2], S.V.Grebenyukov[2]; 1-Fiber Optics Research Center RAS, 2-Prokhorov General Physics Inst. RAS; Russia

We have demonstrated pulse shortening by implementing the nonlinear polarization evolution mechanism inside the ring cavity of the carbon nanotubes mode-locked erbium- doped soliton fiber laser. The shortest pulse width obtained was 220 fs at a spectrum width of 10.4 nm and an average output power of 9 mW.

TuR1-09 **18:15-18:30**

SPECIFICITY OF DEVELOPING OF HIGH POWER DISK LASER AT CRYOGENIC AND ROOM TEMPERATURE CONDITIONS

I. Kuznetsov, I. Mukhin, O. Palashov; Inst. of Applied Physics RAS; Russia

Theoretical model of thermal management and oscillating in Yb:YAG thin disk laser is developed. It helps to design two laser heads for high power applications under cryogenic and ambient conditions. Continuous-wave, Q-switched and mode-locked regimes are tried at room temperature. Disk laser with 50% slope efficiency and 50 W output power is realized in quasi-continuous-wave regime at room temperature.

TuR1-10 **18:30-18:45**

THE THIRD HARMONIC FREQUENCY CONVERTER FOR SHENGUANGII UPGRADE

L. Ji; Shanghai institute of laser and plasma; China

We have designed a frequency converter for the ShengGuangII upgrade laser with type I doubler and the type II tripler, it can convert 5000J fundamental laser to 3000J the third harmonics with 31cmx31cm aperture and 3ns pulse. Some results have been testified by the experiment in the SGII NO.9 laser system.

TuR1-11 Invited **18:45-19:15**

MULTICASCADE GENERATORS OF SECOND HARMONIC OF BROADBAND LASER RADIATION

N.F. Andreev, K.V. Vlasova, V.S. Davydov, S.M. Kulikov[1], A.I. Makarov, S.A. Sukharev[1], G.I. Freidman, S.V. Shubin; Inst. of Applied Physics RAS; 1-Russian Federal Nuclear Center - VNIIEF; Russia

A new scheme of a second harmonic (SH) multicascade generator of CW broadband radiation with compensation of group velocity mismatch is theoretically and experimentally investigated. The effect of a coherent addition of a SH radiation is demonstrated in two- and three cascade schemes. It allows to expect a high conversion efficiency (~30% or 180W).

TuR1-12 **19:15-19:30**

HIGH POWER DIODE-PUMPED Yb:YALO$_3$ LASER

S.V. Kurilchik, V.E. Kisel, A.S. Yasukevich, N.V. Kuleshov, S.A. Smirnova; Belarusian National Technical Univ., Belarus; Russian Research Inst. for the Synthesis of Materials, Russia;

Efficient Yb:YAlO3 laser operation has been demonstrated with output power >5W and tuning range from 1000 to 1050 nm under laser diode pumping. Fiber coupled and free space laser diodes were used as pump sources. Maximum slope efficiency was estimated to be 70.7 %.

R2. High Power Gas Lasers

TuR2-01 Invited **09:00-09:30**

ALKALI VAPOR LASERS: HISTORY, CURRENT STATE AND PERSPECTIVES

B.V. Zhdanov; US Air Force Academy, Laser and Optics Research Center; United States

A review of the history of research and development in the field of optically pumped alkali vapor lasers and discussion of the most important achievements and existing problems in this field are presented in this talk.

TuR2-02 Invited **09:30-10:00**

DIODE-PUMPED CESIUM VAPOUR LASER WITH CLOSED-CYCLE LASER-ACTIVE MEDIUM CIRCULATION

A.V. Bogachev, S.G. Garanin, A.M. Dudov, V.A. Yeroshenko, S.M. Kulikov, G.T. Mikaelian, V.A. Panarin, V.O. Pautov, A.V. Rus, S.A. Sukharev; Russian Federal Nuclear Center - VNIIEF; Russia

The creation of a cesium vapor laser with closed-cycle circulation of the laser-active medium is first reported. The power of the laser radiation amounted to ~1 kW with the 'light-to-light' conversion efficiency of ~48 %. Quasi-two-dimensional computational model of the laser operation that provides adequate description of experimental results is considered. Calculated and experimental dependences of the laser radiation power on the temperature of the cuvette walls, laser medium pressure and pump power are presented.

TuR2-03 Invited **10:00-10:30**

OPTICAL HETERODYNE MEASUREMENTS OF FLIGHT VELOCITY OF PLATES ACCELERATED BY HIGH EXPLOSIVE

V. Baranov; Russian Federal Nuclear Center - VNIIEF; Russia

Abstract is not available.

TuR2-04 Invited **10:30-11:00**

HIGH-POWER LASER PROPULSION

Yu.A. Rezunkov; Inst. of Complex Testing; Russia

We consider the development of new transportation systems based on high power laser propulsion (HPLP). The characteristic feature of laser propulsion is that the effects responsible for a thrust production are switched on under the action of high power laser radiation. These effects are: a) laser ablation, b) laser breakdown of gases, and c) laser detonation of energy materials. Our analysis show the optimal thrust characteristics are achieved if an oxygenic polymer such as polyformaldehyde (POM) is used to produce high power laser propulsion. New supersonic laser propulsion engine operating in upper layers of the Earth atmosphere or in space is suggested too. Analysis of the interaction of a laser ablation jet with supersonic flows is given to prove an engineering feasibility of the supersonic laser propulsion engine.

- COFFEE BREAK -

TuR2-05 Invited **11:30-12:00**

REVISITING MECHANISMS OF I2 DISSOCIATION IN THE CHEMICAL OXYGEN-IODINE LASER USING THREE- AND ONE- DIMENSIONAL COMPUTATIONAL FLUID DYNAMICS MODELING

B. D. Barmashenko, I. Brami-Rosilio, K. Waichman and S. Rosenwaks; Ben-Gurion Univ. of the Negev; Israel

Heidner-Lilenfeld-Azyazov-Heaven-Pichugin mechanism of I2 dissociation is revisited taking into account recent observations of the small populations of vibrationally excited levels of O2. It is shown that one-dimensional model can be used instead of much more complicated three- dimensional models for estimates of the working parameters of supersonic COILs.

TuR2-06 Invited **12:00-12:30**

RESEARCHES IN COIL LASER IN RFNC-VNIIEF

B. Vyskubenko; Russian Federal Nuclear Center - VNIIEF; Russia

Abstract is not available.

TuR2-07 **12:30-12:45**

CHEMICAL OXYGEN –IODINE LASER IN RFNC-VNIIEF

A.A.Adamenkov, V.V.Bakshin, L.A.Vdovkin, S.D.Velikanov, B.A.Vyskubenko, Yu.N.Deryugin, D.K.Zelensky, S.P.Il'in, Yu.V.Kolobyanin; Russian Federal Nuclear Center - VNIIEF (ILFI); Russia

Results of experimental and theoretical investigations of chemical oxygen-iodine laser energetic and spatial characteristics being conducted for two recent years in RFNC-VNIIEF are represented. We show the results of unstable resonator investigations held on setup COIL with six-pass unstable resonator with magnifying factor M=2. The obtained laser radiation power is ~15 kW with divergence ~4*10-4. That corresponds to ~5*1013 W/(sr.*m2) of COIL brightness. We represent the results for energetic and spatial characteristics of COIL radiation simulations with helium and nitrogen as bath and carrier gases.

TuR2-08 Invited **12:45-13:15**

DIRECTLY SOLAR PUMPED OXYGEN-IODINE LASER (FOIL-OIL)

O.B.Danilov, M.S.Yur'ev; Inst. for Laser Physics, Vavilov State Optical Inst.; Russia

Abstract is not available.

- LUNCH BREAK -

TuR2-10 Invited **15:00-15:30**

APPLICATION OF NONLINEAR PROCESSES FOR THE CONTROLLING OF PHOTO DISSOCIATION LASERS

G.G.Kochemasov, S.M.Kulikov, S.A.Sukharev; Russian Federal Nuclear Center - VNIIEF; Russia

The investigation results of the effect of optical phase conjugation (OPC) of radiation of photodissociation iodine laser pumped by shock wave front light at stimulated scattering in compressed gases are presented. Its application enabled to focus radiation into a spot having size of the order of wavelength. Radiation conversion to the second harmonic and a competition of nonlinear processes (SBS, SRS, optical breakdown) is also considered.

TuR2-11 Invited **15:30-16:00**

TRIGGERING AND GUIDING ELECTRIC DISCHARGE BY A TRAIN OF SUB-TW ULTRASHORT UV PULSES

A.A.Ionin, S.I.Kudryashov, A.O.Levchenko, L.V.Seleznev, A.V.Shutov, D.V.Sinitsyn, I.V.Smetanin, N.N.Ustinovsky, V.D.Zvorykin; Lebedev Physical Inst. RAS; Russia

Non-self-sustained electric discharge and electric breakdown were triggered and guided by a train of ultrashort sub-TW UV pulses overlapped with a long (~100ns) free-running UV pulse of a hybrid Ti:Sapphire-KrF laser facility. Photocurrent sustained by this train is two orders of magnitude higher, and electric breakdown distance is twice longer than those for the discharge triggered by the long UV pulse only.

TuR2-12 Invited **16:00-16:30**

AMPLIFICATION OF A TRAIN OF UV PICOSECOND SUBTW PULSES COMBINED WITH A 100-NS PULSE AT GARPUN-MTW KRF LASER FACILITY

V.D. Zvorykin, A.A. Ionin, A.O. Levchenko, L.V. Seleznev, A.V. Shutov, D.V. Sinitsyn, I.V. Smetanin, N.N. Ustinovskii; Lebedev Physical Inst. RAS; Russia

A train of UV picoseconds pulses with subTW peak power being combined with 30-J, 100-ns pulse of a free-running oscillation was produced at hybrid Ti:Sapphire/KrF GARPUN- MTW laser facility when a preliminary amplified train of short pulses was injected into unstable resonator cavity of the main e-beam-pumped KrF amplifier. The advantages of combined radiation for production of long-lived extended plasma channels and HV discharge triggering were demonstrated: photocurrent sustained by the combined pulse is two orders of magnitude higher and HV breakdown distance is twice longer than for the long UV pulse only.

TuR2-13 Invited **16:30-17:00**

THE PROSPECT OF VUV THE INERT GAS LASERS

G.Gerasimov, B.Krylov; Vavilov State Optical Inst.; Russia

The prospects of a narrow spectral bans amplification of inert gas active media are discussing in present publication. The new possibility of laser action is analyzing with experimental results of difference authors.

- COFFEE BREAK -

TuR2-14 **17:30-17:45**

USING OF OPTICAL PYROMETRY FOR MONITORING GAS-ASSISTED LASER CUTTING

Yu.N. Zavalov, V.D. Dubrov, N.G. Dubrovin, A.N. Antonov; Inst. on Laser and Information Technologies RAS; Russia

Measurements of the temperature of the melt on the front of CO2 laser cutting by pyrometer have been performed. The results experimental data are reported for different values of cutting speed and assisted gas pressure. The obtained results show that relying upon the measurements of the brightness temperature average values and fluctuation amplitude, it is not possible to solve the so-called inverse problem, e.g. to find out the cutting speed from the data of statistical sampling.

TuR2-15 **17:45-18:00**

LASER WITHOUT INVERSION ON COPPER VAPOR

S.A. Pulkin, A.S. Sumarokov, Yu.I. Anisimov, E.L. Ryabchikov; St.Petersburg State Univ.; Russia

The new source for copper laser proposed - electrodynamics dispersing systems (EDDSs). The numerical simulation of copper laser gain and lasing without inversion has been made. The two problems were researched: 1) the usual laser without inversion on ?-configuration with incoherent pump on the transition 1 - 2 (λ = 325.0 nm) and strong monochromatic coherent field on transition 2 - 3 (λ = 510.6 nm); 2) coherent modulated strong field on ? = 510.6 nm and lasing on transition 1 - 2 (λ = 325.0 nm) because new parametric polarization sources. The calculations with real experimental parameters for copper medium (N0 = 10^18 cm-3) in special copper source were made.

TuR2-16 **18:00-18:15**

CONSOLIDATED SECOND HARMONIC, SUM AND DIFFERENCE FREQUENCY GENERATION OF THE CO LASER RADIATION IN SINGLE $ZnGeP_2$ CRYSTAL

A. Ionin, I. Kinyaevsky, Yu. Klimachev, A. Kozlov, A. Kotkov, Yu. Andreev, G. Lanskii, A. Shaiduko, A. Soluyanov; Lebedev Physical Inst. RAS, Inst. of Monitoring of Climatic and Ecological Systems SB RAS, NRNU "MEPhI"; Russia

For the first time, consolidated second harmonic, sum and difference frequency generation of the multiline CO laser radiation in single ZnGeP2 crystal was obtained. Second harmonic and sum frequency radiation had ~110 lines within interval of 2.45-2.85 micron with generation internal efficiency ~7%. Difference frequency radiation had ~80 lines within interval of 4.3 - 4.9 micron with generation internal efficiency ~0.5%.

TuR2-17 **18:15-18:30**

RADIO FREQUENCY EXCITED PLANAR IR-LASERS

A. P. Mineev, S.M. Nefedov, P.P. Pashinin, P.A. Goncharov, V.V. Kiselev, A.P. Drozdov; Prokhorov General Physics Inst. RAS; Russia

We study the output characteristics of radiation of the planar CO2-, CO- and Xe-lasers, created on the basis of the same design. A cw radiation CO2-laser power reaches up to 100 W and (efficiency ~ 10%). CO-laser output power of 70 W (10% efficiency; 5-6 μm) and first overtone with of 0,2 W (efficiency ~0,2%; 2.5-3 μm) was achieved. Maximum output power for Xe-laser 4 W (~0,7% efficiency; 2-3.5 μm) was achieved.

TuR2-18 **18:30-18:45**

GAIN SATURATION IN MASTER OSCILLATOR - POWER AMPLIFIER CARBON MONOXIDE LASER SYSTEM EMITTING NANOSECOND PULSES

A.A. Ionin, I.O. Kinyaevsky, Yu.M. Klimachev, A.A. Kotkov, A.Yu. Kozlov; P.N.Lebedev Physical Institute RAS; Russia

A Master Oscillator - Power Amplifier CO-laser system emitting nanosecond pulses was developed on the basis of the wide-aperture pulsed electron-beam-sustained-discharge CO- laser facility. Amplification parameters including gain and saturation intensity were measured. This laser system emitted a train of nanosecond pulses with peak power up to ~0.1 MW on a single spectral line and up to ~0.4 MW with multiline spectrum.

TuR2-19 **18:45-19:00**

CO2 LASER MARKING SYSTEM FOR PRINTING ELECTRIC CABLES INLINE-PROCESSING

S.Messaoud[1], M.Traiche[1], F.Siserir[1], Y.Boucetta[1], A.Senadjki[1], B.Guedouar[1], H.Okay[2]; 1-Center of Development of Advanced Technologies (CDTA), 2-Bestcable; Algeria

In this paper, we present the design of a RF-Excited CO2 Laser Marking System for Printing Electric Cables inline- Processing. It consists of: RF-excited CO2 Laser operating at 10.6 μm in pulsed mode, a rotating mask with character or number apertures as masks disposed all around at regular steps, a pivoting mirror for scanning the beam parallel to the running direction of the cable, a system of mirrors for steering the beam, a focal lens, a rotary encoder, a sensor to detect possible defects in the cable and PC .

TuR2-20 **19:00-19:15**

MODELING OF GAS FLOW DIODE PUMPED ALKALI LASERS – DEPENDENCE OF THE OPERATION ON THE GAS VELOCITY AND ON THE NATURE OF THE BUFFER GAS

B. D. Barmashenko and S. Rosenwaks; Ben-Gurion Univ. of the Negev; Israel

A simple, semi-analytical model of diode pumped alkali lasers (DPALs), applicable to both static and gas flow devices, is reported. The model takes into account the rise of temperature in the lasing medium with increasing pump power, resulting in decreasing pump absorption and slope efficiency.

R3. Semiconductor Lasers, Materials and Applications

TuR3-01 Invited **09:00-09:30**

RECENT PROGRESS IN GaAs AND InP BASED QUANTUM DOT MATERIAL FOR HIGH POWER AND TELECOM APPLICATIONS

J.P. Reithmaier; INA, Univ. Kassel; Germany

An overview will be given about our recent progress in GaAs and InP based QD lasers dedicated for 920 / 1060 nm high power as well as 1.55 µm telecom applications.

TuR3-02 Invited **09:30-10:00**

PROGRESS IN QUANTUM DOT TECHNOLOGY

D. Livshits, A. Gubenko, M. Khomylev, I. Krestnikov, S. Mikhrin, V. Mikhrin, A. Shkolnik; Innolume GmbH; Germany

Significant progress in InAs/GaAs quantum dot based devices covering 1100- 1320nm range is being reported. Wavelength stabilized high power lasers, Single Frequency External Cavity Lasers, DFB lasers, broadly tunable Gain Chips and low noise Comb-laser considered in respect of principles, technology, performance and applications.

TuR3-03 Invited **10:00-10:30**

ADVANCED SELF-ASSEMBLED InAs QUANTUM DOT LASERS

M. Sugawara[1,2] and Y. Arakawa[1-3]; 1-QD Laser, Inc., 2-Inst. for Nano Quantum Information Electronics, the Univ.of Tokyo, 3-Inst. of Industrial Science, the Univ.of Tokyo; Japan

This talk provides advanced self-assembled InAs quantum dot lasers, including the state-of-the-art self-assembling growth of high-density and highly-uniform InAs quantum dots, mass-production for optical communication, and extremely high-temperature operation up to 220 C. We also introduce high-speed 1064nm DFB lasers as well compact visible laser modules of green, yellow-green, and orange based on long-wavelength DFB lasers with SHG.

TuR3-04 **10:30-10:45**

THE ANALYTICAL THEORY OF WIDE LASING SPECTRA IN QUANTUM DOT LASERS

V.V. Korenev[1], A.V. Savelyev[1,2], A.E. Zhukov[1,2,3], A.V. Omelchenko[1,2], M.V. Maximov[1,3], Yu. M. Shernyakov[1,2]; 1-St. Petersburg Academic Univ., 2-St.Petersburg State Polytechnical Univ., 3-Ioffe Physical Technical Inst. RAS; Russia

An analytical theory of wide spectrum quantum dot laser is presented that includes both ground (GS) and excited (ES) states, inhomogeneous broadening, gain compression and independent electron/hole captures. Temperature and power dependencies of spectral width of laser emission, spectra of simultaneous GS/ES lasing and influence of p-doping of active media have been thoroughly analyzed in the frame of suggested approach.

TuR3-05 **10:45-11:00**

STABILITY PROPERTIES OF A DUAL WAVELENGTH OPERATION IN QUANTUM DOT LASERS

M.M.Abusaa[1,3], E.A.Viktorov[2], T.Erneux[2], J.Danckaert[1]; 1-Vrije Universiteit Brussels, Belgium, 2-Optique Nonlineaire Theorique, Universite Libre de Bruxelles, Belgium, 3-Arab American University-Jenin, Palestine

We consider stability properties of quantum dot laser simultaneously operating at the ground state and the excited state. We show how the two-state operation modifies the relaxation oscillation frequency and damping rate.

- COFFEE BREAK -

TuR3-06 Invited **11:30-12:00**

FRONTIERS OF INTERSUBBAND QUANTUM CASCADE LASERS

M. Razeghi; Northwestern Univ.; United States

The InP based quantum cascade technology has demonstrated its superior capability from mid-IR to THz. Recently has been developed InP based mid-IR QCL devices around wavelengths of 4.6-5 µm with the wall plug efficiency pushed up to 21% (5 W) in room temperature cw operation and 27% in room temperature pulsed mode operation, and 53% in low temperature pulsed mode operation.

TuR3-07 Invited **12:00-12:30**

DISPERSIVE GAIN IN INTERSUBBAND OPTICS

M.F. Pereira[1,2]; 1-Materials and Engineering Research Institute, Sheffield Hallam University, S1 1WB Sheffield UK; 2-Department of Physics, Jazan University, P.O. Box 114, Jazan KSA; United Kingdom

Intersubband emitters like the Quantum Cascade Laser (QCL) are key devices for Mid Infrared lasing and can become the dominating source of THz radiation if solutions can be found for room temperature operation without cryocooling. Intersubband Lasing Without Inversion (ISB LWI) is a potential solution for the main microscopic difficulty at low THz frequencies, since it is difficult to achieve population inversion. LWI in ISB emitters typically leads to a dispersive gain shape and it has been recently demonstrated that depending on the energy dispersion characterizing the upper and lower lasing subbands, the gain lineshape can be distorted from the usual dispersive shape or be strongly dispersive. In this paper we focus on dispersive ISB gain media and investigate their impact on Intersubband Polaritons and Antipolaritons, the linewidth enhancement (alpha) factor and finally the quantum optical input-output relations for such media.

TuR3-08 Invited **12:30-13:00**

RECENT PROGRESS IN InAs-BASED QUANTUM CASCADE LASERS.

A.N. Baranov, R. Teissier, M. Bahriz, P. Laffaille; Inst. d'Electronique du Sud; France

The current state-of-the-art in InAs/AlSb quantum cascade lasers will be presented. Specific properties of this material system allowed us to obtain the shortest emission wavelength for this class of semiconductor lasers. These materials are also attractive for the development of long wavelength QCLs. We demonstrated InAs-based QCLs emitting at wavelengths up to 20 µm. Prospects of further improvement of InAs-based QCLs will be discussed.

TuR3-09 Invited **13:00-13:30**

InGaAs QUANTUM WELL LASER WITH WAVELENGTH (1.6-2.0 µm) FOR APPLICATION IN TUNABLE LASER ABSORPTION

J.Q Pan, H.Y Yu, X.L Zhou, D.B Zhou, B.J Wang, J Bian, X An, H.L Zhu, L.J Zhao, and W Wang; Inst. of Semiconductors, Chinese Academy of Sciences; China

The high strained Quantum well DFB laser emitting at 1.6-1.9 micron wavelength has good tunable wavelength by current and temperature. To achieve a more sensitive measurement and filter out noise, a method called "second harmonic phase-sensitive detection" is used in TDLAS system. Now the application of TDLAS in coal mine, natural gas leakage detection, electric power company is beginning.

- LUNCH BREAK -

TuR3-10 Invited **15:00-15:30**

BOTTOM-UP PHOTONIC CRYSTAL CAVITIES LASER

D. Huffaker; Univ. of California; United States

Abstract is not available.

TuR3-11 Invited **15:30-16:00**

BROADBAND NONLINEAR SIGNAL PROCESSING IN SILICON NANOWIRES

K. Yvind; M. Pu; J. Hvam; H.Ch.H. Mulvad; H. Hu; H. Ji; M. Galili; P. Jeppesen; E. Palushani, A. Clausen, L. Oxenlowe; DTU Fotonik; Denmark

The fast non-linearity of silicon allows Tbit/s optical signal processing. By choosing suitable dimensions of silicon nanowires their dispersion can be tailored to ensure a high nonlinearity at power levels low enough to avoid significant two-photon abso We have fabricated low insertion and propagation loss silicon nanowires and use them to demonstrate the broadband capabilities of silicon.

TuR3-12 **16:00-16:15**

THE MODELING OF COMB SPECTRUM STABILITY IN QUANTUM DOT LASERS

A.V. Savelyev, M.V. Maximov, A.E. Zhukov; St. Petersburg Academic Univ.; Russia

A quantum dot laser (QDL) in the regime of continuous emission of broad spectrum is studied. It is argued that conventional theoretical approach can not explain experimentally observed spectrum stability i.e. uniform power distribution between modes and low intensity noise of individual modes. The theory of spatial interaction between modes in QDL is developed in order to discuss this contradiction.

TuR3-13 **16:15-16:30**

FAST MODULATORS OF HIGH OPTICAL POWER BASED ON MODE SWITCHING EFFECTS IN SEMICONDUCTOR LASERS

S.O.Slipchenko, A.A.Podoskin, A.Yu.Leshko, A.V.Rozhkov, N.A.Pikhtin, I.S.Tarasov; Ioffe Physical Technical Inst. RAS; Russia

Mode switching effects in semiconductor lasers based on asymmetric heterostructure with low internal optical losses have been investigated and physical principles of new type fast modulator of high optical power have been developed for the first time. Switching efficiency of 30 W/A, peak pulse output optical power of 10W with rise and fall time of 300ps was demonstrated.

TuR3-14 Invited **16:30-17:00**

QUANTUM DOT BASED DEVICES FOR BROADBAND EMITTERS AND AMPLIFIERS FOR BIOMEDICAL IMAGING

R.A. Hogg[1,2], S.J. Matcher3, N. Krstajic[3], D.T.D. Childs[1], M. Hugues[2], Z.Y. Zhang[1], N. Peyvast[1], M.A. Majid[1], P.D.L. Greenwood[1], S.C. Chen[1], K. Zhou[1], K.Kennedy[2], K.M. Groom[1], D. Livshits[4], A. Shkolnik[4], I. Krestnikov[4]; 1-Department of Electronic and Electrical Engineering, Univ. of Sheffield, UK; 2-EPSRC National Centre for III-V Technologies, Department of Electronic and Electrical Engineering, Univ. of Sheffield, UK; 3-Department of Materials Science and Engineering, Univ. of Sheffield, UK; 4-Innolume GmbH, Germany

Rrecent work on the development of quantum dot based superluminescent diodes and semiconductor optical amplifiers for imaging of skin tissue will be presented. This includes the fabricated device design, selective area intermixing, optimising the quantum dot epitaxy, and the use of hybrid quantum well/quantum dot structures.

- COFFEE BREAK -

TuR3-15 Invited **17:30-18:00**

PHOTONIC CRYSTAL VCSELS AND COHERENT ARRAYS

K.D. Choquette; Univ.of Illinois; United States

The past 30 years of VCSEL development has enabled high performance/low cost lasers for communication and sensing applications. Future applications will demand even better performance and new functionality. We will report on our recent efforts to develop high speed single mode photonic crystal VCSELs, as well as coherently coupled anti-guided 2-dimensional VCSEL arrays.

TuR3-16 **18:00-18:15**

LASING IN ø6-μm QUANTUM DOT MICRORING AT 107°C

N.V.Kryzhanovskaya[1], M.V.Maximov[2,1], A.M.Nadtochiy[1], I.A.Slovinskiy[2,1], M.M.Kulagina[2], Yu.M.Zadiranov[2], S.I.Troshkov[2], A.V.Savel'ev[1], E.M.Arakcheeva[1], A.E.Zhukov[1,2], D.Livshits3; 1-St. Petersburg Academic Univ., 2-Ioffe Physical Technical Inst., Russia, 3- Innolume GmbH, Germany; Russia

Ground-state lasing ($\lambda > 1.3$ μm) is demonstrated well above root temperature (up to 380 K) in a microring laser (6-μm in diameter) with InAs/InGaAs quantum dots.

TuR3-17 **18:15-18:30**

2 W 1.2 μm FLIP-CHIP QUANTUM DOT SEMICONDUCTOR DISK LASER

A. Rantamäki, J. Rautiainen, L. Toikkanen, I. Krestnikov[1], M. Butkus[2], E. Rafailov2, and O. Okhotnikov; Tampere Univ. Technol., Finland; 1-Innolume GmbH, Germany; 2-Univ. Dundee, United Kingdom

We present a flip-chip quantum dot semiconductor disk laser operating at 1200 nm with 2 W of output power. The low-loss flip chip geometry is shown to enable a relatively high output coupling ratio and undisturbed output spectrum. These features indicate that this design allows building a low-loss cavity which is particularly important for quantum dot semiconductor disk lasers.

TuR3-18 **18:30-18:45**

MODELLING OF SURFACE-PLASMON-POLARITON SUBWAVELENGTH MICRODISK LASERS

A.V. Naumenko, N.A. Loiko, V.V. Kabanov; Stepanov Inst. of Physics NAS Belarus; Belarus

Surface-plasmon-polariton guided modes of metal-caped microdisk lasers are analyzed. Their quality Q-factor, frequencies, spatio-temporal profiles, threshold gains of the active layer and confinement factor are determined by numerical simulations of full vectorial Maxwell equations as well as by analytical approaches. Dependencies of these characteristics are found versus azimuthal (radial) mode index, plasmon frequency (material absorption) and cavity geometrical sizes.

TuR3-19 **18:45-19:00**

DYNAMICAL MODEL OF POLARIZATION-CONTROLLED VERTICAL CAVITY SURFACE EMITTING LASER

S.E. Grigas, A.G. Rzhanov; Lomonosov Moscow State Univ.; Russia

Analysis of VCSEL polarization control is performed using numerical solution of rate equations describing the dynamics of photon concentration and inversion population. It is shown that by using of structures with polarization-dependent reflectivity stable single polarization mode can be achieved.

TuR3-20 Invited **19:00-19:30**

HIGH POWER QUANTUM DOT SEMICONDUCTOR DISK LASER

O.G. Okhotnikov; Tampere Univ. of Technology; Finland

The recent achievements of 1180 nm - 1260 nm Stranski-Krastanov quantum dot semiconductor disk lasers operating either at the ground or the excited state were overviewed. Frequency doubling using multiple-gain laser geometry was demonstrated to be practical solution for quantum dot based gain media. Intracavity heat spreader and thinned flip-chip structures are studied and compared.

R5. Super-Intense Light Fields and Ultra-Fast Processes

TuR5-01 Invited **17:30-18:00**

REACHING THE HEISENBERG-SCHWINGER LIMIT WITH X-RAYS

Ch.K. Rhodes; Univ. of Illinois at Chicago; United States

The history of high-intensity nonlinear interactions, that commenced in 1961 with the observation of second harmonic radiation at 347.2 nm in crystalline quartz, spans a range of ~ 1018 in experimental intensity and remains a stable, robust province of laser-based research after a half century. The generation of focal intensities in the 1020-1021 W/cm2 range is presently a routine achievement. Over a period of ~ 25 years, a path of research was cut through this field of nonlinear phenomena that led to the development of a multikilovolt (~ 4.5 keV) x-ray amplifier of exceptional peak brightness that is excited by femtosecond KrF* (248 nm) pulses and whose experimentally based power scaling limit for a compact laboratory instrument falls in the multipetawatt realm The existence of advanced high-energy KrF* technology, that has been independently developed for fusion applications, could be readily adapted to extend the coherent x-ray power level into the 200 - 500 PW regime. The derivation of an elementary figure of merit shows that attainment of an intensity corresponding to the Schwinger/Heisenberg Limit (~ 4.6 x 1029 W/cm2) is significantly facilitated by the use of coherent x-ray sources in the kiloelectronvolt regime. For the Xe(L) system at ~ 4.5 keV, a minimum pulse energy of ~ 1.5 J and corresponding peak power P0 ~ 300 PW are estimated.

TuR5-02 Invited **18:00-18:30**

RELATIVISTIC NANO-PLASMA PHOTONICS

A.A.Andreev; Inst. for Laser Physics, Vavilov State Optical Inst.; Russia

Relativistic nano-plasma photonics is a field, which deals with optical processes in plasma at the scale, much smaller than the wavelength of ultra-intense laser radiation. Particle acceleration in different nanoscale targets irradiated by laser pulses has been studied here with analytical model and PIC simulations. It is found that maximal energy of ions and its directionality can be significantly enhanced, by choosing of shaped targets. The optimal is the target with the maximum absorption and the minimum mass. It is possible to present it as a thin substrate with "brash" consisted from long nano-scale cylinders. The factor of conversion of laser energy in energy of fast ions for such target can come approximately to ten percents. We considered the production of hard X-rays and frequency up-conversion on the basis of interaction of generated electron nanoscale jets with secondary metal target or counter-propagating laser radiation. Efficient conversion of fundamental laser radiation into characteristic sub-femtosecond radiation and generation of tunable up-converted radiation are obtained. The results of the simulations were compared with the experimental data and have shown a good coexistence.

TuR5-03 Invited **18:30-19:00**

PROPAGATION OF LASER RADIATION IN CUBIC NONLINEAR MEDIUM WITH LINEAR BIREFRINGENCE

E. Khazanov; Inst. of Applied Physics RAS; Russia

Recent theoretical and experimental results of investigation of the joint influence of the effects associated with linear birefringence and cubic nonlinearity on the polarization of laser beam are reviewed. Both cubic nonlinearity and birefringence introduce polarization distortions in the laser beam, giving rise to depolarization; the contributions of both the effects are nonadditive in principle.

R6. Nanophotonics and Biophotonics

TuR6-01 Invited **09:00-09:30**

TEN YEARS OF SINGLE-WALLED CARBON NANOTUBE FLUORESCENCE

S.M. Bachilo; Rice Univ.; United States

The discovery of intrinsic fluorescence from semiconducting SWCNT has advanced studies of these novel carbon materials to a new level. Besides being the unprecedented technique for revealing structural composition, fluorescence has enabled single-molecule studies and investigations of chemical nano-scale altering in the carbon nanostructures. The mentioned and other achievements will be discussed in the presentation.

TuR6-02 Invited **09:30-10:00**

CONCENTRATED SUNLIGHT FOR INVESTIGATION OF NANOSTRUCTURED SOLAR CELLS AND SYNTHESIS OF NANOMATERIALS

E.A. Katz; Ben-Gurion Univ. of the Negev; Israel

In this talk we will try to merge two seemingly discontiguous areas of photovoltaic (PV) research: PV conversion of concentrated sunlight; and organic photovoltaics (OPV) with polymer/fullerene bulk heterojunctions. The following questions will be addressed: (1) can OPV be part of the concentrator PV? (2) Can concentrated sunlight be useful for investigation of OPV and, in particular, for accelerated studies of the OPV degradation? Finally, examples of synthesis of inorganic fullerene-like structures and nanotubes using concentrated sunlight are reported.

TuR6-03 Invited **10:00-10:30**

NONPLANAR GRAPHENES IN AQUEOUS AND ORGANIC MEDIA

N.N. Rozhkova; Inst. of Geology Karelian Research Centre RAS; Russia

Shungite carbon (ShC) consisting of nonplanar graphene elements is characterized either as a semiconductor or semimetal and soft matter. Its multi-level structural organization from mesoscopic to atomic levels was studied using various probe technique. Nonplanar graphenes in ShC could be released through water dispersion forming soft clusters and stabilizing them in water. Similar in size ShC clusters were determined in CCl4.

TuR6-04 Invited **10:30-11:00**

OPTICAL POWER LIMITING MATERIALS BASED ON CARBON NANOSTRUCTURES: PROGRESS AND PROBLEMS

I.M. Belousova[1,2], S.K. Evstrop'ev[3], I.M. Kislyakov[2,1], V.M. Volynkin[1,3]; 1-Vavilov State Optical Inst., 2-St.Petersburg National Research Univ. of ITMO, 3-Research Technological Inst. Of Optical Material Science (NITIOM); Russia

Application of carbon nanostructures for optical power limiting is widely known. This paper gives an analysis of strengths and shortcomings of this application and presents novel physical and chemical approaches to preparation of compositions containing carbon nanostructures providing a progress in the field of the material stability and resistance to the action of temperature changes and pulse-periodic laser radiation.

- COFFEE BREAK -

TuR6-05 Invited **11:30-12:00**

NANOPHOTONICS OF GRAPHENE QUANTUM DOTS

E. Sheka[1], B. Razbirin[2], N. Rozhkova[3], D. Nelson[2], A. Starukhin[2]; 1-Peoples' Friendship Univ. of Russia, 2-Ioffe Physical Technical Institute RAS, 3-Inst. of Geology Karelian Research Centre RAS; Russia

Molecular graphene of shungite origin, dispersed in water and nonpolar molecular solvents, exhibits peculiar spectral properties. Enhanced Raman scattering of solvent molecules, enhanced photoluminescence of small addition of fullerene C60, and dependence of both effects on the excitation wave length are discussed at the platform of graphene quantum dots.

TuR6-06 **12:00-12:15**

AGGREGATION OF AMPHIPHILE DISPERSANTS AND PHASE BEHAVIOR OF FLUID MATRICES FOR OPTICAL POWER LIMITERS ON THE PLATFORM OF SWCNTS

A. Venediktova[1], D. Videnichev[2,3], A. Vlasov[1], I. Kislyakov[2,3], E. Obraztsova[4]; 1-St.Petersburg State Univ., 2-Vavilov State Optical Inst., 3-St.Petersburg Univ. of ITMO, 4-Prokhorov Inst. of General Physics RAS; Russia

We report the data on temporal and thermal stability of suspensions of single walled carbon nanotubes (arc-discharge synthesis) stabilized with amphiphiles (sodium dodecylsulfate, a blend "sodium dodecylsulfate +hexylmethylimidazolium chloride", sodium dodecylbenzenesulfonate) in a binary polar solvent (water+glycerol, 67% wt). Aggregation of the amphiphiles in a binary medium and their precipitation from monomeric and micellar solutions have been studied and correlated with parameters of optical power limiting. The latter were estimated in a one-shot and pulse-periodic regimes of applying incident laser radiation (532 nm, confocal telescopic system).

TuR6-07 **12:15-12:30**

LINEAR AND NON-LINEAR OPTICAL FILTERS FOR EYES PROTECTION AGAINST LASER RADIATION

D.A. Videnichev[1,2], I.M. Belousova[1,2], I.M. Kislyakov[1,2], G.A. Muranova[1], V.M. Volynkin[3], A.A. Ryzhov[1,2]; 1-Vavilov State Optical Inst., 2-St.Petersburg National Research Univ. of ITMO, 3-Research and Technological Inst. for Optical Material Science; Russia

Results of devising eye safety modules of observation instruments for protection from laser light are reported. Detailed descriptions of a nonlinear optical module containing silicon-organic liquid with carbon nanoparticles, a multispectral dichroic filter module with narrow bands at 355 nm, 532 nm and 1064 nm and an accessory device with parameters relevant to observation instruments are presented. Complex use of modules in an accessory device allows limiting the output energy below 200 pJ for the incident radiation energy of 50 mJ and the pulse repetition rate of 10 Hz.

TuR6-08 **12:30-12:45**

OPTICAL LIMITING IN SOLUTIONS CONTAINING NANOPARTICLES CdSe / ZnS

V. V. Danilov, A.S. Panfutova, G.M. Ermolaeva, D.A. Videnichev, I.P. Areshev, A.I. Khrebtov; Vavilov State Optical Inst., St. Petersburg State Transport Univ.; Russia

Experimentally investigated the impact of intense laser radiation on the multi- component solutions, including semiconductor nanoparticles (quantum dots and quantum nanorods) CdSe / ZnS. The results confirm the benefits of using the optical limit of the metastable intermediate products of photochemical reactions involving electron phototransfer semiconductor nanoparticles.

TuR6-09 Invited **12:45-13:15**

OPTICAL SPECTROSCOPY OF DIFFERENT FORMS OF NANOCARBON

E.D. Obraztsova; Prokhorov General Physics Inst. RAS; Russia

Abstract is not available.

TuR6-10 **13:15-13:30**

ENERGY TRANSFER IN THE QUANTUM DOT – ORGANIC MOLECULE STRUCTURES, EMBEDDED IN POLYMER TRACK PORE MEMBRANES

A.O. Orlova, Y.A. Gromova, M.A. Kurochkina, V.G. Maslov, A.V. Baranov, A.V. Fedorov; St.Petersburg National Research Univ. of ITMO; Russia

The structures based on semiconductor quantum dots CdSe/ZnS and different type of the molecules had been created in poly(ethylene terephthalate) track pore membranes. In these structures the efficiency of energy transfer from quantum dots to molecules has been investigated. It was found, that in the membranes the conditions for effective energy transfer can be realized without complexing quantum dots with molecules.

- LUNCH BREAK -

R8. Nonlinear Photonics: Fundamentals and Applications

TuR8-01 Invited **09:00-09:30**

COMPREHENSIVE CHARACTERIZATION OF HIGHLY DISPERSIVE METAMATERIALS WITH OPTICAL ACTIVITY

T.Pertsch[1], M. Falkner[1], E. Pshenay-Severin[1], C. Helgert[1], C. Menzel[2], C. Rockstuhl[2], and F. Lederer[2]; 1-Inst. of Applied Physics, Friedrich-Schiller-Universität Jena, 2-Inst. of Condensed Matter Theory and Solid State Optics; Germany

We introduce an experimental scheme to determine the transmission characteristics of optical metamaterials in amplitude and phase. The approach reveals all properties of the respective Jones matrix entirely on experimental grounds. The method enables the complex far-field characterization of a broad class of generally dispersive media. We apply it exemplarily to a chiral metamaterial with a giant optical activity.

TuR8-03 **09:30-09:45**

GLASS CERAMICS WITH COPPER CHLORIDE NANOPARTICLES : NONLINEAR CHARACTERISTICS AND TECHNOLOGY

A.A. Kim, P.S. Shirshnev; St.Petersburg National Research Univ. of ITMO; Russia

Size effect influences on the limitation coefficient of nonlinear optical response of copper chloride nanoparticles embedded in glass matrix. The threshold moves to the higher energy level since the size of nanocrystals becomes less. New nonlinear material was synthesized by simple technological method. This material contains the enormous volume of copper chloride crystals inside: 0.15% of volume.

TuR8-04 **09:45-10:00**

TOWARDS NONLINEAR PHOTONIC WIRES IN Z-CUT $LiNbO_3$

O. Stepanenko[1], E. Quillier[1], H. Tronche[1], P. Baldi[1], P. Aschiéri[1], S. Benchabane2 and M. De Micheli; 1-LPMC, Univ. de Nice Sophia Antipolis, 2-FEMTO ST, Univ. de Franche-Comté; France

Using a modified Proton Exchange process we have realized Photonic Wires in X-cut LiNbO3. They exhibit highly confined mode, low propagation losses, low strain induced polarization coupling and no reduction of the nonlinear properties. We are now transferring this technique to Z-cut LiNbO3 in order to realize very efficient nonlinear devices in PPLN.

TuR8-05 Invited **10:00-10:30**

NONLINEAR DYNAMICS IN SEMICONDUCTOR RING LASERS

J. Danckaert, L. Mashal, W. Coomans, S. Kigni Takougang, S. Beri, L. Gelens, G. Verschaffelt, G. Van der Sande; Applied Physics research group (APHY), Vrije Universiteit Brussel; Belgium

We review several aspects of nonlinear dynamical behaviour that have been observed —theoretically, numerically and experimentally— in semiconductor ring lasers: mode hopping, multistability, excitability, square waves, ...

TuR8-02 Invited **10:30-11:00**

MULTI-WAVE INTERACTIONS IN NEGATIVE INDEX METAMATERIALS

I. Gabitov; Univ. of Arizona; United States

Abstract is not available.

- COFFEE BREAK -

TuR8-06 Invited **11:30-12:00**

COHERENT FIBER OPTIC COMMUNICATION TECHNOLOGIES FOR POWER EFFICIENT DATACENTER NETWORK OPERATIONS

V. Kamalov; Google, Inc.; United States

In this paper, we review the growing trend of warehouse-scale computing (WSC), the Internet transformation driven by WSC, and the opportunities and challenges for fiber optic coherent communication technologies to support the growth of remotely located power efficient WSC in the next 3 to 4 years

TuR8-07 Invited **12:00-12:30**

LIGHT-BY-LIGHT POLARIZATION CONTROL IN TELECOM FIBERS

V.V. Kozlov[1,2], S. Wabnitz[2]; 1-St.Petersburg State Univ., Russia, 2-Univ.of Brescia, Italy;

Conventional polarizers, those which are used in virtually any optical experiment, are lossy in their nature. For example, they loose 50% of unpolarized light incident on them. We review recent advances in the theoretical and the experimental effort in designing lossless polarizers for needs of telecom and quantum-optical applications.

TuR8-08 Invited **12:30-13:00**

DECORRELATION OF PUMP AND SIGNAL STATES OF POLARIZATION IN SPUN FIBER RAMAN AMPLIFIER

S. Sergeyev; Aston Inst. of Photonic Technologies, Aston Univ.; United Kingdom

We report on a theoretical study of activated de-correlation of signal and pump states of polarization based on an advanced vector model of a fiber Raman amplifier accounting for random birefringence and periodic fiber spinning.

TuR8-09 Invited **13:00-13:30**

YB-DOPED FIBER LASER GENERATION SPECTRUM AND ITS POWER BROADENING

S. I. Kablukov, E. A. Zlobina, E. V. Podivilov, S. A. Babin; Inst. of Automation and Electrometry SB RAS; Russia

Analytical model describing output spectrum of Yb-doped fiber laser (YDFL) and its power broadening has been developed. Spectral measurements in cladding-pumped YDFL have proved the validity of the model demonstrating hyperbolic secant shape of the spectrum and linear increase of the linewidth with power. At lower powers, spatial hole burning and line self-sweeping effects define the lower limit for the linewidth.

- LUNCH BREAK -

TuR8-10 **15:00-15:15**

APPLICATION OF LIGHTWAVE OPTICAL-FIBER COMMUNICATION TECHNOLOGY IN GROUND MEASUREMENT SYSTEM OF RUSSIAN-KOREAN SPACE LAUNCH VEHICLE "KSLV-1"

M.P. Ananiev[1], M.M. Ermak[2], M.M. Zemlyanov[2], A.S. Kachurin[2], V.S. Kuznetsov[2], A.V. Mamin[2], I.S. Mikheichev[2], A.I. Pimenov[2], E.P. Spiridonov[2], V.B. Shukilo[1]; 1-Khrunichev State Research and Production Space Center, 2-R&D Inst. "Polyus"; Russia

Results and advantages of constructing of ground measurements system (GMS) for holding prelaunch preparations based on lightwave optical-fiber communication technology are exemplified in Russian-Korean space-rocket complex (SRC) "KSLV-1". Developed data measurement complex FOGMS "KSLV-1" allows to get, to process and to display readout from various sensors, placed on board of SRC. Complex's universality and scalable architecture makes it possible to increase the amount of sensors significantly. The described complex modification allows to query up to 320 sensors and to transmit sensors' readout by fiber-optical circuits from the board of "KSLV-1" to Flight-Control Center, which is situated 5000 meters far from launch pad. No-failure operation probability during time of prelaunch preparation is no less than 0,998. Successful full-scale tests of GSM were carried out at space launching site NARO in South Korea. Complex's potential applications in other fields of science and engineering are considered.

TuR8-12 **15:15-15:30**

TWO MODE COUPLING MODEL IN A FEW MODE FIBER

N.A. Kaliteevskiy, A.E. Korolev, K.S. Koreshkov, V.N. Nazarov, P.M. Sterlingov; Corning Scientific Center, St.Petersburg; Russia

A phenomenological two-mode coupling model in few mode fibers (FMF) is developed. It uses the measured mode coupling coefficient and differential mode delay as the input parameters with the split-step approach. The model is consistent with the experimental results demonstrating distributed mode coupling effects in FMF and may be used for multipath interference estimation based on statistical analysis of fluctuations.

TuR8-13 **15:30-15:45**

EXPERIMENTAL INVESTIGATION OF STATISTICAL PROPERTIES OF YTTERBIUM DOPED FIBER LASER

O.A. Gorbunov[1,2], S.I. Kablukov[1], M.O. Politko[1,2], D.V. Churkin[1], S.A. Babin[1]; 1-Inst. of Automation and Electrometry SB RAS, 2-Novosibirsk State Univ.; Russia

Statistical properties of Ytterbium doped fiber laser were investigated. It was shown that intensity of output radiation fluctuates strongly on sub-ns time scale and longitudinal cavity modes are partially correlated. Intense pikes in the lasers generation exist over many cavity passes.

TuR8-14 Invited **15:45-16:15**

GENERATION AND SHAPING OF PHOTON PAIRS IN NONLINEAR WAVEGUIDE ARRAYS

A.A. Sukhorukov; Australian National Univ.; Australia

We overview our recent results demonstrating the possibility to generate photon pairs and flexibly control their quantum correlation in a single integrated device in the form of nonlinear waveguide array. The photon pairs can be generated through spontaneous parametric down-conversion (SPDC) in waveguides with quadratic nonlinearity, or spontaneous four-wave mixing (SFWM) in case of cubic nonlinearity.

TuR8-15 **16:15-16:30**

ACTIVE QUANTUM CIRCUITS: INTEGRATED PHOTON PAIR GENERATION AND QUANTUM WALKS

A. S. Solntsev[1,2], A. A. Sukhorukov[1,2], M. J. Collins[1,3], A. S. Clark[1,3], C. Xiong[1,3], F. Setzpfandt4, [A]. Wu[1,2], F. Eilenberger[4], R. Schiek[5], A. Mitchell[1,6], B. J. Eggleton[1,3], T. Pertsch[4], D. N. Neshev[1,2] and Y. S. Kivshar[1,2]; 1-ARC Centre for Ultrahigh-bandwidth Devices for Optical Systems (CUDOS), 2-Australian National Univ., Canberra, 3-Inst. of Photonics and Optical Science, School of Physics, Univ. of Sydney, 4-Inst. of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universitat Jena, Germany, 5-Univ. of Applied Sciences Regensburg, Germany, 6-School of Electrical and Computer Engineering, RMIT Univ., Melbourne; Australia

We demonstrate experimentally simultaneous photon-pair generation and quantum walks in a lithium niobate waveguide array, where the output photon correlations can be controlled by varying the temperature-dependent phase-matching, switching from classical to quantum statistics.

TuR8-16 **16:30-16:45**

NUMERICAL MODELING OF OCTAVE SUPERCONTINUUM GENERATED IN HIGHLY NONLINEAR FIBERS WITH COMPLEX DISPERSION PROFILES

I.I. Korel, V.I. Denisov, B.N. Nyushkov, V.S. Pivtsov; Inst. of Laser Physics SB RAS; Russia

We present numerical investigation of the octave supercontinuum for mobile femtosecond clock by use of highly nonlinear fibers with varying dispersion, in order to find an optimal fiber parameters to provide spectral broadening in range of 1-2 μm. We also discuss problems of femtosecond comb stability and signal-to-noise ratio in presence of fluctuations.

TuR8-17 **16:45-17:00**

SINGLE-MODE BRILLOUIN RING FIBER LASER STABILIZED BY SELF-INJECTION LOCKING OF PUMP LASER DIODE

V.V. Spirin[1,2], C.A. Lopez-Mercado[2], P. Megret[1], and A.A. Fotiadi[1,3,4]; 1-UMONS, Belgium, 2-CICESE, Mexico, 3-Ioffe Physical Technical Inst. RAS, Russia, 4-UlGU, Russia;

We demonstrate a single-mode Brillouin fiber ring laser, which is passively stabilized at pump resonance frequency by using self-injection locking of semiconductor pump laser. Resonance condition for Stokes radiation is achieved by length fitting of Brillouin laser cavity. The laser generates single-frequency Stokes wave with linewidth less than 0.5 kHz using approximately 17-m length cavity.

TuR8-18 **17:00-17:15**

FUSED SILICA MICROSTRUCTURING BY FEMTOSECOND BESSEL BEAM

Y.A. Malkov, A.N. Stepanov, D.A. Yashunin; Inst. of Applied Physics RAS; Russia

High aspect ratio microstructures with an induced anisotropic refractive index change were formed when intense femtosecond laser radiation was focused by an axicon lens inside a fused silica sample. Guiding characteristics of the fabricated channels were investigated. Tapered hollow microcapillaries with a diameter as small as 20 μm were produced by chemical etching in HF solution.

- COFFEE BREAK -

R6. Nanophotonics and Biophotonics

TuR6-p01 **15:00-19:30**

PRESSURE DEPENDENCE MICROSTRUCTURING OF SILICON USING ArF EXCIMER LASER IN SF_6 AMBIENT GAS

H.R. Dehghanpopur; P. Parvin; Tafresh Univ.; Amirkabir Univ. of Technology; Iran

The formation process of conical micro-structure on a silicon surface is obtained irradiating ArF excimer laser using experimental set-up. A new model based on the Newtonian fluid is developed for the prediction of the aspect ratio of pressure dependence formation of self organized conical micro-structure on silicon surface in the presence of SF6 ambient gas using the ArF excimer laser. The comparison between the aspect ratio of the conical micro-structure obtained from the experimental results and the aspect ratio predicted by the model is in reasonable agreement. In addition, the time of re-solidification of the conical micro-structure is calculated using the model combined with the Taylor series expansion in terms of pressure of SF6.

TuR6-p02 **15:00-19:30**

SPECTROSCOPIC CHARACTERISTICS OF Cr:LiGaSiO4 NANO-GLASS-CERAMICS AND OF THE VITREOUS PRECURSORS

K. Subbotin, A.A. Veber, D.A. Nikolaev, V.G. Senin[1], V.A. Smirnov, E.V. Zharikov[2], I.A. Shcherbakov; Prokhorov General Physics Inst. RAS, 1- Vernadsky Inst. of Geochem. and Analitical Chem. RAS, 2- Mendeleev Univ. of Chemical Technology of Russia;

The main spectroscopic characteristics (absorption, excitation and emission spectra, fluorescence decay kinetics) of the promising solid-state laser material – transparent Cr:LiGaSiO4 nano-glass-ceramics, and of the vitreous precursors were studied. Peak cross-sections of the characteristic absorption bands of Cr4+, Cr3+, and Cr6+ were found, and different kinds of the fluorescence centers are discussed.

TuR6-p03 **15:00-19:30**

INVESTIGATION OF AMORPHOUS CARBON NANOSTRUCTURES FORMATION IN THE FIELD OF MILLISECOND PULSES OF GLASS: Yb, Er LASER RADIATION

A. Belikov, A. Skrypnik, N. Zulina; St.Petersburg National Research Univ. of ITMO; Russia

For the first time amorphous carbon nanostructures were obtained with ablation of graphite rod under Glass: Yb, Er laser radiation with wavelength 1.54 μm and millisecond duration of pulses. Threshold energy amount for this procedure was estimated experimentally. Process of ablation was recorded with high speed camera "FASTCAM SA4" to investigate main steps of carbon nanoparticles formation.

TuR6-p04 **15:00-19:30**

TRANSPARENT NANO-GLASSCERAMICS DOPED WITH RARE EARTH AND TRANSITION IONS FOR LED

V.A. Aseev[1], Y.A. Nekrasova[1], N.V. Nikonorov[1], E.V. Kolobkova[1], O.A. Usov[2], A.V. Nashchekin[2], P.A. Obraztsov[2], S.G. Konnikov[2]; 1-St.Petersburg National Research Univ. of ITMO; 2-Ioffe Physical Technical Inst. RAS; Russia

Novel transparent nano-glassceramics doped with rare earth ions for white light diodes were synthesized and their optical properties and structure were studied to define the relationships between light conversion efficiency, composition and structures.

TuR6-p05 **15:00-19:30**

MATHEMATICAL SIMULATIONS OF REGISTERED SIGNALS IN LASER NONINVASIVE MEDICAL FLUORESCENT DIAGNOSTICS

O. D. Smirnova, D. A. Rogatkin; Moscow Regional Research and Clinical Inst. "MONIKI" named after M.F.Vladimirsky; Russia

The theoretical study have been done for detailed mathematical simulations of registered signals in laser noninvasive fluorescent diagnostics in medicine. It was shown that in a general case the registered fluorescent signal depends not only on a concentration or a quantum efficiency of a fluorophore in a tested tissue, but also has a complex dependence on both transport absorption and scattering optical properties of the tissue.

TuR6-p06 **15:00-19:30**

THE THIN FILMS FORMATION ON THE STAINLESS STEEL SURFACE BY THE LASER RADIATION OF NANOSECOND DURATION

D. N. Antonov, A. A. Burtsev, O.Ya. Butkovsky; Vladimir State Univ.; Russia

The properties of oxide films on stainless steel surfaces research and control of the films formation are the main objectives of my work. In this paper there were obtained the oxide films with different thicknesses. The films composition was determined by the spectral microanalysis. Also, the morphology of the films was studied using a scanning probe microscope.

TuR6-p07 **15:00-19:30**

SIZE-DEPENDENCE OF PbS QUANTUM DOTS LIFETIMES

A.P. Litvin, P.S. Parfenov, E.V. Ushakova, A.V. Baranov; St.Petersburg National Research Univ. of ITMO; Russia

Luminescence, absorbance spectra, and lifetimes of PbS QDs are measured in 0.8—2 μm spectral range. Lifetimes are close to predicted (250 ns) and Stoke shift is negligible for large QDs, but small dots demonstrate an unusual long (2.5 μs) lifetimes and Stoke shift reaches 200 meV. Modeling and experimental results confirm a presence of the long-live below-gap state.

TuR6-p08 **15:00-19:30**

MULTICOLOR COMPOSITE COMPOUNDS WITH CADMIUM SELENIUM AND CYCLODEXTRIN INCLUSION COMPLEXES WITH ORGANIC MOLECULES

M.M. Asimov[1], S.S. Anufrik2, V.V. Tarkovsky2, H.H. Sazonko2; 1-Stepanov Inst. of Physics NAS Belarus, 2-Yanka Kupala State Univ. of Grodno; Belarus

Spectroscopic properties of new heterogeneous multicolor compositions based on cadmium selenium (CdSe/ZnS) nanocrystal and inclusion complexes of dye molecules with beta cyclodextrin are presented. Spectral florescence of proposed compositions investigated in aqueous solution and thin films. Signals from multicolor fluorescence of proposing compositions may be combined to definite spectral codes that could be used for tracking or verification of different objects. Calibration bar of signal within spectral codes guarantee high reliability in practical application of proposed multicolor compositions. Express analysis the size of nanoparticles during their synthesis and purification by spectroscopic methods is suggested.

TuR6-p08 **15:00-19:30**

BRIGHT 738-NM LUMINESCENT ISOLATED DIAMOND PARTICLES DOPED WITH SILICON

K.V. Bogdanov, M.A. Baranov, A.V. Fedorov, N.A. Feoktistov, V.G. Golubev, S.A. Grudinkin, A.V. Baranov; St.Petersburg National Research Univ. of ITMO, Ioffe Physical Technical Inst. RAS; Russia

Isolated diamond particles with a bright 738-nm narrow-band photoluminescence of the silicon-vacancy color centers are fabricated. A controlled doping with Si atoms was performed by adding silane to the feed-gas mixture during the microwave chemical vapour deposition process. The dependence of photoluminescence intensity of the zero-phonon line on silane concentration in the feed-gas mixture exhibits a pronounced maximum.

TuR6-p10 **15:00-19:30**

LEAD FLUOROSILICATE GLASSES AND TRANSPARENT GLASS-CERAMICS DOPED WITH ND^{3+}, ER^{3+} OR YB^{3+}

O.B. Petrova, A.V. Khomyakov; Mendeleyev Univ. of Chemical Technology of Russia;

PbF2 – PbO – SiO2 glasses doped with RE (Nd3+, Er3+ or Yb3+) were synthesized and researched. We modified these glasses by heat-treatment to make glass-ceramics contained fluoride crystal phase. The changes in the structural and optical properties of the glass- ceramics comparatively to initial glasses were revealed by X-ray diffraction, Raman spectroscopy, and luminescence spectroscopy of RE ions.

TuR6-p11 **15:00-19:30**

Bi2O3-GeO2-Fe2O3 AND Bi2O3-GeO2-Cr2O3 GLASS CERAMICS CONTAINING FERROELECTRIC BISMUTH GERMANATE

I.V.Stepanova, N.G.Goraschenko; Mendeleyev Univ. of Chemical Technology of Russia;

The glass ceramics containing ferroelectric and non-linear optic Bi2GeO5- phase was created by the heat-treatment of 1Bi2O3-1GeO2-xFe2O3 and 1Bi2O3-1GeO2-yCr2O3 glasses. The glasses and glass ceramics were researched by XRD and optical spectroscopy methods. Temperature dependences of dielectric properties were also measured and the Curie temperature was estimated. Revealed that Cr4+, Cr3+, Fe3+-ions and crystallization process influence absorption spectra and dielectric constants.

TuR6-p12 **15:00-19:30**

SEMICONDUCTOR QUANTUM RODS/LIQUID CRYSTALS HYBRID METARIALS FOR OPTOELECTRONIC DEVICES

M. V. Mukhina, V. V. Danilov, A. O. Orlova, A. V. Baranov, M. V. Artemyev[1]; St.Petersburg National Research Univ. of ITMO, 1-Institute for Physico-Chemical Problems, Belarussian State Univ.; Russia

The ways to create hybrid material consisting semiconductor quantum rods as polarized emission source and liquid crystals as ordered matrix are discussed. In the present work different approaches to formation of the stable homogeneous nanoparticles/liquid crystals system, in particular, the microadditives technique, were developed.

TuR6-p13 **15:00-19:30**

HYBRID MATERIALS BASED ON ORGANIC METAL COMPLEX IN INORGANIC GLASS MATRIX

R.I. Avetisov, A.G. Cherednichenko, O.B. Petrova, A.V. Khomyakov, O.A. Mushkalo, I.Ch. Avetissov; Mendeleyev Univ. of Chemical Technology of Russia;

Hybrid materials based on borate glasses matrix and organic phosphor was studied. The phosphor was Alq3 - a green phosphor in OLED's. The dependence of Alq3 concentration in glass in the range 0.02-0.1 wt.% on luminescent properties was studied. The maximum of luminescent peak of hybrid sample was 443 nm comparing to 513 nm for a pure powdered Alq3.

TuR6-p14 **15:00-19:30**

POLARIZATION-DEPENDENT SPECTRA OF PHOTONIC CRYSTAL WITH PLASMONIC DEFECT

S. G. Moiseev[1,2], V. A. Ostatochnikov[2], D. I. Sementsov[2], M. S. Yavtushenko[2]; 1-Ulyanovsk Branch of Kotelnikov Inst. of Radio Engineering and Electronics RAS, 2-Ulyanovsk State Univ.; Russia

Features of the behavior of electromagnetic eigenmodes in an artificial layered periodic structure with a finite number of periods and a plasmonic defect are analyzed. The capability of control of the transmission and reflection spectra by changing the parameters (concentration and shape of nanoparticles) and position of the defect is discovered.

TuR6-p15 **15:00-19:30**

ETCHABLE PHOTO-THERMO-REFRACTIVE GLASS FOR MICROFLUIDIC AND BIOPHOTONIC APPLICATIONS

A.I.Ignatiev, N.V.Nikonorov, M.G.Sorokina; St.Petersburg National Research Univ. of ITMO; Russia

Etching kinetics of virgin photo-thermo-refractive (PTR) glass and glassceramics in HF solution at various concentration and temperatures have been investigated for the first time. It has been shown that the etching rate of the glassceramics is ten times higher than of the glass. Prospects of the PTR glass and chemical etching technology for microfluidic and biophotonic applications have been discussed.

TuR6-p16 **15:00-19:30**

PECULIARITIES OF PHOTOCHEMICAL REACTIONS IN MOLECULES OF BILIRUBIN AT DIRECT LASER EXCITATION OF DISSOLVED MOLECULAR OXYGEN IN IR-BAND

V.Yu. Plavskii, A.I. Tret'yakova, L.G. Plavskaya, A.V. Mikulich, A.S. Grabtchikov, I.A. Khodasevich, V.A. Orlovich; Stepanov Inst. of Physics NAS Belarus;

We investigated regularities of photodecomposition of Z,Z-bilirubin IX at its interaction with singlet oxygen. Selective generation of oxygen was obtained by direct laser excitation at 1064 nm wavelength of O2. Changes in electronic absorption and fluorescence spectra under these conditions confirm directly participation of 1O2 in the modification of the structure of bilirubin molecules.

TuR6-p17 **15:00-19:30**

INFLUENCE OF LOW-INTENSITY LASER RADIATION OF RED AND NEAR INFRARED SPECTRAL REGION ON THE HATCHING OF ZOOPLANKTON ARTEMIA SALINA L

V.Yu. Plavskii[1], N.V. Barulin[2], A.S. Grabtchikov[1], I.A.Khodasevich[1], D.G.Zusin[1], L.G. Plavskaya[1], A.I. Tret'yakova[1], V.A. Orlovich[1]; 1-Stepanov Inst. of Physics NAS Belarus, 2-Belorussian State Agricultural Academy Gorki; Belarus

As a result of experiments with Artemia salina L nauplius regulatory effect of near-infrared laser radiation lying out of electronic absorption band of biological macromolecules and endogenous photosensitizers was firstly revealed. This effect is attributed to direct excitation of singlet oxygen by radiation and its subsequent influence on course of physiological processes in living organism by effect of trigger molecules.

TuR6-p18 **15:00-19:30**

ENHANCED ABSORPTION SPECTRA OF A THIN ORGANIC SEMICONDUCTOR LAYER CONTAINING METAL NANOPARTICLES

A.V. Naumenko, N.A. Loiko, V.V. Filippov; Stepanov Inst. of Physics NAS Belarus;

An increase in a fraction of energy absorbed by the organic layer due to local field enhancement around metal nanoparticles embedded in the layer are analyzed by numerical experiments. The dependences of the absorption spectra of the layer on the absorption factor of the semiconductor, on the distance between the nanoparticles and on the type of their packing are obtained.

TuR6-p19 **15:00-19:30**

PREPARATION AND OPTICAL PROPERTES OF NOVEL GLASS-CERAMICS BASED ON $Er_xYb_{2-x}Ti_2O_7$ NANOSIZED CRYSTALS

O. Dymshits, A. Zhilin, S. Zapalova, I. Alekseeva, N. Scoptsov, A. Malyarevich, K. Yumashev; Research and Technological Inst. of Optical Material Science; Russia

Transparent glass-ceramics containing $Er_xYb_{2-x}Ti_2O_7$ nanosized crystals were prepared in lithium aluminosilicate glass system for the first time. Crystallization of rare-earth titanates with defect fluorite structure and their structural rearrangements to disordered pyrochlore structure were studied by XRD method. Spectral-luminescent properties of transparent glass-ceramics in visible in near IR spectral region were measured and analyzed in relation to their structure.

TuR6-p20 **15:00-19:30**

MULTISPECTRAL GLASSES FOR EYE PROTECTION FROM RADIATION OF LASER POINTERS

I.A. Antimonov, I.M. Belousova, A.V. Kris'ko, G.A. Muranova, D.A. Videnichev; Vavilov State Optical Inst.; Russia

Calculations are made and a construction of multilayer optical coatings for effective eye protection from lasers emitting in visible spectral range is developed. These calculations were underlain to produce multispectral filters for simultaneous protection from radiation of most frequently used laser modules within three spectral range: 400 - 460 nm, 510 - 540 nm and 620 - 700 nm. Optical density of the filters in the area of suppression is larger than 3 (D > 3). Using our production facilities a pilot batch of coatings and protective glasses is made. Testing results are given.

TuR6-p21 **15:00-19:30**

OBSERVATION OF THE SINGLET OXYGEN LUMINESCENCE AT THE WAVELEGTH 1270 NM WITH THE LED IRRADIATION OF CCL4 SOLVENT

I.V. Bagrov, I.M Belousova, V.M. Kiselev, I.M. Kislyakov, E.N. Sosnov; Inst. for Laser Physics, Vavilov State Optical Inst.; Russia

The results of studies of singlet oxygen generation efficiency for optical pumping of oxygen dissolved in CCl4, using the LED matrices at three wavelengths (465, 525 and 625 nm) with direct detection of the luminescence of singlet oxygen from the irradiated volume of the solvent are given. A represented comparison with the efficiency of singlet oxygen generation using C60 dissolved in CCl4 as a photosensitizer, has shown that the difference in efficiency of generation of singlet oxygen by four orders of magnitude takes place only in relation to incident radiation. With respect to the optical pumping radiation, absorbed in the volume of the solvent, the quantum yield of singlet oxygen by direct optical excitation is close to unity.

R3. Semiconductor Lasers, Materials and Applications

WeR3-22 Invited **09:00-09:30**

MODULATION BANDWIDTH OF A QUANTUM DOT LASER: THE UPPER LIMIT AND LIMITING FACTORS

L. Asryan[1], Y. Wu[1], R. Suris[2]; 1-Virginia Polytechnic Inst. and State Univ., United States, 2-Ioffe Physical Technical Inst. RAS, Russia

A theory of modulation response of quantum dot (QD) lasers is reviewed. The upper limit for the modulation bandwidth in a single QD-layer laser is estimated to be as high as 60 GHz. The actual bandwidth is, however, considerably lower due to several factors, such as carrier capture delay from the waveguide region into QDs and internal optical loss.

WeR3-23 **09:30-09:45**

HIGH POWER HIGH BRIGHTNESS LASER DIODES WITH EXTERNAL VOLUME BRAGG GRATINGS

I. Divliansky[1], L. Glebov[1], K. Shavitranuruk[2], V. Smirnov[2], G. Venus[1]; 1-CREOL, The College of Optics and Photonics, Univ. of Central Florida; 2-OptiGrate Corp.; United States

Creation of low losses volume Bragg gratings recorded in photo-thermo- refractive glass and their utilization as components in external resonators of semiconductor lasers enabled increase of spectral brightness in two order of magnitude and spatial brightness in order of magnitude for wide interval of pumping currents without significant penalties in power and efficiency.

WeR3-24 **09:45-10:00**

SPECTRAL PROPERTIES OF TWO SECTIONAL COUPLED ASYMMETRIC QUANTUM WELL LASERS

I. M. Gadzhiev, M. S. Buyalo, I. O. Bakshaev and E. L. Portnoi; Ioffe Physical Technical Inst. RAS; Russia

Laser structures with two coupled InGaAs quantum wells separated with GaAs barrier have been investigated. The nature of absorption edge is basically defined by barrier thickness and applied external electric field. In structures with wide barrier it is necessary to apply high reverse bias more than 100 kV/cm to get sufficient absorption level for mode locking at lasing wavelength. In contrast, in structures with narrow barrier the absorption edge is strongly affected by the diagonal optical transition, so absorption becomes high enough at considerably low fields.

WeR3-25 Invited **10:00-10:30**

DETERMINISTIC QUANTUM WIRE AND DOT SYSTEMS FOR NANOPHOTONIC AND LASER APPLICATIONS

E. Kapon; Swiss Federal Inst. of Technology; Switzerland

The structure and optical properties of semiconductor quantum wire (QWR) and quantum dot (QD) systems grown on patterned substrates are reviewed. In particular, ordered pyramidal QD systems with exceptional uniformity, wavelength setting, heterostructure control and the capability of efficient emission of single and entangled photons are presented. Recent results on integration of ordered QDs with photonic crystal cavities are highlighted.

WeR3-26 **10:30-10:45**

EFFECT OF ASYMMETRIC BARRIER LAYERS IN THE WAVEGUIDE REGION ON THE TEMPERATURE STABILITY OF QUANTUM-WELL LASERS

F. I. Zubov[1], A. E. Zhukov[1], N. V. Kryzhanovskaya[1], Yu. M. Shernyakov[2], M. V. Maximov[2], E. S. Semenova[3], K. Yvind[3] and L. V. Asryan[4]; 1-St. Petersburg Academic Univ., Russia, 2-Ioffe Physical Technical Inst. RAS, Russia, 3-Technical Univ. of Denmark, Denmark, 4-Virginia Polytechnic Inst. and State Univ., Blacksburg, USA

We fabricated and tested a quantum well laser with asymmetric barrier layers. Such a laser has been proposed earlier to suppress bipolar carrier population in the optical confinement layer and to improve temperature-stability of the threshold current. Compared to the conventional reference laser, our laser with asymmetric barriers demonstrates reduced threshold current density, internal optical loss, and higher characteristic temperature.

WeR3-27 **10:45-11:00**

LINEWIDTH ENHANCEMENT FACTOR: COMPARISON BETWEEN QUANTUM-DOT AND QUANTUM-WELL LASERS UNDER OPTICAL INJECTION

B. Lingnau[1], K. Lüdge[1], W.W. Chow[2], E. Schöll[1]; 1-Technische Univ. Berlin, Germany, 2-Sandia National Laboratories, USA

The concept of a linewidth enhancement factor is critically examined for optically injected quantum-dot (QD) and quantum-well (QW) lasers. We show that the charge carrier scattering between QD states and the carrier reservoir leads to desynchronized real and imaginary parts of the optical susceptibility. Thus a quantity like the α-factor is therefore not justified in QD lasers, while it is a good approximation in the case of QW lasers.

- COFFEE BREAK -

WeR3-28 Invited **11:30-12:00**

QUANTUM DOT MODE LOCKED LASERS FOR COHERENT FREQUENCY COMB GENERATION

R. Ricardo[1], R T Watts[2], K Merghem[1], C Calò[1], A Martinez[1], A Accard[3], F Lelarge[3], L P Barry[2], A Ramdane[1]; 1-CNRS Laboratory for Photonics and Nanostructures, France; 2-The Rince Institute, School of Electronic Engineering, Dublin City University, Ireland; 3-III-V Lab, a joint Laboratory of "Alcatel Lucent Bell Labs" and "Thales Research & Technology" and CEA-LETI, France

The mode locking characteristics of both single and two-section InAs/InP quantum dash passively mode locked lasers are presented. Spectral amplitude and phase measurements show the potential of this material system for the generation of high peak power sub-picosecond pulses, and highly coherent optical frequency combs spanning an optical bandwidth >1.5 THz in the 1.55 μm fibre window.

WeR3-29 **12:00-12:15**

BROADLY TUNABLE PICOSECOND PULSES QUANTUM-DOT MODE-LOCKED LASER

D. I. Nikitichev[1], K. A. Fedorova[1], Y. Ding[1], A. Alhazime[1], A. Able2, W. Kaenders[2], I. Krestnikov[3], D. Livshits[3], E. U. Rafailov[1]; 1 Photonics and Nanoscience Group, Univ. of Dundee,UK; 2 TOPTICA Photonics AG,Germany; 3 Innolume GmbH, Germany

Wavelength tunability between 1192.9nm and 1287.4nm in mode-locked regime is demonstrated in a multi-section QD laser in external cavity configuration. The maximum peak power of 532mW in pulsed operation was achieved at 1226nm wavelength.

WeR3-30 **12:15-12:30**

ENHANCED LONGITUDINAL MODE SPACING IN BLUE-VIOLET InGaN SEMICONDUCTOR LASER

I.V. Smetanin, P.P. Vasil'ev; Lebedev Physical Inst. RAS; Russia

An explanation of observed enhanced longitudinal mode spacing in InGaN semiconductor lasers has been proposed. It has been demonstrated that e-h plasma oscillations, which can exist in the laser active layer at certain driving conditions, are responsible for mode clustering effect. The resonant excitation of the plasma oscillations occurs due to longitudinal mode beating. The separation of mode clusters is typically by an order of magnitude larger that the individual mode spacing.

WeR3-32 **12:45-13:00**

TUNABLE VISIBLE SHG IN CW AND PICOSECOND REGIMES

K.A. Fedorova[1,2], G.S. Sokolovskii[1,3], D.I. Nikitichev[1], P.R. Battle[4], I.L. Krestnikov[5], D.A. Livshits[5], E.U. Rafailov[1]; Univ. of Dundee, UK; 2-SPE "LAZMA", Russia, 3-Ioffe Physical Technical Inst. RAS, Russia; 4-AdvR Inc., USA; 5-Innolume GmbH, Germany

We demonstrate compact all-room-temperature laser sources broadly tunable in the visible spectral region in CW (between 567 nm and 629 nm) and picosecond regimes (between 600 nm and 627 nm) by frequency-doubling in a periodically-poled KTP waveguide using a tunable quantum-dot external-cavity diode lasers.

WeR3-33 Invited **13:00-13:30**

QUANTUM DOT BASED InGaAlN VISIBLE LEDs

A. Tsatsulnikov, W. Lundin, A. Nikolaev, A. Sakharov, N. Cherkashin, M. Hytch; Ioffe Physical Technical Inst. RAS, Russia; Center for Material Elaboration & Structural Studies, National Center for Scientific Research, France

This article presents results of the investigations of different approaches for growth of quantum dots in the InGaAlN-based heterostructures by MOCVD for realization of LED emission in whole optical range. Methods of stimulated formation of the InGaN quantum dots by technological regimes and heterostructures design were investigated. It was shown that quantum dot formation strongly affects current dependence of external quantum efficiency of the LEDs. Technology of the formation of nanostructured short-period InGaN/GaN superlattices for active region of LEDs was developed. It was shown that such superlattices allow improve emission efficiency of deep green LEDs and monolithic white LEDs containing in active region several InGaN ultrathin layers emitting at different wavelengths.

- LUNCH BREAK -

WeR3-34 Invited **15:00-15:30**

3D FS LASER WRITING OF QUANTUM DOT AND METALLIC NANOSTRUCTURES

M. Farsari; IESL-FORTH; Greece

We present our investigations on the fabrication of three-dimensional nanostructures by diffusion-assisted direct laser writing using organic-inorganic hybrid materials that (i) can be structured without shrinkage, (ii) contain quantum dots and (iii) can be covered with metal selectively.

WeR3-35 Invited **15:30-16:00**

OPTICAL COHERENCE TOMOGRAPHY

P. Andersen; Technical Univ. of Denmark; Denmark

Abstract is not available.

WeR3-36 Invited **16:00-16:30**

MULTIPHOTON IMAGING WITH COMPACT SEMICONDUCTOR DISK LASERS

P. Loza-Alvarez; ICFO - The Institute of Photonic Sciences, Parc Mediterrani de la Tecnologia; Spain

We present the performance of a compact, non-expensive, easy-to-use ultrafast semiconductor disk laser (1W average power, 1.5 ps, 500MHz) for multiphoton imaging. The laser's operating wavelengths of 970nm makes it ideal for nonlinear excitation of GFP. We show the suitability of this laser for in-vivo imaging. The laser performance is evaluated in commercial microscopes and in comparison with Ti:sapphire lasers.

WeR3-37 **16:30-16:45**

MULTI-PARAMETER ANALYSIS IN PERIPHERAL BLOOD MICRO-CIRCULATION DIAGNOSTICS

N.A. Stewart[1], A.V. Dunaev[1], S.G. Sokolovski[1], V.V. Sidorov[2], E.U. Rafailov[1]; Univ. of Dundee, Dundee, UK, 2-SPE "LAZMA" Ltd, Moscow, Russia

Multi-functional non-invasive laser-based diagnostic systems suffer high Laser-Doppler Flowmetry and Tissue Reflectance Oximetry reading variations which seriously limits the prospects for use in general medical practice. The use of complex relative parameters and improved LDF by cardiovascular phantoms correlation is proposed which can reduce variations and ease analysis and interpretation of blood flow parameters, tissue oxygen utilization and biomarker fluorescence.

WeR3-38 **16:45-17:00**

NON-DIFFRACTING BEAMS FROM SEMICODUCTOR LASERS

V.V.Dudelev [1], G.S.Sokolovskii [1,2], M.Butkus [2], S.N.Losev [1], A.G.Deryagin [1], V.I.Kuchinskii [1], W. Sibbett[3], E.U.Rafailov [2]; 1-Ioffe Physical Technical Inst. RAS, Russia; 2-Univ. of Dundee, UK; 3-Univ. of St Andrews, UK

We present generation of non-diffracting (Bessel) beams from semiconductors light sources, including light emitting diodes (LED), edge emitter laser diodes (LD), vertical cavity surface emitting lasers (VCSEL), vertical external cavity surface emitting lasers (VECSEL). The best result for Bessel beams generated from any semiconductor light sources which is comparable to that achievable from vibronic lasers are demonstrated.

- COFFEE BREAK -

17:30

POSTDEADLINE SESSION

R4. Laser Beam Control

WeR4-01 Invited **09:00-09:30**

TOPOLOGICAL ERGODIC DYNAMICS OF OPTICAL SINGULARITIES IN LASER-INDUCED SPECKLE FIELD FOLLOWING "OPTICAL DAMAGE" OF PHOTOREFRACTIVE LiNbO3:Fe CRYSTAL

M. Soskin, V. Vasil'ev, Inst. of Physics NAS Ukraine; Ukraine

Illumination of photorefractive crystal LiNbO3: Fe by He-Ne laser initiates its "optical damage" which creates the generic developing elliptically polarized speckle-field full with optical singularities which born and annihilate by pairs. The singular chain and loop reactions were found and investigated in details. Chain reactions consist from system of connected links with born and annihilated singularities pairs and differ cardinally from known nuclear or chemical chain reactions due to conservation of singularities system topological charge. The much rarer are short-term loop reactions. They consist from nucleated pair of singularities which repel a little then attract and annihilate. They were classified as "topological impurity" because noninvolvement in general development of singularities system. All singularities reactions are strictly mandated by conservation principles of Poincare index for induced speckle-field, total topological charge of singularities and minimization of system free energy.

WeR4-02 Invited **09:30-10:00**

ON THE COLLECTIVE PROCESSES AT STIMULATED SCATTERING OF LIGHT

V. Sidorovich; Rozhdestvensky Optical Society; Russia

An approach to analysis of optical phase conjugation at stimulated scattering that is alternative to well known 3D-hologram mode theory has been developed in detail. Application of the mode theory is based on phenomenological amplification coefficient induced by the pump wave for stokes radiation. The approach considered here rests on direct consideration of pump and stokes wave interaction via dynamic gratings generated by interference of the waves in the nonlinear medium. Key element of such approach is the methodology of picking gratings contributing to interaction of each particular pair of pump and stokes plane components from the entire gratings ensemble. This methodology is not reduced to elementary Bragg criterion.

WeR4-03 **10:00-10:15**

ACOUSTO-OPTIC MODULATOR MADE OF KGW CRYSTAL

M. M. Mazur[1], D. Yu. Velikovskiy[1,2], L. I. Mazur[1], V. E. Pozhar[2,3], V. I. Pustovoit[2,3], A. A. Pavlyuk4; 1-FSUE "National Research Institute for Physicotechnical and Radio Engineering Measurements" ("VNIIFTRI"), 2-Scientific Technological Center of Unique Instrumentation of RAS, 3-Bauman Moscow State Technical Univ., 4-Nikolaev Inst. of Inorganic Chemistry SB RAS; Russia

As maximum power of lasers increases there appears a need for power- resistant instruments to control it. Acousto-optical (AO) devices are widely used for modulation and deflection of the laser beam. But most of AO materials doesn't capable to withstand intense radiation. We have specified that KGd(WO4)2 "laser" crystal exhibits rather good acousto-optic properties. The AO modulator has been made of this material and it is capable to operate with more intensive laser beams than usual.

WeR4-04 **10:15-10:30**

CONFORMAL OPTICAL ELEMENTS FOR WAVEFRONT DISTORTION CORRECTION IN YAG:ND ACTIVE ELEMENTS

R.K. Nasyrov[1], Yu.D. Arapov2, V.P. Korolkov[1], A.G. Poleshchuk[1]; 1-IAE SB RAS, 2-VNIITF; Russia

Conformal optical elements were developed and fabricated for wavefront distortion correction in YAG:ND active elements. Cyllindrical rods were tested interferometrically, individual phase functions were calculated and realized as conformal optical elements. YAG:ND rods with the correctors have been tested experimentally. Significant wavefront quality improvement has been demonstrated.

WeR4-05 **10:30-10:45**

LASER-HOLOGRAPHIC TEST STAND

V.A.Baloev, V.P.Ivanov, S.D.Kozlov, N.P.Larionov, A.V.Lukin, A.N.Melnikov, A.R. Nasyrov, A.M. Uraskin; OJSC "NPO GIPO"; Russia

The paper presents examples of practical application of Laser-holographic test stand.

WeR4-06 **10:45-11:00**

POLARIZATION CONTROL OF CO2-LASERS WITH THE PHOTO-ELASTIC EFFECT

F. Bammer, S. Galle; Vienna Univ.of Technology; Austria

We propose a system for polarization control of CO2-Lasers, mainly for use in laser cutting to orient the polarization parallel to the cutting direction to achieve higher absorption and higher cutting speed. The system is based on a ZnSe-lens which is set under pressure by piezo-actuators. Due to the photo-elastic effect this can be used to control the polarization.

- COFFEE BREAK -

WeR4-07 Invited **11:30-12:00**

ROLIC® LCMO PHOTO-ALIGNMENT TECHNOLOGIES: STATE OF THE ART

M. Ibn-Elhaj, I. Bury; Rolic Technologies Ltd.; Switzerland

Rolic® Light Controlled Molecular Orientation (LCMO) technology is the basis for todays advanced mass production technologies for large LCD-TV panel, 3D Filters and optical security devices. This fundamental technology allows an easy achievement of high resolution azimuthal LC-director patterns using UV light from lamps and/or lasers. Applications examples and performances of state of the art materials will be discussed.

WeR4-08 Invited **12:00-12:30**

DYNAMIC DIFFRACTION GRATINGS IN DYE-DOPED CHIRAL NEMATICS

A. Iljin; Inst. of Physics NAS Ukraine; Ukraine

Dynamic diffraction gratings realised in dye-doped chiral nematic liquid crystals (CLC) reveal specific peculiarities in the frequency range near the selective reflection band of CLC.

Optical properties characteristic of the photonic band gap allows for a relatively fast response time, high spatial resolution and a maximum gain for circularly polarized interacting beams.

Helical LC structure has been also found responsible for a manifold increase of the LC texture stability to intense laser beam radiation.

WeR4-09 Invited **12:30-13:00**

IMPROVING SPECTROPOLARIMETRIC AND FULL FIELD OPTICAL COHERENCE TOMOGRAPHY SYSTEMS WITH LIQUID CRYSTAL DEVICES

I. Abdulhalim; Ben-Gurion Univ. of the Negev; Israel

Using liquid crystals as tunable filters, polarization rotators and phase modulators especially designed for incorporation into biomedical optical imaging systems we demonstrated spectropolarimetric system for skin imaging , and high resolution full field optical coherence tomography (FF-OCT) system. The FF-OCT microscope is capable of observing 3D microbiological structures as small as 0.4x0.4x1.0 μm3 (xyz) using quasi monochromatic light and a unique integration scheme of a liquid crystal retarder. Unlike traditional FF-OCT systems, this microscope can be operated in high resolution for any preferable wavelength with minimized defocusing and dispersion effects.

WeR4-10 Invited **13:00-13:30**

LC NANOCOMPOSITES: INDUCED OPTICAL SINGULARITIES, MANAGED NANO/MICRO STRUCTURE AND ELECTRICAL CONDUCTIVITY

V. V. Ponevchinsky[1], A. I. Gonchsruk[2], S. S. Minenko[3], L. N. Lisetskii[3], N. I. Lebovka[2], M. S. Soskin[1]; 1-Inst. of Physics NAS Ukraine, 2-Ovcharenko Inst. of Biocolloidal Chemistry, 3-Inst. of Scintillation Materials; Ukraine

Carbon nanotubes are among the most promising fillers for composite materials. An extremely low doping of liquid crystal by multi-walled carbon nanotubes (MWCNTs) (typically 0.05-0.1 wt. %) resulted in formation of interconnected fractal aggregates and percolation networks. The direction of liquid crystal in the vicinity of aggregates differs from the initial director distribution in the unperturbed LC matrix. Such layers of perturbed LC introduce phase modulation to ordinary and extraordinary waves that propagates inside the cell. So, the perturbed liquid crystal layers can be observed using polarization microcopy. Application of external electric field to the cell changes the area of perturbed LC. The phase modulation introduced by perturbed LC influences on scattering of light that comes through the composite. The change of composite transparency in the presence of external field correlates with the change of perturbed liquid crystal area. The perturbed LC structure in the vicinity of MWCNT aggregates produces the optical singularities in the propagating laser beam. These singularities are extremely sensitive to the structural organization of LC matrix and might serve as markers of the perturbed structure induced by NT clusters in a LC matrix. Evident discontinuities in temperature dependencies of electrical conductivity in the vicinity of solid-nematic and nematic-isotropic phase transitions were observed near the percolation threshold. The results for various LC matrices filled by NTs are reported. New promising applications of the LC+MWCNTs nanocomposites are discussed.

- LUNCH BREAK -

R5. Super-Intense Light Fields and Ultra-Fast Processes

WeR5-05 Invited **09:00-09:30**

FAST ELECTRON GENERATION AND TRANSPORT IN ULTRAINTENSE LASER-SOLID INTERACTIONS

P. McKenna; Univ. of Strathclyde; United Kingdom

The generation and transport of fast (MeV) electrons in solids irradiated by ultraintense laser pulses is of fundamental importance to many topics in intense laser-solid interactions. I will present results from several recent experiments focusing on (1) the effect of lattice structure on electron beam transport instabilities, and (2) factors influencing the electron beam injection and transport angles.

WeR5-06 Invited **09:30-10:00**

INVESTIGATIONS OF LASER DRIVEN PLASMAS ON SOLID AND GASEOUS TARGETS AT 100TW ARCURTUS LASER FACILITY

M. Cerchez; Heinrich Heine Universität Düsseldorf; Germany

We present recent experimental investigations performed at 100TW Arcurtus Laser Facility, Heinrich Heine University Düsseldorf where different fundamental physical processes have been studied in relativistic regime, like laser energy absorption, particle beam acceleration, laser driven ultrafast X-ray/XUV radiation or direct applications on laser shaping by propagating through underdense matter.

WeR5-07 Invited **10:00-10:30**

PRODUCING HIGH ENERGY ION BUNCHES USING HOLE-BORING RADIATION PRESSURE ACCELERATION

A. Robinson; Science and Technology Facilities Council; United Kingdom

Radiation Pressure Acceleration is a promising route to generating high energy (> 100MeV) proton and ion bunches using ultra-intense laser pulses. In this talk we will present the work we have done to develop theoretical understanding of this concept and numerical simulations of RPA. In particular we are interested in developing a scheme based on the 'hole-boring' variant of RPA, and our efforts have concentrated on finding combinations of laser and plasma parameters that come as close to the absolute theoretical limits as possible.

WeR5-08 Invited **10:30-11:00**

COHERENT SYNCHROTRON EMISSION IN ULTRAINTENSE FOIL INTERACTIONS

M. Zepf[1,5], B. Dromey, S. Rykovanov[2], M. Yeung[1], R. Hoerlein[2,3], D. Jung3,4, D. C. Gautier[4], T. Dzelzainis[1], D. Kiefer[2,3], S. Palaniyppan[4], R. Shah[4], J. Schreiber[2,3], H. Ruhl[2], J. C. Fernandez[4], C. L. S. Lewis[1] , M. Zepf[1], B. M. Hegelich[3,4]; 1-Department of Physics and Astronomy, Queens Univ. Belfast, UK, 2-Department fuer Physik, Ludwig-Maximilians-Universitaet, Germany, 3-Max-Planck-Institut fuer Quantenoptik, Germany, 4-Los Alamos National Laboratory, USA, 5-Helmholtz Institut Jena, Germany

Several processes can lead to the emission of coherent XUV emission in laser solid foil interactions – most notably to date Relativistic Oscillating Mirror (ROM) [1] and Coherent Wake Emission (CWE)[2]. Most recently a synchrotron-like mechanism has been discussed in such interactions in reflection[3]. Here we observe and theoretically investigate a synchrotron-like mechanism in the transmitted laser direction for the first time. Coherent XUV emission with low divergence and synchrotron like scaling is observed experimentally and discussed theoretically.

- COFFEE BREAK -

WeR5-09 Invited **11:30-12:00**

INNOVATIVE ELECTRON AND X RAY BEAM WITH LASER-PLASMA ACCELERATORS

V. Malka, S. Corde, C. Thaury, K. Ta Phuoc, J. Faure, G. Lambert, A. Lifschitz, A. Rousse; LOA; France

Thanks to the giant longitudinal electric fields that plasmas can support when they are irradiated by an intense and short laser pulse, plasma accelerators offer the possibility to generate, in a compact and reproducible way, energetic electron beams with tuneable parameters. The different injection schemes have been demonstrated, such as the forced laser wake field [1], the bubble/blow out regime [2], or the colliding laser pulses [3]. The scheme of principle of the colliding laser pulses is shown on figure 1. This scheme offers the possibility to control the electron beam parameters such as the charge, the energy spread or the energy. In Figure 2 we show the control of the electron beam energy with in inset a spectra with 1% relative energy spread. These electron beams with peak current of a few kA [4] are of interest for a very broad range of applications in medical, biological, chemistry or material science domains [5]. They are also of major int erest for the production of very bright X/gamma ray beams [6]. I report here on the evolution of laser plasma accelerators developed at LOA and on very recent achievements we performed on the applications side.

WeR5-10 Invited **12:00-12:30**

RAMAN X-RAY FREE ELECTRON LASER IN THE STRONG FIELD KAPITZA-DIRAC REGIME

Ph. Balcou, I. A. Andriyash, E. d'Humie`res, V. T. Tikhonchuk; Univ. Bordeaux, CEA, CNRS; CELIA; France

We present a new compact approach to generate an X-ray Free Electron Laser. We show how a bunch of moderately relativistic electrons interacting with a high intensity optical lattice exhibits a rich dynamical behavior, including coherent Raman scattering of laser light. The most important features of this Raman XFEL scheme will be presented from numerical and analytical approaches.

WeR5-11 **12:30-12:45**

GENERATING BRIGHT COHERENT ATTOSECOND X-RAY PULSES WITH RELATIVISTIC ELECTRON MIRRORS

V. V. Kulagin, V. A. Cherepenin[1], V. N. Kornienko[1]; Sternberg State Astronomical Inst. of Lomonosov Moscow State Univ., 1-Inst. of Radioengineering and Electronics RAS; Russia

X-ray pulses can be generated using a probe laser pulse reflection off a relativistic electron mirror (REM). The main problem preventing experimental realization of this scheme is an absence of accelerating laser pulses with sharp enough fronts. We consider laser pulse shaping using plasma layers with thickness of about laser wavelength and density of about 2-10 times larger than the critical density. Here, petawatt class electromagnetic pulses with sharp fronts can be produced. Generation of REM with such pulses was simulated and reflection of counter-propagating probe pulse was studied giving x-ray coherent pulse (wavelength about 10 nm) with attosecond length and power of about 100 GW.

WeR5-12 **12:45-13:00**

COLLIMATED BEAMS OF ACCELERATED ELECTRONS GENERATED BY INTENSE FEMTOSECOND LASER PULSES AT GRAZING INCIDENCE

Yu. A. Malkov, A. A. Gonoskov, A. M. Kiselev, A. N. Stepanov, D. A. Yashunin; Inst. of Applied Physics RAS; Russia

Generation of highly collimated (up to 4 mrad) beams of accelerated electrons produced by irradiation of aluminum targets by grazing incidence femtosecond laser pulses with an intensity ~ 10^17 W/cm2 was observed. These electron beams propagate along the laser axis and have an essentially non-Maxwellian energy distribution peaked in a range of 300-500 keV.

WeR5-13 **13:00-13:15**

HARD X-RAY GENERATION ACCOMPANIED WITH SELF-GUIDED PROPAGATION OF FEMTOSECOND LASER RADIATION IN MOLECULAR CLUSTER BEAM

I.A. Zhvaniya, V.M. Gordienko, M.S. Dzhidzhoev, D.O. Fedorov, D.N. Trubnikov; Lomonosov Moscow State Univ.; Russia

We have studied hard X-rays generation with energy of 2-4 keV (efficiency ~10^(-6)), generated by interaction of femtosecond laser radiation with vacuum intensity of 10^16 W/cm^2 with large molecular (SF6, CF3I) clusters. It was shown that at maximal X-ray yield, laser filament is essentially nonuniform and has a multifocal structure.

WeR5-14 **13:15-13:30**

SELF-SIMILAR SHOCK WAVE SOLUTIONS OF THE NON-LINEAR MAXWELL EQUATIONS

I.F. Barna[1], R. Kersner[2]; 1-Energy Research Center of the Hungarian Academy of Sciences, 2-Univ. of Pécs, PMMK; Hungary

In our study we consider nonlinear, power-law field-dependent electrical permitivity and magnetic permeability and investigate the time-dependent Maxwell equations with the self-similar Ansatz. This is a first-order hyperbolic PDE system which can conserve non-continuous initial conditions describing electromagnetic shock-waves. Besides shock-waves other interesting solutions (e.g. with localized compact support) can be found with delicate physical properties. Such phenomena may happen in complex materials induced by powerful ELI laser pulses.

- LUNCH BREAK -

R6. Nanophotonics and Biophotonics

WeR6-11 Invited **09:00-09:30**

LASER WITH MATRIX RADIATOR FROM SEMICONDUCTOR LASERS USING FOR EFFECTIVE THERAPY IN CLINICS

V. Ovsyannikov; Ioffe Physical Technical Inst. RAS; Russia

The mechanism of therapeutic effect of low-energy laser therapy and principles of therapeutic effect from laser-tissue interaction are presented. It is pay attention that special therapeutic lasers with matrix radiators are required for effective treatment. Safety and harmlessness of laser irradiation of tissues are explained. Clinical results from 10 clinics of St. Petersburg for the 25 years period are presented. Laser therapy methods were used for treatment patients with oncology, infectious neurological diseases and radiation injuries of tissue.

WeR6-12 Invited **09:30-10:00**

IN VIVO HIGHER-HARMONIC GENERATION BIOPSY BASED ON A FEMTOSECOND CR:FORSTERITE LASER

Ch.-K. Sun, M.-R. Tsai, Yi-H. Liao, A.A. Ivanov, A.B. Fedotov, A.M. Zheltikov; National Taiwan Univ., Taiwan, Lomonosov Moscow State Univ., Russia;

Recently in vivo harmonic generation microscopy (HGM) based on a femtosecond Cr:forsterite laser has been reported to have a superior performance on healthy human skin and oral mucosa. In this paper, we summarize our current clinical trial to perform in vivo HGM on pigmented skin lesions. Our clinical trial indicates the superior performance of HGM over two-photon and confocal based technologies.

WeR6-13 Invited **10:00-10:30**

APPLICATIONS OF TERAHERTZ RADIATION IN DIAGNOSTICS: BIOLOGY AND NANOTECHNOLOGY

A. Angeluts, A. Borodin, M. Esaulkov, I. Kuritsin, M. Nazarov, A. Shkurinov; Lomonosov Moscow State Univ.; Russia

In the lecture we present the review of the recent results on the interaction of terahertz radiation with the complex biological molecular systems and nanostructures. The influence of the radiation on the fictional activity of enzymes is also discussed. A parts of the lecture will be directed to the discussion of the prospect of the THz diagnostics of biopolymers.

WeR6-14 Invited **10:30-11:00**

RESONANT INELASTIC LIGHT SCATTERING AND PHOTOLUMINISCENCE IN SEMICONDUCTOR QUANTUM DOTS AND FUNCTIONALIZED BIOMEDICAL MATERIALS FOR BIOPHOTONIC APPLICATIONS

F. B. Bayramov[1,2], V.V. Toporov[1], E.D. Poloskin[1], B.H. Bayramov[1], M.V. Dubina[2], C. Roder[3], C. Sprung[3], G. Irmer[3], A. Lashkul[4], E. Lahderanta[4], Y.W. Song[5] , M. Dutta[6,7], M. A. Stroscio[6,7]; 1-Ioffe Physical Technical Inst. RAS, 2-St. Petersburg Academic Univ., Russia, 3-Inst. of Theoretical Physics, Univ. of Mining and Technology, Germany; 4-Lappeenranta Univ.of Technology, Finland; 5-Korea Polytechnic Univ., Korea; 6-Department of Physics, Univ.of Illinois, USA; 7-Department of Bioengineering, Univ.of Illinois, USA;

We show that investigations of high sensitive and high resolution inelastic laser light scattering in nanoscale functionalized semiconductor quantum dots such as Si/SiO2, CdS-, ZnS-capped CdSe, with biomedical structures such as short peptides and specialized transmembrane cellular structures known as integrins of MDA-MB-435 cancer cells, is promising for many applications and novel studies of intrinsic properties of both constituent systems.

- COFFEE BREAK -

WeR6-15 Invited **11:30-12:00**

OPTICAL COHERENCE TOMOGRAPHY IMAGING OF MAMMALIAN EMBRYOS

I. Larina[1], S.H. Syed[1], N. Sudheendran[2], M.E. Dickinson[1], K.V. Larin[1,2,3]; 1-Baylor College of Medicine, Houston, USA; 2-Univ. of Houston, Houston, USA; 3-Saratov State Univ., Russia;

The mouse provides an excellent model for studying mammalian development of cardiovascular system because of the resemblance to humans, potential for genetic manipulation, and rapid generation time. There exists a critical need to visualize and analyze development of embryonic vasculature. For this, we have developed a protocol for live 3D structual imaging, hemodynamic analysis and cardiodynamic visualization at nearly cellular resolution using Optical Coherence Tomography technique. This work demonstrates that OCT enhanced with Doppler analysis can provide essential information about early embryonic development and opens a door for a wide range of studies in mouse mutants associated with human birth defects and diseases.

WeR6-16 Invited **12:00-12:30**

PHOTONICS OF SINGLET OXYGEN: PHOTOCHEMICAL AND LUMINESCENCE STUDIES.

A.A Krasnovsky; Bach Inst. of Biochemistry RAS; Russia

The IR absorption spectra corresponding to the singlet-triplet transitions in O2 molecules dissolved in organic solvents and aqueous micellar dispersions have been measured under ambient conditions, using oxygenation of singlet oxygen traps upon direct laser excitation of oxygen molecules. The data are compared with the luminescence properties of the singlet-triplet transitions in O2 molecules. Significance of the obtained spectroscopic data for biomedical research is discussed.

WeR6-17 **12:30-12:45**

TERAHERTZ AND RAMAN SPECTROSCOPY OF ORGANIC MOLECULAR CRYSTALS

M. Trzebiatowska-Gusowska[1], J. Baran2, M. J. Walczakowski[1], P. P. Jarzab[1], K. Nowak[1], L. Augustyn[1], and E. F. Plinski; 1-Wroclaw Univ. of Technology, 2-Polish Academy of Sciences; Poland

Nonlinear optic organic crystals are investigated in the terahertz band. There were selected a few crystals for the investigations: triglycine sulphate (TGS), triglycine selenate (TGSe), triglycine zinc chloride (TGZnCl2), diglycine hydrobromide (DGBr), diglycine hydrochloride (DGCl). The terahertz absorption characteristics are compared to the Raman spectroscopy results according to suitable selections rules.

WeR6-18 **12:45-13:00**

MOLECULAR ORGANIC FORMS IN TERAHERTZ LIGHT

S. Plinska[1], B. Fuglewicz[1], M. Cebrat[2], J. Brasun[1], K. Nowak[3], P. P. Jarzab[3], M. J. Walczakowski[3], L. Augustyn[3], and E. F. Plinski; 1-Wroclaw Medical Univ., 2-Univ. of Wroclaw, 3-Wroclaw Univ. of Technology; Poland

Terahertz Time-Domain spectroscopy investigations on nonapeptides are presented in the paper. Two nonapeptides are selected for investigations: oxytocin and vasopressin. Eight derivatives of the investigated peptides are synthetized and measured in the terahertz band. The results are compared according to the assumed methods.

WeR6-19 **13:00-13:15**

DIGITAL REFOCUSING IN SPECTRAL DOMAIN OPTICAL COHERENCE TOMOGRAPHY

A.A. Moiseev, G.V. Gelikonov, P.A. Shilyagin, D.A. Terpelov, V.M. Gelikonov; Inst. of Applied Physics RAS; Russia

The problem of restoration Optical Coherence Tomography (OCT) images, acquired with tightly focused probing beam, in out-of-focus region for improving lateral resolution of the OCT has been

considered. Phase stability issue has been discussed and phase equalization algorithm has been proposed. Spectral algorithm of digital refocusing, based on angular propogation method of solving difraction problem has also been develped.

WeR6-20 **13:15-13:30**

FIBER-BASED INTERFACES FOR FUNCTIONAL STUDIES IN NEUROPHOTONIC

L.V.Amitonova, I.V. Fedotov, O.I. Ivashkina, M.A. Zots, A.B. Fedotov, K.V. Anokhin, A.M. Zheltikov; Lomonosov Moscow State Univ.; Anokhin Inst. of Normal Physiology; Kurchatov National Research Center; Russia

Specialty fiber probes are used for in vivo depth-resolved mapping of neuron activity through the optical detection of fluorescent-protein reporters expressed inside the living brain of anesthetized transgenic mice. Supercontinuum radiation produced by highly nonlinear photonic- crystal fibers is employed to demonstrate a simultaneous multicolor interrogation of several biomarkers in a model aqueous solution system, thus suggesting the way toward a multiplex mapping of various types of neuron dynamics inside the living brain.

- LUNCH BREAK -

WeR6-21 Invited **15:00-15:30**

SINGLET OXYGEN GENERATION BY FULLERENE-CONTAINING MEDIA IN DIFFERENT PHASE STATES

I.M. Belousova[1,2], N.G. Gogoleva[3,4], V.M. Kiselev[1], I.M. Kislyakov[2,1], T.D. Murav'eva[1], A.M. Starodubtsev[1]; 1-Vavilov State Optical Inst., 2-St.Petersburg National Research Univ. of ITMO, 3-St.Petersburg State Univ. of Service and Economics, 4-St.Petersburg State Electrotechnical Univ.; Russia

The efficiency of singlet oxygen generation by fullerene-containing liquid and solid-phase composite media is studied. Effect of fullerene aggregation on its triplet state lifetime and on the singlet oxygen quantum yield is shown. Examples of application of solid-phase fullerene-containing composite media for medical equipment are provided.

WeR6-22 **15:30-15:45**

DETECTION OF EARLY MANIFESTATIONS OF CARDIAC ISCHEMIA WITH AUTOFLUORESCENT ORGANOSCOPY

N.N. Petrishchev[1,2], M.M. Galagudza[1,2], G.V. Papayan[1,2]; 1-Pavlov Federal Medical Univ., 2-Almazov Federal Heart, Blood and Endocrinology Center; Russia

The present study demonstrated that NAD fluorescence is significantly increased soon after induction of cardiac ischemia both in the experimental and clinical settings. The data obtained indicate that registration of myocardial autofluorescence might be used as a sensitive marker of ischemia and, thus, recommended for intraoperative monitoring of ischemia-induced metabolic changes aimed at optimization of cardiac protection in cardiac surgery.

WeR6-23 **15:45-16:00**

HIGH RESOLUTION COLPOSCOPY WITH A MINIATURE CONFOCAL MICROSOCOPE

S. Rattanavarin[1], P. Sarapukdee[2], U. Jarujareet[1], N. Khemthongcharoen[1], A. Ruangphacha[1], M. J. Mandella[3], and W. Piywattanametha[1,2]; 1-National Electronics and Computer Technology Center, Thailand, 2-Chulalongkorn Univ., Thailand, 3-Stanford Univ., USA;

We demonstrate a MEMS based miniature near-infrared dual-axis confocal fluorescence microscope for in vivo cervical cancer screening in human patients with depth ranging of 300 µm. Images are obtained with 2-5 frame rate and 140 µm x 100 µm in field of view size.

WeR6-24 **16:00-16:15**

DISTRIBUTION OF QUANTUM DOTS WITH VARIOUS TYPES OF ORGANIC COATS IN MICE

N.I. Kazachkina, Y.F. Loginova, A.S. Shebanova, V.V. Zherdeva, A.P. Savitsky; Bach Inst. of Biochemistry RAS, Lomonosov Moscow State Univ.; Russia

Biodistribution of quantum dots (Qds) (CdSe/ZnS/CdS) with various organic coats was investigated by the method of local fluorescence spectroscopy using the laser fiber-optic setting. Qds were administered to mice intravenously or intraperitoneally. Shown, Qds accumulation and retention in the tissues depended on the way of introducing. Biodistribution of Qds depended on their size at the same method of administration.

WeR6-25 **16:15-16:30**

BIOPHOTONICS OF LASER INTERACTION WHITH BLOOD ERYTHROCYTES

M.M. Asimov[1], R.M. Asimov[2], A.N. Batyan[3], V.O. Trusevich[3], A.N. Rubinov[1]; 1-Stepanov Inst. of Physics NAS Belarus, 2-"Sensotronic Ltd.", Belarus High Tech. Park, 3-Int. State Univ. of Ecology after A.D. Sakharov;

The results of investigations the effect low intensity laser radiation on thermal denaturation of blood erythrocyte and oxyhemoglobin molecules are presented. The effect of laser radiation on reduction of structural changes of blood oxyhemoglobin alfa and beta protein chains caused by thermal effect is observed. This phenomenon significantly increases the thermal stability of erythrocytes and adult oxyhemoglobin. Different applications of obtained experimental results in clinical practice are discussed.

WeR6-26 **16:30-16:45**

OPTICAL PROBING DEPTH AND EFFECTIVE MEAN SCATTERING COSINE OF BRAIN TISSUE

M. Kholodtsova, P.Grachev, V. Loschenov; Prokhorov General Physics Inst. RAS; Russia

To improve diagnostic sensitivity the method for determining the optical probing depth of biotissue with laser irradiation and fluorescence induced by this radiation is proposed. The optical probing depth obtained to be almost twice as great as the fluorescent optical probing depth. The effective scattering cosine of laser-induced fluorescence was calculated for two wavelengths using diffusion theory.

WeR6-27 **16:45-17:00**

PHOTOTHERMAL PROPERTIES OF ABSORBING HOMOGENEOUS AND TWO-LAYERED NANOPARTICLES FOR APPLICATIONS IN NANOPHOTONICS AND BIOPHOTONICS

V. Pustovalov[1], L. Astafyeva[2]; Inst. of Innovation Technology, Belarusian National Technical Univ., 2-Stepanov Inst. of Physics NAS Belarus;

Platform for analysis of nanoparticle (NP) properties (optical, thermal, structural, and others) allowing to select their parameters in the presence of different ambiences is presented. The several types of homogeneous and two-layered NPs are described which provide significant increased conversion of laser pulse energy in phenomena. These NPs make it possible to use them with maximal efficiency for laser applications in nanotechnology and nanophotonics.

- COFFEE BREAK -

WeR6-28 **17:30-17:45**

GLASS-METAL NANOCOMPOSITES WITH PLANAR WAVEGUIDES FOR BIOSENSOR APPLICATIONS

P.A. Obraztsov, A.V. Nashchekin, O.A. Usov, V.N. Nevedomskiy, A.I. Sidorov, K.K. Turoverov; Ioffe Physical Technical Inst. RAS; St.Petersburg Research Univ.of ITMO; Inst. of Cytology; Russia

Presented paper concerns the development of biosensor platform based on silver nanoparticles, synthesized in glasses of two types: in UV irradiated photo-thermo-refractive glasses and in sodium-borosilicate glasses treated in water atmosphere. Two methods of creation of optical waveguides are examined: by thermal diffusion and ion exchange. The configuration of localized surface plasmon resonance based biosensor is presented and discussed.

WeR6-29 **17:45-18:00**

ENDOSCOPIC ANALYSIS OF DIFFUSE-REFLECTED LIGHT FOR BLADDER EARLY CANCER DETECTION

N.A. Kalyagina, T.A. Savelieva, W. Blondel, Ch. Daul, D. Wolf and V.B. Loschenov; Prokhorov General Physics Inst. RAS, Russia; Research Center on Automation of Nancy, France;

By varying sizes and concentrations of the epithelial scatterers and absorption properties, different changes of the bladder tissue at dysplasia formation were mimicked with the use of the biological phantoms. The results of the diffuse-reflected light measurements and mathematical modelling showed the ability to detect different changes of the diffuse-reflected light signals depending on the tissue scattering and absorbing properties.

R7. Lasers in environmental monitoring

WeR7-01 Invited **14:45-15:15**

HYPERSPECTRAL LIF LIDAR IN MONITORING OF WATER ENVIRONMENT

S. Babichenko; AS Laser Diagnostic Instruments; Estonia

The presentation provides overview of the developments and applications of multipurpose hyperspectral FLS-LiDARs based on the technique of Laser Induced Fluorescence (LIF) used for operation on board of aircrafts, ships and stationary platforms for oil spill detection and mapping, profiling the biomass, and general assessment of water quality in water environment.

WeR7-02 **15:15-15:30**

BASIC PRINCIPLES OF THE WIRELESS OPTICAL LASER COMMUNICATION FOR REMOTE CONTROL UNDERWATER ROBOTS

A.G. Zhurenkov, A.S. Tibilov, V.A. Yakovlev; Vavilov State Optical Inst.; Russia

The report analyzes the problems of underwater wireless optical laser communication, and methods for their solution are determined on the basis of physical and mathematical modeling of laser light propagation in the marine environment at different depths for different wavelengths. The estimates range and speed of information transfer are made.

WeR7-03 **15:30-15:45**

SINGLE MODE FIBERS WITH HIGH SBS THRESHOLD FOR REMOTE SENSING APPLICATIONS

A.S. Belanov[1], S.V. Tsvetkov[1], A.A. Sysoliatin[2]; 1-MGUPI, 2-Fiber Optics Research Center; Russia

We propose the technique for suppressing SBS in single mode fibers by the method of varying the waveguide parameters in accordance with some prearranged low. Longitudinally acoustic velocity design of P-doped fibers resulted to efficient SBS suppression up to 10dB and more and possibility to build up all-fiber LIDAR for remote sensing of atmospheric oxygen levels.

WeR7-04 Invited **15:45-16:15**

THE LIDAR AIRCRAFT EXPERIENCE TO MEET CHALLENGES OF FISHING

V.I. Chernook[1], Yu.A. Goldin[2], A.N. Vasiliev[1]; 1-Res. Inst. "Giprorybflot", 2-Shirshov Institute of Oceanology RAS, Russia

The algorithms and hardware programs allowing in real time identify the extended optical heterogeneity in sea water (fish, plankton, layer of jump, etc.) registered by laser sensing have been developed on the basis of the obtained experimental data. LIDAR airborne photography has allowed to optimize the new methods for the solution of fishery problems and to receive information on distribution of fish congestions on depths from 5 to 35 m.

WeR7-05 Invited **16:15-16:45**

ESTIMATION OF TECHNICAL CONDITION OF "PEMEX" FIRM PIPELINES (MEXICO) USING THE AIRCRAFT LASER AND LINEAR IR SCANNERS

D.S.Gavrilov; JSC "NEF", Russia;

Abstract is not available.

WeR7-06 **16:45-17:00**

USING DSP AND PIV METHODS FOR LASER VISION IN WATER MEDIA

N.V. Petrov[1,2], V.G. Bespalov[2], V.S. Bortkevich[1,2], A.P. Zhevlakov[1], Yu.I.Soldatov[1]; 1-Vavilov State Optical Inst., 2-St.Petersburg National Research Univ. of ITMO; Russia

The methods of a correlation digital speckle photography (DSP) and particle image velocimetry (PIV) have been investigated to solve the problems of monitoring of water media. Experiments were carried out both in the closed pool and in natural sea conditions. In all cases the results testifying to prospect of offered approaches were received.

- COFFEE BREAK -

WeR7-07 Invited **17:30-18:00**

DEVELOPMENT OF LASER SYSTEMS FOR ENVIRONMENTAL MONITORING BY JSC OPTEC

H. Adam [1], M. Kozliner [2], V. Chelibanov [3], V. Kudryavtsev [3], A. Marugin [4], Peter Domnin[4]; 1-BOREAL laser CEO, Canada, 2-JSC OPTEC Ltd., USA, 3-National Research Univ. ITMO, Russia, 4-JSC OPTEC, Russia

This paper presents the results of using open path gas analyzers based on near infrared diode laser for atmospheric monitoring. The presentation also reviews the development of Raman spectroscopy for quantitative analysis and identification of various substances. The paper presents the results of using of nano scale doping on semiconductor structures used as a matrix to increase the sensitivity of Surface Enhanced Raman Spectroscopy (SERS). The SERS method is applied to study chemical kinetics of stable and unstable products during oxidation of organic compounds and remote identification of hazardous chemicals.

WeR7-08 Invited **18:00-18:30**

MODULAR CHEMICAL SENSOR TECHNOLOGIES FOR ENVIRONMENTAL MONITORING

F.K.Tittel[1], R.Lewicki[1], M.Jahjah[1], Y.F.Ma[1], J.Waclawek[2], E.t.H.Chrysostom[2], B.Lendl[2], Y.Zhang[3]; 1-Rice Univ., USA, 2-Vienna Univ. of Technology, Austria, 3-Scinovation, Inc., USA

A 5.26 um and 7.24 um CW TEC HHL packaged DFB-QCL based quartz enhanced photoacoustic spectroscopy (QEPAS) sensor for NO and SO2 detection was demonstrated. A 1σ minimum detection limit of 3 ppb and 33 ppb was achieved for a sampling time of 1 sec. using interference free NO and SO2 absorption lines located at 1900.08 cm-1 and 1380.94 cm-1 respectively.

WeR7-09 Invited **18:30-19:00**

DEVELOPMENT OF THE MULTITASK LIDAR SYSTEM FOR ENVIRONMENT MONITORING

A.V.Chugreev, A.S.Boreysho, D.N.Vasiliev, A.V.Morozov, S.S.Smolentsev, S.V.Viktorov[1], I.N.Melnikova[1], V.K.Donchenko[1]; Laser Systems Ltd., 1-Saint Petersburg State Univ.and Research Centre for Ecological Safety; Russia

Multitask lidar systems are intended to fulfill routine procedures of ecology monitoring and to solve the urgent tasks in remote measurements and diagnostics. In recent years lasers with the better characteristics allows construction of the compact multitask lidar system based on the chassis cab. The system includes multiwavelength aerosol, UV DIAL and coherent wind lidars.

WeR7-10 **19:00-19:15**

RESEARCH OF SPECTRAL LINEWIDTH INFLUENCE OF THE LASER GENERATION ON LEVEL OF BACKSCATTERED SIGNAL FROM THE ATMOSPHERE

V.R. Akhmetyanov, R.A. Liventsov, M.C. Penkin, Z.S. Tsarev, I.F. Shiryaev; Laser systems Ltd.; Russia

Nowadays to determine the wind parameters, the systems of remote sensing, like laser locators and lidars, are becoming more widespread. Developing a lidar it is important to research the influence of spectral linewidth generation on the level of backscattered signal from the atmosphere. For the experiment fiber lasers with spectral linewidth of 2 kHz, 4 kHz, 12 kHz working at wave length of 1558 nanometers were chosen.

WeR7-11 **19:15-19:30**

FIBER-OPTIC SENSOR NETWORK FOR REGISTRATION PARAMETERS OF DEFORMATION IMPACT

V.A. Kolchinskiy, O.T. Kamenev, Yu.S. Petrov; Far Eastern Federal Univ.; Russia

The aim of this work is the development of physical and technological basics of building a network based on the measurement of multi-mode and single-mode optical fibers. Results of research and development of distributed fiber-optic sensor network for registration parameters of deformation impact are presented.

R8. Nonlinear Photonics: Fundamentals and Applications

WeR8-19 Invited **15:00-15:30**

ALL-OPTICAL SWITCHING USING COLLISIONS OF PULSED BEAMS IN NONLINEAR MEDIA

A.P. Sukhorukov, V.E. Lobanov; Lomonosov Moscow State Univ.; Russia

We present the study of interplay between pulsed beams in nonlinear media. Particular attention is paid to the effect of total internal reflection of signal beam from the reference one. Cascade three-wave interactions are analyzed for the different convergence angle, the group velocity mismatch, and the initial delay. Reflections in the space-time domain can occur in one or two coordinates.

WeR8-20 Invited **15:30-16:00**

MAKER-FRINGES ANALYSIS OF THE SECOND-ORDER SUSCEPTIBILITY OF INHOMOGENEOUS ABSORBING MEDIA

A.A. Golubkov, V.A. Makarov; Lomonosov Moscow State Univ.; Russia

The possibility of the unambiguous reconstruction of the coordinate dependence of all complex components of the second-order susceptibility tensors, which are responsible for the second harmonic, sum and difference frequency generation in one-dimensionally inhomogeneous plate, is proved and the methodology for its calculation is offered.

WeR8-21 **16:00-16:15**

HIGH HARMONICS GENERATION OF PICOSECOND RADIATION FROM LASER PLASMA PLUMES

R. A. Ganeev, G. S. Boltaev, N. Kh. Satlikov, I. A. Kulagin, T. Usmanov; Inst. of Electronics; Uzbekistan

We present the results of studies of high-order harmonic generaion (up to the 21st order) in carbon-containing and metal plasmas using the picosecond pulses. An important peculiarity of these studies was the observation of efficient 7th harmonic (152 nm) of Nd:YAG laser in carbon-containing plasmas. Its efficiency considerably (two to seven times) exceeded that of the lower (5th) order harmonic, contrary to expected dependence defined from the perturbative theory of lower- order harmonics generation in isotropic media.

WeR8-22 **16:15-16:30**

ELLIPTICALLY POLARIZED CHIRPED CNOIDAL WAVES IN A MEDIUM WITH SPATIAL DISPERSION OF CUBIC NONLINEARITY

V.A. Makarov, V.M. Petnikova, N.N. Potravkin, V.V. Shuvalov; Lomonosov Moscow State Univ.; Russia

We present particular solutions (two circularly-polarized light field components consistently propagate inside their common nonlinear waveguide) corresponding to cnoidal waves (CWs) in media with linear and nonlinear gyrotropy. The main feature of considered CWs is a chirp therefore CW's polarization state can be periodic or nonperiodic. In last case the end of Stokes vector fill all its phase space.

WeR8-23 **16:30-16:45**

SUPERLUMINAL PARAMETRIC DOPPLER EFFECT IN NONLINEAR MEDIA

N. Rosanov; Inst. for Laser Physics, Vavilov State Optical Inst.; St.Petersburg National Research Univ. of ITMO; Russia

It is shown that two counterpropagating optical waves with different frequencies induce in cubically nonlinear media two gratings one of which is typically superluminal. When a weak radiation is incident on the superluminal grating, quasi-phase conjugation occurs with distortions due to the Doppler frequency shift. These phenomena take place in dielectrics with fast optical nonlinearity and in electron-positron vacuum.

WeR8-24 **16:45-17:00**

IMPROVING OF SPECTRALLY RESOLVED TWO-BEAM COUPLING METHOD FOR THIRD-ORDER OPTICAL SUSCEPTIBILITY MEASUREMENTS

A. Afanasiev; Inst. of Applied Physics RAS; Russia

We use three broad band approximation for the spectrum of the laser pulse of an erbium doped femtosecond fiber laser. The determination of the spectral components at the edge of the laser spectral range becomes more precise. These spectral components can be successfully used in spectrally resolved two-beam coupling technique despite of the significant pulse-to-pulse perturbations at the central frequencies.

- COFFEE BREAK -

WeR8-25 **17:30-17:45**

TERAHERTZ GENERATION BY TILTED FRONT TECHNIQUE IN CRYOGENICALLY COOLED LITHIUM NIOBATE: PULSE DURATION AND CRYSTAL LENGTH EFFECT

S.B. Bodrov, Yu.A. Sergeev, A.A. Murzanev, Yu.A. Mal'kov, A.N. Stepanov; Inst. of Applied Physics RAS; Russia

Terahertz generation by tilted front technique in cryogenically cooled LiNbO3 crystal was experimentally investigated in a wide range of pump laser energies for different pulse durations and crystal lengths. Maximum efficiency as high as ~ 0.2% is obtained for 190 fs pulse duration and 10 mm crystal length at T=770 K.

WeR8-26 **17:45-18:00**

HARMONICS AND SUPERCONTINUUM GENERATION IN NEMATIC LIQUID CRYSTALS

B. Nyushkov[1,2,3], S. Trashkeev[1], V. Klementyev[1], V. Pivtsov[1,3], S. Kobtsev2; 1-Inst. of Laser Physics SB RAS, 2-Novosibirsk State Univ., 3-Novosibirsk State Technical Univ.; Russia

We report recent results of experimental and theoretical study of nonlinear optical frequency conversion in small volumes of nematic liquid crystals (NLCs) with light-induced symmetry breakdown. Simultaneous generation of second and third harmonics accompanied by a spectral supercontinuum was achieved in a fiber-coupled drop of NLC pumped by near-infrared cw- lasers.

WeR8-27 **18:00-18:15**

NUMERICAL MODEL OF LONG CAVITY LASERS WITH COUNTER PROPAGATING PULSES

L.A. Melnikov, Yu.A. Mazhirina, E.I.Romanova; Saratov State Technical Univ.; Russia

We propose and use numerical model for simulation of bidirectional lasers, including ultra-long fiber laser which allows to solve initial-value problem and periodical boundary condition at the cavity ends. The examples of bidirectional regimes in laser and Raman laser are presented.

WeR8-28 **18:15-18:30**

YB-DOPED FIBER LASER WITH 1017-1040 NM TUNING RANGE AND SECOND HARMONIC GENERATION

E.I. Dontsova, S.I. Kablukov, S.A. Babin; Inst. of Automation and Electrometry SB RAS, Novosibirsk State Univ.; Russia

A tuning of the Yb-doped fiber laser in the short-wave IR region (1017-1040 nm) was performed. The frequency doubling of the tunable laser is performed in single-pass scheme with KTP crystal optimized for wavelength 1030 nm. In this frequency doubling experiment the minimal wavelength of about 509 nm has been obtained.

WeR8-29 **18:30-18:45**

LIGHT PROPAGATION IN PHOTONIC CRYSTAL FIBERS CONTAINING SEMICONDUCTOR ELEMENTS

O. Kozina[1], L. Melnikov[2]; 1-Saratov Branch of the Inst. of Radio-Engineering and Electronics RAS, 2-Saratov State Technical Univ.; Russia

The results of calculations of propagating modes in microstructure dielectric fibers with semiconductor inclusions are presented. We propose PC fibers which contain semiconductor elements in various combinations suitable for tuning of the parameters of the semiconductor via electric or optical fields to provide the control of optical properties of the fibers and can be used as elements for optical signal processing.

WeR8-30 **18:45-19:00**

SLOWED DOWN PULSE PROPAGATION IN SATURABLE ACETYLENE IN HOLLOW CORE PHOTONIC CRYSTAL FIBERS

P. Agruzov[1], A. Shamray[2], M. Osegueda[2], E. Hernandez[2], S. Stepanov[2]; 1-Ioffe Physical Technical Inst. RAS, Russia; 2-CICESE, Mexico;

We report experiments on slowed-down pulse propagation via saturable absorption of acetylene confined in a hollow-core photonic crystal fiber. Measurements were performed for the 3 m long fiber with a 10mm core. The saturation power was found to be 1.2W for pressure 0.7 mbar and 150 mW for 0.07 mbar. The highest fractional pulse delay was 0.1 for 30-ns pulses.

WeR8-31 **19:00-19:15**

STABILITY OF SOLITARY WAVES IN PHOTONIC BAND GAP

A. Savickas[1], E. Gaizauskas[1], K. Staliunas[2]; 1-Vilnius Univ., Lithuania, 2-Univ. Politecnica de Catalunya, Spain;

We analyse radiation of band gap solitons (solitary wave propagating in the band gap of the 1D photonic crystal), where it radiates into mode continuum of the upper and lower bands due to the fourwave mixing. Self-stabilization of BGS by losing their mass due to the radiation and moving into area of the band-gap with negligibly small radiation are shown.

R1. Solid-State Lasers and Nonlinear Frequency Conversion

WeR1-p01 **09:00-13:30**

A COMPARATIVE STUDY OF EXTRACAVITY EYE-SAFE KGW RAMAN LASERS EMITTED 1ST AND 3RD STOKES AT PUMPING BY Nd:KGW LASERS AT 1351 AND 1067 nm

U.I. Dashkevich, V.A. Orlovich; Stepanov Inst. of Physics NAS Belarus; Belarus

We compare extracavity eye-safe 1st and 3rd Stokes KGW Raman lasers pumped by 1351- and 1067-nm Nd:KGW lasers. At 34-mJ pumping, SRS lasers exhibit identical 36 % optical efficiency. But 3rd Stokes electrical efficiency is 1.7 times higher. The 4F3/2–4I11/2 transition provides greater 3rd Stokes energy at identical SRS and laser crystals: ~14 against ~12 mJ for 1st Stokes.

WeR1-p02 **09:00-13:30**

TWO-STAGE DIODE-PUMPED EYE SAFE RANGE LASER FOR RANGE-FINDING

Mikhail Telegin; Vavilov State Optical Inst.; Russia

This work presents an efficient, two-stage eye safe range laser. The output energy of 7-8 mJ at wavelength of 1.54 μm was obtained using six 150 Watt diode laser arrays operating at 805 nm. It is shown that the diode laser arrays pump YLF:Nd laser which in turn pumps KTP-based laser. The output pulse frequency can be up to 50 Hz.

WeR1-p03 **09:00-13:30**

DIODE-PUMPED Q-SWITCHED ND: YAG LASER OPERATING OVER A WIDE TEMPERATURE RANGE WITHOUT THERMO STABILIZATION OF PUMP DIODES

A.E. Vainshenker, A.V. Vilenskiy, A.A. Kazakov, B.G. Lysoy, L.K. Mikhailov, V.A. Pashkov; R&D Inst. "Polyus"; Russia

The results of development and investigation of a compact Nd:YAG laser with a low power consumption and 20-mJ single pulses at pulse repetition rate of 20 Hz (in cyclic duty). The laser is designed for operation over a temperature range from minus 40 to + 50 C. The problem was solved by the use of quasi-end diode pumping without using thermo stabilization of pump diodes.

WeR1-p04 **09:00-13:30**

ELECTRONIC REGULATION FOR SOLID-STATE LASER COOLING SYSTEM

F. Almabouada and D. Louhibi; CDTA; Algeria

In some applications of laser, the laser cavity enclosing its media and pumping source needs to be cooled. In this paper, we present an electronic control circuit which allows the automatic switching mode (on/off) of the cooling system according to the coolant temperature. The originality of this work is the use of thermoelectric coolers for cooling. Depending on the quantity of coolant the number of the thermoelectric coolers will be fixed.

WeR1-p05 **09:00-13:30**

RESEARCH IN GENERATION OF LASER PRODUCED PARAMETRIC INSTABILITIES IN PLASMA WITH RADIATION HAVING A CONTROLLED LEVEL OF COHERENCE.

Yu.A. Voronin, V.N. Derkach, N.V. Ghidkov, S.V. Kalipanov, A.I. Kedrov, N.A. Petrazhitskaya, K.V. Starodubtsev, S.A. Sucharev, A. E Chaunin; ILFI, Russian Federal Nuclear Center - VNIIEF; Russia

Propagation of laser radiation at the wavelength of 0.657 microns have been investigated through the extensive plasma layers having thickness up to one millimeter and density of a quarter of critical. Results received testifying the existence of the strong hydrodynamic currents in such plasma. The increase to 1.1 nm in spectral bandwidth of radiation passed through a plasma layer is registered. The exponential dependence of laser transmission from the plasma thickness is shown also. Features of 3/2ω generation in plasma are probed. It is shown that generation locates in a narrow layer having the thickness about 60 microns. The spatial distribution of the converted light radiation repeats the structure of the incoming beam. The gain is found to be about (2-6)x10^-4.

WeR1-p06 **09:00-13:30**

COMPENSATION OF POLARIZATION DISTORTIONS IN FARADAY ISOLATORS WITH THE HELP OF INHOMOGENITY OF MAGNETIC FIELD

E.A. Mironov, A.V. Voitovich, O.V. Palashov; Inst. of Applied Physics RAS; Russia

We propose the method of decrease of polarization distortions in Faraday isolators caused by the temperature dependence of the Verdet constant and by the magnetization of magnetooptical element with the help of inhomogenity of magnetic field. We developed a new configuration of magnetic system based on permanent magnets that allows creating necessary profile of magnetic field.

WeR1-p07 **09:00-13:30**

TWO-FREQUENCY SIGMA-POLARIZED VANADATE PICOSECOND LASER

S.P.Sadovskiy, A.A.Sirotkin, S.V.Garnov; Prokhorov General Physics Inst. RAS; Russia

Here, we present a novel two-color picoseconds diode-pumped solid state laser based on a-cut (sigma- polarization) composit YVO4-Nd:YVO4 crystals. Tuning of the laser radiation wavelength (delta=5,4nm) is demonstrated. CW, mode-locking and Q-switching regimes with active acoustic-optical modulators were realised for two-color lasers.

WeR1-p08 **09:00-13:30**

PICOSECOND SYNCHRONOUSLY PUMPED OPTICAL PARAMETRIC OSCILLATOR WITH INTRACAVITY DIFFRACTION GRATING

R. Antanavicius, K.Balskus, A.Michailovas; Ekspla UAB/ Center for Physical Sciences and Technology; Lithuania

We demonstrated the use of a Lyot filters and a diffraction grating as a frequency selective elements in a synchronously pumped OPO based on lithium triborate (LiB3O5) crystal. Experiments revealed that the resonator with diffraction grating is less sensitive to the cavity length detuning but suffers from low damage threshold.

WeR1-p09 **09:00-13:30**

HIGH-POWER AND HIGH-PERFORMANCE LASERS IN CW AND PULSED MODES ON BULK Yb:KYW CRYSTALS WITH LD END-PUMPING

G. H. Kim, J. Yang, A.V. Kulik, E. G. Sall, S. A. Chizhov, V. E. Yashin, D. S. Lee, U. Kang; RSS Center, Korea Electrotechnology Research Institute, South Korea, State Optical Institute; Russia

The results of lasers investigation on the basis of single and dual Yb:KYW crystals with end laser pumping operating in continuous wave, Q-switch and mode-locking regimes are presented. Generation of stable ultrafast pulses with duration less than 100 fs with average power more than 1 W on wavelengths of 1035 nm and 1043 nm is received in the single-crystal laser. The dual- crystal laser provided generation of radiation with average power more than 18 W in a continuous wave mode and more than 16 W in a Q-switch mode at slope efficiency more than 30 %.

WeR1-p10 **09:00-13:30**

TUNABLE LIGHT SOURCE FOR MID-IR RANGE

A.G.Kalintsev, A.F.Kornev, A.S.Narivonchik, A.L.Pavlova; Vavilov State Optical Inst.; Russia

An experimental study of pulsed radiation source mid-IR range been done. The principle of operation of the source based on a multistage parametric frequency conversion of two laser sources - Nd: YAG and Ho: YLF lasers. We obtain a pulse energy of up to 50 mJ in the mid-IR range (about 3.8 micron) at a pulse repetition frequency to 100 Hz.

WeR1-p11 **09:00-13:30**

HIGH EFFICIENCY KTP PARAMETRIC AMPLIFIER PUMPED BY ND:YAG LASER

A.G.Kalintsev, A.F.Kornev, V.P.Pokrovsky, S.S.Terekhov, A.S.Narivonchik, A.L.Pavlova, V.A.Serebryakov, D.O.Oborotov, U.V. Katsev; Vavilov State Optical Inst.; Russia

KTiOPO4 -based two stage parametric amplifier was studied. Up to 20 mJ Ho:YLF laser 2.05 μm pulses were used as the input signal of the first OPA stage. Both stages were consequentially pumped by 600 mJ/100 Hz Nd:YAG pump laser. 2.2 μm idler output of the first stage was used as an input for the second OPA stage. Two 10x10x15 mm KTP crystals were oriented in walkoff compensation geometry in the first stage, the second stage consisted of one crystal of the same dimension. Pulse widths were about 18 ns for Ho:YLF and about 10 ns for Nd:YAG lasers. OPA output energies was 200 mJ at 2,05 μm and 190 mJ at 2,2 μm that corresponds to 65% of overall OPA efficiency. The beam quality M2 of both output beams was about 3.

WeR1-p12 **09:00-13:30**

ACOUSTOOPTICAL FILTER IN 2 μm SPECTRAL RANGE

A.V. Mukhin, S.D. Velikanov, V.D. Glukhodedov, V.I. Lazarenko, S.N. Sin'kov, Y.N. Frolov; Russian Federal Nuclear Center - VNIIEF; Russia

The paper presents the results of calculated and experimental studies of the parameters of TeO_2 – based acoustooptical filter (AOF) in 2 μm spectral range. Solid-state holmium laser (Ho:YAG), operating at 2.091, 2.097 and 2.123 μm wavelengths, was used as the 2-micron optical source. These lasers are very attractive for medical applications, remote sensing and spectroscopy applications.

WeR1-p13 **09:00-13:30**

TIME SYNCHRONIZATION OF Ho:YLF (2.05 μm) AND Nd:YAG (1.06 μm) LASERS

A.F. Kornev, A.S. Narivonchik, A.L. Pavlova, V.P. Pokrovskiy, S.S. Terekhov; Inst. for Laser Physics, Vavilov State Optical Inst.; Russia

Ho:YLF (λ =2.05 μm, τ=18 ns) and single-frequency Nd:YAG (λ=1.06 μm, τ=10 ns) Q-switched lasers with pulse repetition rate up to 1000 Hz were developed for synchronous pumping of KTP OPA. To synchronize pulses of two lasers the electro-optical Q-switch of injection seeded Nd:YAG laser was triggered by fast photo-detector signal from Ho:YLF laser. Build-up time of Nd:YAG laser was minimized to 26 ns. Optical and electrical delays were compensated by optical delay relay in Ho:YLF laser. Optical delay relay had 30 passes, 30 m optical length and 70% transmittance. The mutual jitter of synchronized pulses was better than 1 ns.

WeR1-p14 **09:00-13:30**

POWERFUL 2.796 μm YSGG: Cr:Er LASER WITH FTIR Q-SWITCH FOR DIRECT OPTICAL PUMPING HIGH PRESSURE CO2 LASER

V.M. Gordienko, M.S. Djidjoev, V.V. Firsov, V.T. Platonenko, A.A. Sirotkin[1]; Lomonosov Moscow State Univ., 1-Prokhorov General Physics Inst. RAS; Russia

The results of investigation of YSGG:Cr:Er laser with FTIR Q-switch and two stage amplifier supplied by polarization isolation are reported. Using the two stage amplifier supplied by polarization isolation we obtained four-hold amplification of injected 60 mJ nanosecond pulses. The scheme of high pressure CO2 regenerative amplifier optically pumped by YSGG: Cr: Er laser working at 2.796 μm will be discussed.

WeR1-p15 **09:00-13:30**

DEMONSTRATION OF ROOM-TEMPERATURE LASER ACTION FROM FE:ZNTE IN THE RaNGE OF 4.35-5,45 MICROMETERS

V.V.Mislavskii, M.P. Frolov, Yu.V. Korostelin, V.I. Kozlovsky, Yu.P. Podmar'kov, Ya.K.Skasyrsky, A.A.Voronov; Moscow Inst. of Physics and Technology, Lebedev Physical Inst. RAS; Russia

We report the first demonstration of lasing from Fe2+:ZnTe. Room-temperature laser operation was achieved under pumping by the 2.94 μm output of a Q-switched Er:YAG laser. Output energy up to 0.18 mJ with 2.4% slope efficiency was obtained. With an intracavity prism, the Fe2+:ZnTe laser was tuned from 4.35 to 5.45 μm.

WeR1-p16 **09:00-13:30**

DOUBLE-END-PUMPED CONTINUOUS-WAVE SOLID STATE SELF-RAMAN LASER

A.A. Kananovich, D.H. Zusin, V.A. Orlovich, E.A. Cheshev, M.S. Krivonos, Yu.M. Popov; Stepanov Inst. of Physics NAS Belarus, Lebedev Physics Inst. RAS; Belarus

Double-end-diode-pumped scheme for continuous-wave solid state self-Raman laser as a method for power scaling is proposed for the first time. Practical self-Raman Nd:YVO4 laser is demonstrated and its operation under double-end-pumping is compared in experiment with that under single-end-pumping. A novel thermal lens measurement method based on cavity degeneracy observation is proposed.

WeR1-p17 **09:00-13:30**

1.54 μm RAMAN PASSIVELY Q-SWITCHED DIODE PUMPED KGW:Nd LASER

P.S.Ivanov[1], I.V.Mochalov[1], A.V.Sandulenko[2], S.V.Sandyga[1]; 1-St.Petersburg National Research Univ. of Information Technologies, Mechanics and Optics, 2-Research and Technology Inst. Of Optical Material Science; Russia

The Raman conversion of 1.35 μm radiation to 1.54 micron emission has been obtained in longitudinally diode pumped miniature laser based on $KGd(WO_4)_2$:Nd with passive q- switching. The pulses with energy up to 10 mJ with duration of 3 ns and repetition rate of 10 KHz have been registered.

WeR1-p18 **09:00-13:30**

SOLID STATE SEEDING OSCILLATOR FOR VAPOR IODINE AMPLIFYING SYSTEM BASED ON INTRACAVITY 2-nd STOCKES RAMAN CONVERSION, EMITTING AT λ~1.3152 μm

V.I.Annenkov[1], O.N.Antonov[2], V.S.Chebotar[1], N.A.Kalmikov[1], I.V.Mochalov[2], Y.S.Pantas'[2], A.V.Sandulenko[2], S.V.Sandyga[2]; 1-Sarov All-Russia Research Inst. of Experimental Physics, 2-St. Petersburg National Research Univ. of ITMO; Russia

The solid state intracavity 2-Stokes conversion is suggested as the way to build the seeding oscillator for vapor iodine amplifying system. To couples of active medium – Raman converting element were suggested to provide oscillation at the wavelength of ~1.3152 μm iodine amplifying system. Those were $Gd_3Ga_5O_{12}$-Nd as an active medium and $KY(WO_4)_2$ as a Raman crystal, LaF_3:Nd and $KGd(WO_4)_2$. The oscillation and Raman conversion at the wavelength of 1.3152 μm has been obtained on both couples of active crystal – Raman element, output energy been up to 6 mJ.

WeR1-p19 **09:00-13:30**

DIODE PUMPED FIRST AND SECOND STOCKES INTRACAVITY RAMAN CONVERTER BASED ON $Gd_3Ga_5O_{12}$:Nd ACTIVE CRYSTAL AND $KY(WO_4)_2$ RAMAN ELEMENT

V.I.Annenkov[1], O.N.Antonov[2], V.S.Chebotar[1], P.S.Ivanov[2], N.A.Kalmikov[1], I.V.Mochalov[2], Y.S.Pantas'[2], A.V.Sandulenko[2], S.V.Sandyga[2]; 1-Sarov All-Russia Research Inst. of Experimental Physics, 2-St. Petersburg National Research Univ. of ITMO; Russia

The first and second Stockes Raman conversion has been achieved for longitudinally pumped passively q-switched solid State laser based on $Gd_3Ga_5O_{12}$-Nd with $KY(WO_4)_2$ crystal applied as Raman converting element. The second Stocks emission of the converter having wavelength 1.3152 μm is aimed to be applyed in seeding oscillator for vapor iodine amplifying system.

WeR1-p20 **09:00-13:30**

RAMAN INVESTIGATION OF THE RARE-EARTH OXYORTHO-SILICATES

Y. K. Voron'ko, A. A. Sobol', V. E. Shukshin, A. I. Zagumennyi, Y. D. Zavartsev, S. A. Koutovoi; Prokhorov General Physics Inst. RAS; Russia

The assignments of the vibrational modes in the Lu_2SiO_5 (LSO) and Gd_2SiO_5 (GSO) measured Raman spectra were determined. Evaporation of SiO_2 from the LSO crystal at annealing above 2100 K and from the LSO melt was determined. The invert glasses with the LSO and GSO compositions were synthesized by quick quenching their melts. The structure of these glasses was studied.

WeR1-p21 **09:00-13:30**

THE INFLUENCE OF THE THERMAL EXCITED STATE Nd^{3+} ABSORPTION BAND BROADENING OF TO RAMAN LASER THRESHOLD ENERGY INCREASING.

V.N.Ivanov, V.Yu.Khramov, A.N.Titov, O.B.Storosthuk, I.P.Krotov; NITIOM Vavilov State Optical Inst., IFMO, OOO NPO KARAT; Russia

There is edge of the absorption band from the excited state Nd3+ at the generation wave length 1,351mkm of KGW:Nd3+. The thermal broadening of this band leads to self- Raman threshold energy increasing. As active element was used KGW:Nd3+ crystal. As Q-switchers were used YAG:V3+ for lasers operating both at λ=1,351mkm and λ=1.538mkm, and GSGG:Cr4+ for laser operating at λ=1.067mkm.The results of numerical modeling and experimental data are published.

WeR1-p22 **09:00-13:30**

A COMPARATIVE STUDY OF EXTRACAVITY EYE-SAFE KGd(WO4)2 AND PbWO4 RAMAN LASERS

U.I. Dashkevich, V.A. Orlovich; Stepanov Inst. of Physics NAS Belarus; Belarus

We compare extracavity nanosecond 1538-nm PbWO4 and KGd(WO4)2 Raman lasers. At 1351-nm pumping, the PbWO4 Raman gain increasing 4 times at full pump polarization rotation is ~2.5 time greater then the KGd(WO4)2 one. The higher damage threshold of KGd(WO4)2 allows using more intense pumping and achieving the higher output energy: 11.9 mJ against 11.3 mJ for PbWO4 at 32-mJ pump.

WeR1-p23 **09:00-13:30**

PHASE MATCHING OF FOUR-WAVE MIXING OF RAMAN COMPONENTS IN BIREFRINGENT RAMAN-ACTIVE CRYSTALS

S.N. Smetanin, T.T. Basiev; Research Center for Laser Materials and Technologies of Prokhorov General Physics Inst. RAS; Russia

A new method has been proposed for achieving wave vector matching in four- wave interactions of frequency components upon stimulated Raman scattering in birefringent Raman- active crystals. The method ensures anti-Stokes wave generation and enables a substantial reduction in higher order Stokes Raman generation thresholds.

WeR1-p24 **09:00-13:30**

INTRACAVITY CONTINUOUS-WAVE KGd(WO4)2 RAMAN LASERS: GENERATION AT 1159 nm AND TWO-WAVELENGTH GENERATION OF 1ST STOKES AT 1157.3 AND 1159 nm

A.A. Kananovich, V.I. Dashkevich, D.H. Zusin, V.A. Orlovich; Stepanov Inst. of Physics NAS Belarus; Belarus

We demonstrate for the first time to our knowledge intracavity KGd(WO4)2 Raman laser emitting at 1159 nm due to a 767-cm-1 Raman shift. We also demonstrate simultaneous generation of 1157.3- and 1159-nm 1st Stokes by means of lasing by Nd3+:GdVO4 and Nd3+:YVO4 active media differing in the working transition wavelength and conversion of fundamental in the same Raman crystal

WeR1-p25 **09:00-13:30**

NEW METHODS OF CW SOLID STATE INTRACAVITY RAMAN LASERS INTERNAL LOSSES MEASUREMENT

A.A. Kananovich, P.A. Apanasevich; Stepanov Inst. of Physics NAS Belarus; Belarus

Two new methods for measurement of internal losses in diode-pumped continuous wave solid state Raman lasers are presented. One method is applicable for measurement internal losses near threshold and the other one — for pump power high above threshold. The methods were applied to measure internal losses of a real laser system.

WeR1-p26 **09:00-13:30**

INTRACAVITY SFG AND SHG IN CW DIODE-PUMPED SOLID STATE RAMAN LASERS: THEORETICAL APPROACH

P.A. Apanasevich, A.A. Kananovich, V.A. Orlovich, G.I. Timofeeva; Stepanov Inst. of Physics NAS Belarus; Belarus

We present a theory of intracavity sum frequency generation (SFG) and second harmonic generation (SHG) in continuous-wave solid state diode-pumped Raman laser. The analytical expressions for dependence of generated SHG and SFG powers on pump, cavity and active media properties are obtained. The phenomenon of Stokes oscillation suppression by SFG is explained. The suppression in SHG case is shown impossible.

WeR1-p27 **09:00-13:30**

OBSERVATION OF THE SELF-MODE-LOCKING IN A RING RAMAN LASER

R. Chulkov, V. Markevich, V. A. Orlovich; Stepanov Inst. of Physics NAS Belarus; Belarus

Possibility of the self-mode-locking at the backward first Stokes oscillation in a ring-cavity Raman laser with the broadband pump was demonstrated numerically and experimentally observed during Raman lasing with KGW crystal excited by radiation of the multimode Nd:YAG laser. The locking was attributed to the effect of synchronous pumping guided by competition between the forward and backward Raman scattering.

WeR1-p28 **09:00-13:30**

TERAHERTZ GENERATION BY OPTICAL MIXING OF CHIRPED FIBER LASER PULSES

J. Adamonis, N. Rusteika, R. Danilevicius, A. Krotkus; Center for Physical Sciences and Technology; Lithuania

We generated narrow band tunable terahertz radiation by optical mixing of two linearly chirped pulses from picosecond fiber laser system. The linear chirp was generated by the interplay of self phase modulation and dispersion. We present experimental THz power spectrum over the tuning range together with modeling results.

WeR1-p29 **15:00-19:30**

MICROMACHINING WITH PICOSECOND LASERS

D. Müller, B. Klimt and F. Bachmann; LUMERA LASER GmbH; Germany

Picosecond lasers are poised to change the world of micromachining. Picosecond lasers allow a new level of precision micromachining through unparalleled quality in a variety of applications such as microelectronics, semiconductor, and photovoltaic industries.

WeR1-p30 **15:00-19:30**

HIGH LASER STRENGTH OF DIELECTRIC INTERFERENCE COATINGS ON OPTICAL MATERIALS, RODS AND NON-LINEAR CRYSTALS

V.V. Novopashin, E.A.Levchuk, A.V. Shestakov; R&D Inst. "Polyus"; Russia

High performance dielectric interference coatings (anti-reflection, dielectric mirrors, polarizes, beam-splitters) in a broad spectral range are observed. All types of coatings were produced by electron beam evaporation, in some cases ion source was used. Thus ion beam provided to obtain more density films, that were closed to their stoichiometry structure. This is urgent for high power lasers at 1064nm, lasers in medium infrared region and also for disc lasers. It was shown, that influence of ion beam allowed to evaporate materials without substrate heating where it was necessary and obtain strong films.

WeR1-p31 **15:00-19:30**

NEODYMIUM-GLASS AMPLIFIER WITH A ZIGZAG LASER BEAM PROPAGATION

A.V. Vinogradov, V.E. Gaganov, S.G. Garanin, N.V. Zhidkov, V.A. Krotov, S.P. Martynenko, E.V. Pozdnyakov, I.I. Solomatin; Russian Federal Nuclear Center - VNIIEF; Russia

A neodymium-glass laser-diode-pumped amplifier with a zigzag laser beam propagation through the active medium was elaborated. Parameters of the amplifier (unsaturated amplification coefficient, distribution linear gain over the aperture, stored energy and wavefront distortions) were experimentally determined.

WeR1-p32 **15:00-19:30**

NUMERICAL SIMULATION ON AMPLIFIED SPONTANEOUS EMISSIONS IN ND:YAG SLAB AMPLIFIER

H. Su, X.-J. Wang; Inst. of Applied Physics and Computational Mathematics; China

The amplified spotaneous emission (ASE) in Nd:YAG slab amplifier is studied numerically. The ray tracing method is used to solve coupled rate equations and electrodynamics equations. The results explore competing processes between the parasitic oscillations (PO) and the laser, and conclude that the ASE/PO can not only reduce the stored energy of amplifier but also induce the degeneration of beam quality according to the thermal effect.

WeR1-p33 **15:00-19:30**

RAMAN SPECTRA AND PRETRANSITION STATE OF THE CRYSTALLINE POTASSIUM PERCHLORATE IN THE REGION OF STRUCTURAL PHASE TRANSITION OF THE FIRST KIND

A.R.Aliev, I.R.Akhmedov, M.G.Kakagasanov; Amirkhanov Inst. of Physics of Dagestan Scientific Center RAS; Russia

We have investigated the temperature dependence of the Raman spectra of the crystalline potassium perchlorate in the temperature range 298 - 583 K. T=573 K is the temperature of the structural phase transition of the first kind. In the temperature range 500 - 570 K the pretransition state was found. In the pretransition state there is saturation of the rotation mobility of the anion ClO4-.

WeR1-p34 **15:00-19:30**

Z-SCAN IN VANADATES IN THE NEAR INFRARED AND VISIBLE

A.I. Vodchits[1], V.A. Orlovich[1], P.A. Apanasevich[1], V.S. Gorelik[2], N.V. Tcherniega[2], A.D. Kudryavtzeva[2]; 1-Stepanov Inst. of Physics NAS Belarus, 2-Lebedev Physical Inst., Russia

Nonlinear refraction and absorption have been studied for a number of vanadates crystals using Z-scan method with picosecond pulses at 1064 and 532 nm. In crystals with active ions nonlinear refraction is lowered. In the visible, all crystals show the nonlinear refraction and absorption which are considerably stronger in comparison with the known other crystals.

WeR1-p35 **15:00-19:30**

MODIFICATION OF KGW CRYSTAL TRANSMISSION SPECTRUM BY CONTINUOUS-WAVE DIODE LASER RADIATION

I.A.Khodasevich[1], A.A.Kornienko[2], E.B.Dunina[2], A.S.Grabtchikov[1]; 1-Stepanov Inst. of Physics NAS Belarus, 2-Vitebsk State Univ.; Belarus

Modification of transmition spectrum for the undoped KGW crystal is observed at excitation by continuous-wave radiation of the 2 W diode laser. The shift of the absorption edge to the longer wavelengths with creation of broad absorption bands is registered. Modification of transmition is accompanied by appearance of two emission bands at 525 and 550 nm.

WeR1-p36 **15:00-19:30**

PECULIARITIES OF GLASSES FOR MICROCHIP LASERS

A. Dmitryuk, V. Savostyanov; NITIOM Vavilov State Optical Inst.; Russia

The modulated radiation emitted by microchip lasers was super luminescence. Spectral interval between adjacent lines of comb spectrum varies with radiation wavelength, thickness of Fabry-Perot resonator and refractive index of amplifying medium. The phenomenon of super luminescence modulation in Fabry-Perot micro resonator can be used for designing the simplest comb spectral channels generators for DWDM working in 0.9-1.6 μm spectral range. 200 and 250 spectral channels were realized for Yb/Er and Nd micro-chip lasers, correspondingly.

WeR1-p37 **15:00-19:30**

PHOTO INDUCED TEMPERATURE QUENCHING OF ND^{3+} LUMINESCENCE IN ANTIMONY PHOSPHATE LASER GLASS

A.V. Dmitryuk, V.A. Savostyanov; Research and Technological Institute of Optical Material Science; Russia

Spectroscopic and kinetic study of Nd doped highly concentrated antimony phosphate laser glass intended for manufacturing of active elements of microchip lasers have been studied. Temperature dependencies of luminescence decay of the glass and active element of microchip laser made of the same glass have been compared. In the case of quasi CW pumping regime the temperature of glass in work channel achieved 150-300 C that led to photo induced temperature quenching Nd3+ luminescence.

WeR1-p38 **15:00-19:30**

SPECTROSCOPIC PROPERTIES OF Nd^{3+}– DOPED ANTIMONY PHOSPHATE GLASSES

A.Dmitryuk, A.Anan'ev, L.Maksimov, V.Savostyanov, B.Tatarintsev, A.Zhilin; Research and Technological Institute of Optical Material Science; Russia

Nd^{3+} doped alkali antimony phosphate glasses were synthesized at various synthesis conditions with controlling OH group percentage. Absorption and luminescence spectra of Nd^{3+} ions and absorption spectra of OH groups were measured. Nd^{3+} luminescence quenching as functions of Nd_2O_3 and OH group concentrations were studied. Optimized spectroscopic and spectral kinetic parameters of glasses were found close to those of commercial phosphate glasses produced by Schott. The nearest neighborhood of Nd^{3+} ions was formed by phosphate polyhedrons.

WeR1-p39 **15:00-19:30**

ELECTRO-CONDUCTIVITY INVESTIGATION OF THE HIGH-RESISTANCE EOD CRYSTALS APPLIED IN ELECTRO-OPTICAL MODULATORS.

V.A.Rusov[1], N.A.Zaharova[1], A.B.Kaplun[2], A.B.Meshalkin[2]; 1-Inst. for Laser Physics, Vavilov State Optical Inst., 2-Inst. of Thermophysics; Russia

In this work the mechanisms of electrical conductivity for the high-resistance KTP crystals are investigated in a pulse mode. It is determined that when an electric field is switched on, the conduction current pulse is a slowly increased and duration of this pulse front is an order 5,2 ms. It is shown, that the change of a conduction current in a wide temperature range is caused by mechanisms of thermal ionic polarization. Specific crystal conductivity at usual times of inclusion of an order 1,0 μs does not exceed 10^-11 -10^-12 S/cm, therefore, practically all restrictions of use of KTP crystals in the electro-optical modulators, connected with their electro-chromic damage are removed.

WeR1-p40 **15:00-19:30**

COMPOSITE YAG:Nd LASER ROD WITH GLASS ABSORBING ENVELOPE FOR SUPERLUMINESCENCE SUPPRESSION

R.M.Boiko, S.A.Bolshakov, B.G.Lysoi, A.V.Vilensky, A.V.Shestakov, I.A.Shestakova; R&D Inst. "Polyus"; Russia

YAG:Nd cylindrical laser rod cladded with Sm co-doped glass envelope was investigated in laser with both collinear and side diode pumping. The experiments demonstrated substantial superluminescence suppression and an increase of laser output pulse energy for such kind of laser rod.

WeR1-p41 **15:00-19:30**

EFFECTIVE Nd,Ce:YAG LASER ROD FOR COMPACT FLASHLAMP-PUMPED LASERS

S.A.Bolshakov, A.M.Onischenko, A.V.Shestakov, I.A.Shestakova; R&D Inst. "Polyus"; Russia

A series of Nd,Ce:YAG crystals with different impurity doping levels was grown. Measurements of main laser parameters such as output energy and slope efficiency for laser rods with Nd,Ce as well as only with Nd-dopant were performed. Almost twofold increase of laser oscillator efficiency was demonstrated for laser rods of small diameter due to mainly radiative energy transfer from Ce ions to Nd ions.

WeR1-p42 **15:00-19:30**

DEVELOPMENT OF ACTIVE ELEMENTS FOR HIGH-POWER DISK LASER

N.P. Badalyan, G.M. Zverev, A.B. Kozlov, M.I. Mit`kin, N.N. Semenovsky, A.V. Shestakov, I.A. Shestakova; R&D Inst. "Polyus"; Russia

Abstract is not available.

WeR1-p43 **15:00-19:30**

DIODE- EXCITED 5d–4f LUMINESCENCE FROM Ce^{3+} IONS DOPED INTO FLUORIDE HOST BaR_2F_8.

T. V. Uvarova, N. S. Kozlova[1], S.Yu. Kuznetsov[1]; Prokhorov General Physics Inst. RAS, 1-National Univ. of Science and Technology "MISIS" (MISIS); Russia

The article discusses spectra of the realizing up-conversion 5d-UV luminescence of Ce3+ ions at a wavelength of 312-357 nm, excited by radiation of laser diodes 960 nm, 840 - 808nm. Moreover, we discuss the dependence of the populations on the crucial intermediate 3P0 level Pr3+ from the absorbed energy.

WeR1-p44 **15:00-19:30**

ACTIVE LASER ELEMENTS BASED ON ORGANIC DYE MOLECULES, BONDED COVALENTLY WITH POLYMER MATRIX

V.I. Bezrodnyi, A.M. Negriyko, N.A. Derevyanko[1], A.A. Ishchenko[1]; Inst. of Physics NAS Ukraine, 1-Inst. of Organic Chemistry NAS Ukraine; Ukraine

Photostability and generation parameters of laser active elements, based on organic dyes, bonded covalently to polyurethane polymer chain were investigated. Effects of covalent bonds on spectral properties of dyes from widely used coumarins, phenalenones, xanthenes and polymethines were studied. The experimental data show perspectives in the applications of the covalent bond formation during the development of dye-polymer laser elements.

WeR1-p45 **15:00-19:30**

SPECTROSCOPIC, LUMINESCENT AND LASER PROPERTIES OF ZRO_2-Y_2O_3-TM_2O_3 CRYSTALS

P.A. Ryabochkina[1], A.V. Malov[1], E.E. Lomonova[2], S.N. Ushakov[2], A.N. Chabushkin[1]; 1-Ogarev Mordovian State University, 2-Prokhorov General Physics Institute RAS; Russia

The spectral-luminescence properties of ZrO_2-12mol.%Y_2O_3-2mol.%Tm_2O_3 have been studied. The cross-relaxation efficiency for Tm^{3+} ions (3H4->3F4, 3H6->3F4) in these crystals has been estimated. For the first time with crystals ZrO_2-12mol.% Y_2O_3-2mol.%Tm_2O_3 obtained laser operation at the transition 3F4 -> 3H6 of Tm3+ ions with λ_{gen} = 2046 nm.

WeR1-p46 **15:00-19:31**

INFLUENCE OF CO-DOPING ON OPTICAL PROPERTIES $Na_{0.4}Y_{0.6}F_{2.2}$:Ce^{3+},RE^{3+} (RE: Yb, Eu, Gd,Tm, Pr) CRYSTAL SAMPLES AFTER UV-IRRADIATION

D.I. Tselischev, A.K. Naumov, E.Yu. Tselischeva, E.Yu., Gordeev, V.V.Semashko, S.L. Korableva; Kazan Federal Univ.; Russia

In this paper we present results of studies of optical properties of $Na_{0.4}Y_{0.6}F_{2.2}$:Ce^{3+} crystal before and after UV irradiation, when crystal was co-doped by various RE^{3+} ions (RE: Yb, Eu, Gd, Tm, Pr). Appearance of additional absorption bands in all samples after irradiation by fourth harmonic of YAG:Nd^{3+} laser was observed.

WeR1-p47 **15:00-19:30**

OPTICAL PROPERTIES OF SHORT-LIVED COLOR CENTERS INDUCED BY UV RADIATION IN CRYSTALS KY_3F_{10}:Ce^{3+}, KY_3F_{10}:Ce^{3+},Yb^{3+}

E.Yu. Tselischeva, A.K. Naumov, D.I. Tselischev, S.L. Korableva; Kazan Federal Univ.; Russia

This paper demonstrates differential transmission spectra (ratio of transmission spectra of excited and unexcited sample) of KY_3F_{10}:Ce and KY_3F_{10}:Ce,Yb samples of crystals in wavelength range from 300 to 800 nm. Effect of co-doping by Yb ions on color centers formation is demonstrated. Reasons for low efficiency of lasing in KY_3F_{10}:Ce and KY_3F_{10}:Ce,Yb crystals are explained.

WeR1-p48 **15:00-19:30**

THE ADDITIONAL COLORATION OF SCHEELITE-LIKE MOLYBDATE SINGLE CRYSTALS

D.A.Lis, G.M. Kuz'micheva, K.A.Subbotin, D.A. Nikolaev, V.B.Rybakov, E.V.Zharikov; Prokhorov General Physics Inst. RAS, Moscow State Academy of Fine Chemical Technology, Moscow State Univ.; Russia

Present paper is devoted to the investigation of the issues related to the formation and elimination of the color centers in scheelite-like double molybdate single crystals. The crystals grown appeared to be black-colored due to the presence of very broad absorption band, covering whole visible part of the spectrum. Annealing the crystals in air resulted in disappearance of the additional absorption band and of dark color.

WeR1-p49 **15:00-19:30**

CROSS RELAXATION LUMINESCENCE PARAMETERS OF PR^{3+} IONS IN LaF_3 CRYSTAL

O.A.Morozov[1], S.L.Korableva[1], Yu.Ye.Polskiy2, V.V.Semashko[1], A.K.Naumov[1]; [1]Kazan Federal Univ., 2Kazan National Research Technological Univ.; Russia

Results are presented of studies of influence Pr3+ ions concentration on up- conversion channels in LaF3:Pr3+ crystal. Registration of dependences of luminescence spectra versus concentration of Pr3+ ions in LaF3 crystal has allowed determining effect and cross-section of cross-relaxation process. Thus dependences of cross-relaxation process and up-conversion parameters on concentration of Pr3+ ions in LaF3 crystal were obtained.

WeR1-p50 **15:00-19:30**

LASER PROPERTIES DEPENDENCE ON THE STRUCTURAL IMPERFECTION OF ACTIVE ELEMENTS FROM RARE- EARTH VANADATES

G.Yu. Orlova, V.I. Vlasov, Yu.D. Zavartsev, A.I. Zagumennyi, I.I. Kalashnikova, S.A. Kutovoi, V.S. Naumov, A.A. Sirotkin; R&D Inst. "Polyus", Prokhorov General Physics Inst. RAS; Russia

The efficiency of diode-pumped lasers with active elements made from yttrium, gadolinium, yttrium – gadolinium and yttrium – scandium orthovanadate crystals has been shown for the first time to be influenced by structural imperfections (quality) of the crystals. This allows one to predict lasing parameters of such crystals without fabricating active elements.

WeR1-p51 **15:00-19:30**

INFLUENCE OF HIGH-ENERGY ELECTRON IRRADIATION ON FORSTERITE LASER CRYSTALS

O. N. Zaitseva[1], K. A. Subbotin[1], V. B. Dudnikova[2], V. M. Lazarenko[3], V. N. Kolokol'tsev[4], V. I. Tovtin[4], and E. V. Zharikov[1]; 1-Prokhorov General Physics Inst. RAS; 2-Moscow State Univ., 3-Baikov Inst. RAS; Russia

The effect of 21-MeV electron irradiation on the optical absorption characteristics of Czochralski-grown forsterite single crystals has been investigated. The irradiation is found to induce additional optical absorption in the crystals in the range of 225-1200 nm. A possible structure of the color centers responsible for the additional optical absorption is discussed.

WeR1-p52 **15:00-19:30**

ANALYSIS OF PHOTOREFRACTIVE PROPERTIES OF LiF COLOR CENTER CRYSTALS FOR MID-IR VOLUMETRIC BRAGG GRATING APPLICATIONS

A. Fedorov[1,2], A. Arumugam[1], D. Martyshkin[1], V. Fedorov[1], D. Hilton[1], S. Mirov[1], A. Fomichev[2]; 1-Univ. of Alabama at Birmingham, USA; 2-Moscow Inst. of Physics and Technology, Russia;

A gamma irradiated LiF Color Center Crystals was proposed as a material for Volumetric Bragg Grating (VBG) operating in the mid-IR spectral range. Theoretical estimation as well as preliminary experimental results on fabricated periodic structures demonstrated that photorefractive effect based on color center bleaching could provide VBG efficiency ~60% in 1-6 μm spectral range.

WeR1-p53 **15:00-19:30**

COMPENSATION OF THERMALLY INDUCED BIREFRINGENCE AND PHASE DISTORTIONS IN [100]-CUT Nd:YAG CRYSTALS

I. A. Gorbunov, A. K. Kotov, O. V. Kulagin; Inst. of Applied Physics RAS; Russia

We present the results of numerical and experimental study of thermally induced phase distortions, birefringence and it's compensation in [100]-cut Nd:YAG laser rods. Inevitable non circularly-symmetric phase distortions were considered in the simulation of the beam propagation in laser rods. Crystal axes alignment requirements for compensation were found and confirmed by analytical estimation and experiment.

WeR1-p54 **15:00-19:30**

THERMAL DEPOLARIZATION IN CUBIC CRYSTALS WITH ANISOTROPIC ELASTIC PROPERTIES

A. G. Vyatkin, E. A. Khazanov; Inst. of Applied Physics RAS; Russia

We calculated the thermally induced depolarization ratio in cubic crystals at an arbitrary orientation considering the anisotropy of the elastic properties. The stress-optic anisotropy ratio describes the photoelastic properties better than the strain-optic one. In the case of 23 and m3 crystals the optimal orientations are shifted relative to their existing estimates.

WeR1-p55 **15:00-19:30**

COMPENSATION OF THERMALLY INDUCED DEPOLARIZATION IN CaF_2 WITHOUT ADDITIONAL PHASE ELEMENTS

A. G. Vyatkin, I. L. Snetkov, O. V. Palashov, and E. A. Khazanov; Inst. of Applied Physics RAS; Russia

Compensation of depolarization in lasers' active elements at small birefringence without additional phase elements was proposed and experimentally observed. Requirements on the crystal properties and orientations were formulated.

WeR1-p56 **15:00-19:30**

THERMAL OPTICAL DISTORTION AND LASING OF NON-COOLED SOLID STATE LASER BASED ON ATHERMAL-CUT $KGd(WO_4)_2$:Nd^{3+} ACTIVE ROD.

I.V.Mochalov[1], A.V.Sandulenko[2], E.K.Serdyuk[1], O.B.Storoshuk[3], A.N.Titov[2]; 1-St.Petersburg National Research Univ. of Information Technologies, Mechanics and Optics, 2- Research and Technology Inst. of Optical Material Science, 3-Research and Production Company "Karat"; Russia

The experimental comparative studies of thermal optical distortion are presented for standard-oriented and athermal-oriented $KGd(WO_4)_2$:Nd^{3+} active rods. It has been shown that at similar pumping conditions the cline deformation is considerably lower for athermal- oriented $KGd(WO_4)_2$:Nd^{3+} toward standard-oriented active rod. The comparison was performed for lasing properties at the wave length of 1.067 μm and Raman self-conversion lasing at the wave length of 1.54 μm.

WeR1-p57 **15:00-19:30**

MODELING OPTICAL PARAMETRIC FREQUENCY CONVERTORS WITH THERMAL DISTORTION

A.G. Kalintsev[1], N.A. Kalintseva[1], V.A. Serebryakov[1], A.V. Kopyltsov[2]; 1-Vavilov State Optical Inst., 2-Herzen State Pedagogical Univ.; Russia

Software package for calculation of the parametric nonlinear frequency converter with thermal self-action was developed. The algorithm is based on a calculation the phase- mismatch taking into account non-uniform temperature over the volume of crystal, which arises due to the absorption of laser radiation. Method of successive approximations is optimized solution of the stationary heat conduction problem in view of the nonlinear frequency conversion.

WeR1-p58 **15:00-19:30**

DIODE-PUMPED SLAB Nd:YAG LASER WITH THERMALLY INDUCED BIREFRINGENCE COMPENSATION

A.M.Onischenko, A.A.Shestakov, A.V.Shestakov; R&D Inst. "Polyus"; Russia

A diode-pumped Q-switched Nd:YAG laser is developed that operates at a pulse repetition rate up to 100 Hz and an output energy up to 70 mJ. A feature of the laser is the use of rods in the form of a rectangular parallelepiped in side pumping with a laser diode array through one of the faces and reflection from the opposite face. To compensate the gain inhomogeneity in such a pumping and to decrease the effect of thermooptic distortions, two identical laser rods are used that are located in the laser cavity so that pumping of the rods is carried out through mutually opposite faces. In operation of the laser in a wide range of pulse repetition rates thermally induced birefringence and distortions of a "wedge" type are low and practically have no effect on the parameters of laser output.

WeR1-p59 **15:00-19:30**

COMPENSATION OF THERMAL EFFECTS IN POWERFUL FARADAY ISOLATOR

O.V. Palashov, I. L. Snetkov; Inst. of Applied Physics RAS; Russia

A Faraday isolator system with external compensation of thermally induced birefringence was investigated for the case when optical components of the Faraday isolator and the compensator are made of different materials. A method of compensating thermally induced birefringence without reciprocal polarization rotator was described theoretically and demonstrated in experiments for the first time.

WeR1-p60 **15:00-19:30**

MEASUREMENTS OF OPTICAL ABERRATIONS IN ZIG-ZAG PUMPED COMPOSITE SLAB

A. Aleknavicius[1,2], A. Michailovas[1,2], M. Grishin[1,2], M. Gabalis[1], V. Girdauskas[3]; 1-Center for Physical Sciences and Technology, Vilnius, Lithuania, 2-Ekspla, Vilnius, Lithuania, 3-Faculty of Natural Sciences and Technology; Lithuania

Measurements and analysis of optical aberrations of proposed composite active element were performed. Measured phase maps are represented by Zernike polynomials. Leading aberrations are focusing and astigmatism. All Zernike coefficients are linearly dependent on absorbed pump power. Optimization for beam quality and gain after passing such element will be presented.

WeR1-p61 **15:00-19:30**

THE DIFFERENCE OF THE THERMAL DEPENDENCES OF GENERATION ENERGY KGW:Nd^{3+} PASSIVE Q-SWITCH LASER FOR 1,538 μm AND 1.067 μm WAVE LENGTHS GENERATION

V.N.Ivanov, V.Yu.Khramov, A.N.Titov, O.B.Storosthuk, I.P.Krotov, A.V. Sandulenko,B.A.Ignatenkov; NITIOM Vavilov State Optical Inst., IFMO, OOO NPO KARAT; Russia

KGW:Nd^{3+} passive Q-switch laser can lasing at 1.067μm and 1.538μm. Active elements, the system of pumping and optical resonators are same. For 1.067μm use crystal passive Q-switch GSGG:Cr^{4+} and for 1.538μm - YAG:V^{3+}. In the case of 1.067μm wave length the generation energy is increasing with temperature growth, but at 1.538μm it is decreasing.

WeR1-p62 **15:00-19:30**

COMPACT TUNABLE LiF COLOR CENTER LASER SYSTEM

P. G. Zverev[1], V. A. Konyushkin[1], Z.J. Liu2, X.Y. Zhang[2]; 1-Prokhorov General Physics Inst. RAS, Russia, 2-Shandong Univ., Jinan, China; Russia

The efficient LiF:F^{2-} color center laser pumped by a compact LD-pumped Nd:YVO_4 acousto optically Q-switched laser was developed. The narrow line tunable from 1.1 to 1.290 μm laser radiation with 10% conversion efficiency in the maximum was achieved under pumping with 1.6 W average pump power and 30 kHz pulse repetition rate. The average output power as high as 230 mW was reached.

WeR1-p63 **15:00-19:30**

SPECTRUM-, PULSE-WIDTH AND WAVELENGTH VARIABLE ALL-FIBER MODE-LOCKED YB LASER WITH BIREFRINGENT FILTER

Y.S.Fedotov[1], S.M.Kobtsev[1], A.G.Rozhin[2], C.Mou[2], S.K.Turitsyn[2]; 1-Novosibirsk State Univ., Russia; 2-Aston Univ., United Kingdom

We demonstrate experimentally a method to control pulse duration, spectral width and operational wavelength in all-fiber passively mode-locked laser through insertion of a PM- fiber section into resonator. Using as a particular example of this general technique, we present a new scheme of all-panda passively mode-locked Yb laser.

WeR1-p64 **15:00-19:31**

STABILITY OF BIDIRECTIONAL GENERATION IN A RING YAG:Cr^{4+} LASER

Yu.Yu. Broslavets, M.A. Georgieva, A.A. Fomitchev; Moscow Inst. of Physics and Technology; Russia

In this work we investigated how the spectral characteristics of laser transition of the broadband active medium affect the level of fluctuations and stability of bidirectional generation, and stability of mode locking in a ring laser in the rotation sensing mode. We developed the model of bidirectional generation of such a laser taking into account spectral proper-

ties of the active medium. In order to find the polarization of the crystal we used the quantum kinetic equations for density matrix. Luminescence spectrum of the YAG:Cr^{4+} crystal and generation spectra of the laser showed that this medium has both homogeneous and inhomogeneous broadenings. Stable bidirectional generation is a result of the fact that competition between counterpropagating waves is less than in the case of homogeneously broadened medium.

WeR1-p65 **15:00-19:30**

INVESTIGATION OF TWO-WAVELENGTH LASER OPERATION MODE

Yu. Arapov, A. Ivanov, I. Kasyanov, L. Magda; VNIITF, Snezhinsk; Russia

Determined cross sections for transitions at wavelengths 1.06μm and 1.33μm neodymium ions in YAG. Implemented pulse-periodic two-wavelength laser generator and amplifier. Research of the laser amplifier based on a crystal of the act medium YAG:Nd3+ in the mode of simultaneous amplification of two wavelengths in a pulsed mode.

WeR1-p66 **15:00-19:30**

MULTIWAVE GENERATION OF Er:YLF LASER AT SIMULTANEOUS SELECTIVE PUMPING IN TWO SPECTRAL REGIONS

M.V. Inochkin, L.V. Khloponin, V.Yu. Khramov, V.V. Nazarov, D.Yu. Sachkov; St.Petersburg National Research Univ. of ITMO; Russia

This paper presents the results of theoretical investigation of Er:YLF lasing wavelengths switching by means of varying of the pumping parameters. The Er:YLF lasing in case of selective pumping in two spectral regions (1.5 μm and 0.98 μm) is discussed. The theoretical model of Er:YLF lasing with pumping at 2 wavelengths simultaneously is presented.

WeR1-p67 **15:00-19:30**

ANALYSIS OF THE LINE BROADENING OF DIODE-PUMPED SOLID-STATE LASERS

S. V. Boritko; CDB Unique Instrumentation RAS; Russia

The output parameters of the system for pumping of solid-state lasers that is based on laser diode arrays are studied. The spatial profile of radiation of diode arrays and the differences in the radiation spectra of emitting elements are determined. It is demonstrated that the main reason for the spectral broadening of laser radiation is related to thermal effects resulting from the spatial nonuniformity of radiation of the diode pumping system.

WeR1-p68 **15:00-19:30**

TUNABLE TWO-MODE Cr:ZnSe LASER FOR COMPACT METHANE BASED OPTICAL FREQUENCY STANDARDS

Yu.P.Podmar'kov[1,2], M.P.Frolov[1,2], M.A.Gubin[1], A.N.Kireev[1], Yu.V.Korostelin[1], V.I.Kozlovsky[1], A.B.Pniov[3], D.A.Shelestov[3], A.Shelkovnikov[1], D.Tyurikov[1]; 1-P.N.Lebedev Physical Institute RAS; 2-Moscow Inst. of Physics and Technology; 3-Bauman Moscow State Technical Univ.; Russia

A tunable two-mode optically pumped solid state Cr:ZnSe laser for compact optical frequency standards was developed. The laser frequency noise at the level 0.03 $Hz/Hz^{1/2}$ was measured. Narrow (less then 500 kHz) saturated dispersion resonances on F2(1) R(2) and E(1) R(2) lines of v1+v4 band of methane were recorded at room and liquid nitrogen temperatures.

WeR1-p69 **15:00-19:30**

BROADBAND FREQUENCY CONVERSION IN RANDOM NONLINEAR PHOTONIC CRYSTALS

A. S. Aleksandrovsky, A. M. Vyunishev, A. I. Zaitsev, G. I. Pospelov, V. E. Rovsky, V. V. Slabko; Kirensky Inst. of Physics, Siberian Federal Univ.; Russia

In this communication we report the results of experimental and theoretical studies of broadband frequency conversion in one-dimensional random nonlinear photonic crystal of strontium tetraborate. Three kinds of second order nonlinear processes were studied, namely, random quasi-phase-matching, Cerenkov nonlinear diffraction and parametric down-conversion.

WeR1-p70 **15:00-19:30**

OPTIMIZATION OF CONDITIONS FOR STEADY-STATE INTRACAVITY SECOND HARMONIC GENERATION IN SOLID-STATE LASERS

P. Khandokhin, Yu. Mamaev; Inst. of Applied Physics RAS; Russia

Optimization of the conditions of steady-state second harmonic generation on the basis of the anisotropic model of an active medium comprising amplitude and phase anisotropy and an anisotropic nonlinear element is considered using the Jones matrix method. An optimal angle of orientation of the nonlinear element as a function of its phase anisotropy and the active medium anisotropy is found.

WeR1-p71 **15:00-19:30**

INFLUENCE OF RESONATOR CONFIGURATIONS ON MODE PROFILES AND THRESHOLD IN NON-HOMOGENEOUSLY DIODE END-PUMPED Nd-DOPED LASERS

V.V. Besotosnyy[1], M.V. Gorbunkov[1], P. V. Kostryukov[2], M.S. Krivonos[1], Y. M. Popov[1], V.G.Tunkin2, E. A. Cheshev[1]; 1-Lebedev Physical Institute RAS, 2-Lomonosov Moscow State Univ.; Russia

The synchronization of transverse modes in solid-state lasers with spatially inhomogeneous diode-pumping is studied theoretically and experimentally, including peculiarities in the critical configurations of the cavity. It is shown that threshold pump power and radial spatial profiles essentially depend on the length of the cavity. The theoretical conclusions are confirmed experimentally for Nd:YAG [100], Nd:YLF [100], Nd:GGG [111] and Nd:YAG-ceramic lasers.

WeR1-p72 **15:00-19:30**

FREQUENCY CONTROL OF SELF-MODULATION IN SOLID-STATE LASERS WITH FEEDBACK AT INTRACAVITY SECOND HARMONIC GENERATON

P. Khandokhin, V. Zhislina; Inst. of Applied Physics RAS; Russia

The influence of optoelectronic feedback on chaotic oscillations at intracavity frequency conversion is analyzed within the framework of the model taking into account phase-sensitive mode interaction. It is shown that the transition of chaotic oscillations to regular self-oscillations with a frequency of one of the polarization relaxation oscillations occurs under the feedback. Conditions for frequency switching of self-oscillations are found.

WeR1-p73 **15:00-19:30**

ANALYSIS OF GAIN-GRATING DIFFRACTION EFFICIENCY AND OSCILLATION IN THE SELF-PUMPED PHASE- CONJUGATE MULTI-LOOP LASER CAVITY

A.P. Pogoda[1], M.R.Yusupov[1], V.F. Lebedev[1], S.N. Smetanin[2]; 1-Baltic State Technical Univ., 2-Research Center for Laser Materials and Technologies of GPI; Russia

We present the results of analysis and calculations of the diffraction efficiencies and the laser oscillations for single gain grating and for the gain grating combination in the self-pumped phase-conjugate multi-loop laser cavity. Basic result consists in sharp (more than twofold) reduction in requisite gain coefficient of the laser medium and accordingly in the required pumping level.

WeR1-p74 **15:00-19:30**

TB-DOPED POTASSIUM-LEAD DOUBLE CHLORIDE CRYSTALS (TB^{3+}:KPb_2Cl_5) AS PROMISING MATERIAL FOR UV-VIS OPTICAL CONVERTERS

A.M. Tkachuk[1,2], S.E. Ivanova[2], A.A. Mirzaeva[1], F. Pellé[3], L.I. Isaenko[4]; 1-Inst. for Laser Physics, Vavilov State Optical Inst., 2-CIOT, St. Petersburg National Univ. of ITMO, Russia, 3-LCMCP, France, 4-Inst. of Mineralogy & Petrography SB RAS

The emission properties of Tb3+:KPb2Cl5 crystals were studied to evaluate the potential of these crystals for application as luminescent down converters. On the bases of experimental and calculated spectroscopic characteristics of the studied crystals it is shown that they can convert UV photons in the visible range with a quantum yield more then unity with minimal thermal losses. A conclusion is made about perspectives of use of the Tb3+:KPb2Cl5 crystals as down-converters for enhancement a-Si and c-Si solar cells efficiency

R1. Solid-State Lasers and Nonlinear Frequency Conversion

ThR1-13 Invited **09:00-09:30**

LASER METHODS OF GENERATION AND VISUALIZATION OF SINGLE-SHOT MEGAVOLTAGE TERAHERTZ PULSES

S. V. Garnov, I. A. Shcherbakov; Prokhorov General Physics Inst. RAS; Russia

Abstract is not available.

ThR1-14 **09:30-09:45**

TERAHERTZ WAVES GENERATION IN AIR PLASMA BY USING TWO-COLOR TUNABLE FEMTOSECOND LASER EXCITATION

A.I. Korytin, A.A. Murzanev, A.N. Stepanov; Inst. of Applied Physics RAS; Russia

Terahertz pulse generation in the laser-induced air plasma was investigated. Femtosecond laser pulses consisting of both a weak fundamental and its intense second-harmonic frequency were used for the terahertz generation. The dependences of terahertz emission on the laser pulses energy, polarization and frequency shift were studied. Experimental results reveal that free electrons clearly contribute to terahertz emission.

ThR1-15 Invited **09:45-10:15**

THZ-WAVE GENERATION FROM NONLINEAR OPTICAL SEMI-WAVEGUIDE

Y.-Ch. Huang; National Tsinghua Univ.; Taiwan

We demonstrated enhanced forward and backward THz-wave DFG at 1.5 and 0.6 THz, respectively, from a PPLN waveguide that guides a THz wave but not the optical pumps. A theory accounting for mode mismatch is derived to explain the experiment.

ThR1-16 **10:15-10:30**

LD-PUMPED 1.2J, 1064NM SINGLE FREQUENCY PULSED LASER

Y. Lu , G. Xie, L. Zhang, N. Li, B. Wei, Y. Pang, C. Tang, W. Wang, Q. Gao, Y. Huang, X. Xu; Inst. of Applied Electronics, China Academy of Engineering Physics; China

We report on a LD-pumped single frequency , maser oscillator power amplifier (MOPA) system. The seed is generated by modulating a continuous single frequency laser. With one fiber amplifier and three Nd:YAG rod amplifiers, single frequency pulsed laser with pulse energy of 1.2J , repletion-rate of 50Hz , pulse width of 220μs , linewidth less than 100kHz and beam quality M2~1.5 is obtained.

ThR1-17 **10:30-10:45**

DISSIPATIVE SOLITONS IN ULTRA-LONG ACTIVELY MODE-LOCKED FIBER LASER

N. Koliada[1], B. Nyushkov[1,2], A. Ivanenko[2,3], S. Kobtsev[2], P. Harper[3], S. Turitsyn[3], V. Denisov[1], V. Pivtsov[1]; 1-Inst. of Laser Physics of SB RAS, 2-Novosibirsk State Univ., Russia; 3-Aston Univ., UK;

Active mode locking is for the first time implemented in an ultra-long fiber laser to generate high-energy pulses. We demonstrate that such mode locking allows fine tuning and stabilization of lasing wavelength and pulse repletion rate. Thus, 34-nJ dissipative solitons with the continuously tunable wavelength (~1558 nm to ~1560 nm) were generated in a 1.3-km-long actively mode-locked normal-dispersion Er-fiber laser.

ThR1-18 **10:45-11:00**

SPECTRAL PARAMETER CONTROL IN DIODE-PUMPED VANADATE LASERS

A.A. Sirotkin, V.I. Vlasov, A.I. Zagumennyi, Yu.D. Zavartsev, S.A. Kutovoi, V.A. Brendel, S.V. Garnov, I.A. Shcherbakov; Prokhorov General Physics Inst. RAS; Russia

We present laser sources based on a novel methods control of spectral parameters in diode-pumped vanadate lasers. Spectroscopic and lasing properties of Nd:$GdVO_4$, Nd:$GdVO_4$ and mixed Nd:$Y_xGd_{1-x}VO_4$, Nd:$Y_xSc_{1-x}VO_4$ crystals were investigated. We have investigate polarization and angular dependences of the luminescence intensity of Stark transitions in vanadate crystals. The frequency shift and redistribution of the luminescence intensity of Stark transitions are observed.

- COFFEE BREAK -

ThR1-19 Invited **11:30-12:00**

SPACE-BASED LASER WITH SWITCHEABLE BEAM DIRECTION FOR PHOBOS-GROUND SPACECRAFT

V.M.Polyakov; Inst. for Laser Physics, Vavilov State Optical Inst.; Russia

The Phobos-Ground laser project results are discussed. The space-based DPSSL with LC-switchable beam direction for verticant-altimeter is presented. The scheme decisions for the laser design are considered. The problems occurred during the developing and testing are described. The testing results, obtained during the laser and beam director testing and environmental testing are discussed. The space-based use of laser diode pumping, MOPA scheme and twist-nematic LC cells are analyzed.

ThR1-20 **12:00-12:15**

JOULE RANGE HIGH BEAM QUALITY Nd:YAG LASER WITH SELF-PUMPED PHASE-CONJUGATE LOOP CAVITY AND REPETITIVE PULSED DIODE-MATRIX SIDE-PUMPING

A.P. Pogoda[1], T.B. Lebedeva[1], M.R.Yusupov[1], R.A. Liventsov[1], V.F. Lebedev[1], A.S. Boreysho[1], A.V. Gavrilov[2], S.N. Smetanin[3], A.V.Fedin[2]; 1-Baltic State Technical Univ., 2-Kovrov State Technological Academy, 3-Research Center for Laser Materials and Technologies of GPI; Russia

We present the new technique of high power diode-matrix side-pumping and high-efficient single-mode oscillation for the Nd:YAG laser with self-pumped gain-grating phase- conjugate loop cavity. At the 12.6-kW pumping with 0.45-ms pulse duration and 20-Hz repetition rate the maximum laser pulse energy, average power and oscillation efficiency reached 0.9 J, 18 W and 16 % respectively.

ThR1-21 **12:15-12:30**

300 J Nd:GLASS LASER WITH PULSE REPETITION RATE OF 1 SHOT/1 MINUTE

A. Kuzmin, A. Shaykin, E. Khazanov; Inst. of Applied Physics RAS; Russia

300 J Nd:glass laser with a pulse repetition rate of 1 shot per 1 minute has been designed and a prototype is constructed. The active elements (rods 4.5 cm in diameter) have a safety factor of at least 5 before damage. Thermally induced distortions of radiation have been measured and compensated.

ThR1-22 **12:30-12:45**

SPECTRAL CHARACTERISTICS OF CR:ZNSE LASER WITH SELECTIVE RESONATOR.

A.S. Egorov, O.N. Eremeykin, K.Yu. Pavlenko, A.P. Savikin; Lobachevsky Nizhny Novgorod State Univ.; Russia

Different tuning methods for Cr:ZnSe laser in 2100-2400 nm diapason were under research. We have investigated two of the most widely-spread methods: Lyot-filter and intracavity Brewster-cut prism. We have made theoretical estimations and practical measurement of bandwidth and tuning coefficient for two prisms made of CaF2 and quartz. Moreover, extensive research of single and composite Lyot-filter was carried out.

ThR1-23 **12:45-13:00**

EFFICIENT 50 mJ/1000 Hz Q-SWITCHED Ho:YLF MOPA LASER

A.F. Kornev, A.S. Narivonchik, A.L. Pavlova, V.A.Serebryakov; Lasers and optical systems; Russia

We developed a high-energy and high-repetition rate Q-switched Ho:YLF MOPA laser longitudinally pumped by a Tm-fiber laser. Conductively cooled amplifier of the laser consisted of three Ho:YLF laser rods that were consequently pumped. We optimized cavity parameters of Ho:YLF MO, concentration of Ho^{3+}, the lengths of the laser rods as well as mode matching of pumping and lasing beams in Ho:YLF laser rods. As a result a slope efficiency of Ho:YLF MO at 1000 Hz was 35%, an extraction eff Ho:YLF MOPA laser produced ~ 50 mJ at repetition rate 1000 Hz and > 70 mJ at repetition rate 100 Hz with pulse width (FWHM) 20 ns, with a beam quality M^2 better than 2.

ThR1-24 **13:00-13:15**

EFFECTS RESTRICTING HIGH PEAK AND AVERAGE POWER OF PW LASER SYSTEMS

M.S. Kuzmina, E.A. Khazanov, A.A. Shaykin, A.N. Stepanov; Inst. of Applied Physics RAS; Russia

The theoretical model describing the laser radiation propagation in a birefringent nonlinear medium is proposed. Cubic nonlinearity impact on thermally induced depolarization compensation and polarization conversion by means of λ/4 plate is investigated.

ThR1-25 **13:15-13:30**

SINGLE FREQUENCY REGENERATIVE AMPLIFIER DISK LASER SYSTEM

P. Mahnke, J. Speiser, A. Giessen; DLR Inst. of Technical Physics; Germany

We present a single frequency, frequency tripled nanosecond master oscillator power amplifier Yb:YAG disk laser system

- LUNCH BREAK -

ThR1-26 **15:00-15:15**

THE HIGH AVERAGE AND PEAK POWER MOPA SYSTEM BASED ON CRYOGENICALLY COOLED YB:YAG DISKS

I.B. Mukhin, I.I. Kuznetsov, O.V Palashov, E.A. Khazanov; Inst. of Applied Physics RAS; Russia

The high efficient MOPA system based on cryogenically cooled Yb:YAG disks is developed with output energy 54mJ at 0.2kHz. The system is tried at 1kHz, output energy 30mJ was obtained. The AMC scheme allows realizing very high small signal gain (up to 300) in the preamplifier. Further upgrade will allow extracting 50mJ in sub-ns pulse at 1kHz repetition rate

ThR1-27 **15:15-15:30**

THE NEW TECHNIQUE OF THERMAL BONDING FOR COMPOSITE ACTIVE ELEMENTS FABRICATION

I.B. Mukhin, E. A. Perevezentsev, O.V. Palashov; Inst. of Applied Physics RAS; Russia

The new simple technique of thermal diffusion bonding is developed and Yb:YAG/YAG composite active elements are fabricated by using this method. The key of technology is the chemical activating before thermal diffusion bonding. The experimental investigation of contact quality shows extremely low reflection losses (< 0.03%) and high strength of contact (more strength than YAG medium).

ThR1-28 **15:30-15:45**

SINGLE MODE OPERATION OF 1018 NM MULIMODE FIBER LASER WITH INTRACAVITY TAPERS

H. Xiao, P. Zhou, X. Wang, S. Guo, X. Xu; College of Optoelectric Science and Engineering, National Univ. of Defense Technology; China

Single mode operation of a multimode 1018 nm fiber laser is achieved. A pair of tapered fiber mode filed adapters is inserted into the laser cavity to suppress high order modes excitated in the multimode gain fiber. The maximum laser power is 20 W with near diffraction limited beam quality when 33W pump power absorbed.

ThR1-29 **15:45-16:00**

OPTICAL LAYOUT OF A POWERFUL NEODYMIUM LASER FACILITY UFL-2M

S.A. Bel'kov, I.N. Voronich., S.G. Garanin, I.N. Derkach., V.A. Eroshenko, I.E. Chernov, Yu.V. Shagalkin; ILFI, Russian Federal Nuclear Center - VNIIEF; Russia

Report shows the concept of optical system layout of a powerful neodymium laser facility UFL-2M. The main decisions of optical scheme and the applying techniques were checked on laser facility Luch created in RFNC-VNIIEF. The multi-passing regime of amplifying channel operation, high requests on laser divergence on the output of the facility and nonlinear effects of powerful laser propagation dictate the special requirements to tolerances on manufacture of optical elements. The general approaches to the analysis of tolerances and aberrations, and also the methods applied to compensate the aberrations are discussed in the report.

ThR1-30 Invited **16:00-16:30**

THERMOOPTICAL DISTORTIONS IN END-PUMPED Nd:YAG SLAB LASER

A.D. Lyashedko, D.A. Lisicin, V.F. Seregin, V.B. Tsvetkov and I.A. Shcherbakov; Prokhorov General Physics Inst. RAS; Russia

The study of temperature distribution, probe beam phase distortion in end- pumped Nd:YAG zigzag slab laser was made at different pump conditions. The small signal gain in one- pass and multiple-pass zigzag slab amplifier was measured. Lasing was obtained and influence of pump inhomogeneity on lasing efficiency was demonstrated.

ThR1-31 **16:30-16:45**

GENERATION OF HIGH POWER LEVELS OF NARROW LINEWIDTH 1178 NM VIA RAMAN AMPLIFICATION OF THE SECOND STOKES

L.J. Henry, G.T. Moore, J.Grosek; Air Force Research Laboratory; United States

A dual seeded (pump at 1069 nm and second Stokes at 1178 nm) narrow linewidth polarization maintaining Raman fiber laser system involving amplification of the second Stokes in a Raman resonator having high reflector Bragg gratings tuned to the first Stokes at 1121 nm is proposed. This system has the potential of generating 50 W of output power at 1178 nm.

ThR1-32 **16:45-17:00**

QUASI-PHASE-MATCHED OPTICAL PAPAMETRIC OSCILLATOR IN HIGH POWER OPERATION

X. Wei, Y. Peng, W. Wang, J. Gao, D. Li; Inst. of Applied Electronics, China Academy of Engineering Physics; China

This paper presents our recent experiment research on high-power QPM-OPO base on PPLN. Average power of 40.8 W at 2.7 μm was obtained with the pump power of 195 W at 8 kHz repetition rate. In the high pump intensity operation, high order nonlinear processes of up converting and cascaded interaction were found.

- COFFEE BREAK -

ThR1-33 **17:30-17:45**

STABILIZED HARMONIC GENERATION IN LASER PLASMA USING THE NEAR INFRARED FEMTOSECOND PULSES

R. A. Ganeev, C. Hutchison, A. Zaïr, T. Witting, F. Frank,S. Weber, W. A. Okell, J. W. G. Tisch, and J. P. Marangos; Blackett Laboratory, Imperial College London; United Kingdom

We show the advantages of using the rotating targets for plasma harmonic generation, which allowed the dramatic improvements of harmonic stability in the case of resonance enhancement and application of 800 and 1300 nm multi-cycle and few-cycle radiation.

ThR1-34 Invited **17:45-18:15**

THERMAL LENSING IN Nd:YAG LASERS: INEVITABLE ABERRATIONS AND CORRECTION POSSIBILITIES

O.V. Kulagin[1], I.A. Gorbunov[1], A.M. Sergeev[1], M. Valley[2]; 1-Inst. of Applied Physics RAS, Russia; 2-Sandia National Laboratories, Albuquerque, USA

We discuss theoretical investigations of thermal lensing aberrations in high-power solid-state lasers caused by the temperature dependence of laser media parameters and pump non-uniformities. We also review experimental efforts to compensate for these distortions using specially designed aspherical optical components.

ThR1-35 **18:15-18:30**

SUB-JOULE LEVEL CRYOGENIC DISK LASER BASED ON Yb:YAG CERAMICS

E.A. Perevezentsev, I.B. Mukhin, O.L. Vadimova, O.V. Palashov, E.A. Khazanov; Inst. of Applied Physics RAS; Russia

Using two 20mm in diameter, 1.4mm thick, 5%at doping Yb:YAG ceramic active elements we reached 233mJ at 143 kHz in the output with 70ns 30mJ input pulses. According to out 3D calculations we extracted somewhat half of stored energy. To our knowledge, this output result is the best among all high repetition rate cryogenic pulse Yb:YAG laser systems.

ThR1-36 **18:30-18:45**

NUMERICAL MODELING AND EXPERIMENTAL INVESTIGATION OF AMPLIFICATION IN CRYOGENIC DISK LASER AT HIGH THERMAL LOAD

O. Vadimova, I. Mukhin, O. Palashov, O. Vadimova; Inst. of Applied Physics RAS; Russia

A theoretical model of energy storage in high thermally loaded Yb:YAG disk is developed for 78K-400K temperature range. ASE is calculated in 3D-geometry at strong spectral dependence of amplification. Theoretically predicted limitation of stored energy by ASE is tried experimentally under cryogenic temperature. It is possible to reduce this parasitic effect by using undoped cap for the disk active element.

ThR1-37 **18:45-19:00**

A SIMPLE METHOD OF DETERMINIG THE STRESS-OPTIC ANISOTROPY RATIO

I.L. Snetkov, A.G. Vyatkin, O.V. Palashov, and E.A. Khazanov; Inst. of Applied Physics RAS

A simple method for measuring the stress-optic anisotropy ratio (including its sign) in crystals with cubic lattice symmetry was proposed and verified in experiment. The stress-optic anisotropy ratio at room temperature for λ=1.076 μm was measured for CaF_2 and TGG crystals as -0.47 and +2.25, respectively. In crystals with negative value of this parameter thermally induced depolarization may be reduced significantly by choosing crystal orientation. In a CaF_2 crystal with the [111] orientation a 20-fold reduction of thermally induced depolarization compared to the [001] orientation was obtained in experiment, which is very promising for using CaF_2 as an active element in high-average-power lasers.

ThR1-38 Invited **19:00-19:30**

LOW SPECTRALLY-COHERENT AND BROAD TEMPERATURE-TUNED BLUE/GREEN QUASI-PHASE-MATCHING LASERS INVOKING PHASE-APODIZATION DESIGN

C.-M. Ho, S.-D. Tsai, S.-H. Fu, C.-M. Lai, L.-H. Peng, A.-H. Kung; National Taiwan Univ.; Taiwan

We reported SHG green lasers with spectral/temperature FWHM ~5nm/80 C and single-pass efficiency >30% on 5.7mm-long PPLN using phase-apodized QPM design. Monolithic PPLT devices composed of cascaded QPM-OPO-SHG segments of 18mm-length are shown to enable up- conversion blue lasers with 100mW threshold, 16% slope efficiency, temperature-tuning range >15 C and 8nm spectral shift in the peak wavelength with a Q-switch green pump.

R4. Laser Beam Control

ThR4-11 Invited **09:00-09:30**

ADAPTIVE CORRECTION AND PHASE LOCKING FOR POWERFUL LASERS IN RFNC-VNIIEF

S. Garanin, F. Starikov; Russian Federal Nuclear Center - VNIIEF, Inst. of Laser Physics Research; Russia

The report is devoted to development of adaptive optical systems and beam combining systems in RFNC-VNIIEF and the results of adaptive phase correction of powerful pulsed and cw laser beams.

ThR4-12 Invited **09:30-10:00**

ADAPTIVE OPTICS AND FOCAL SPOT CORRECTION ON HIGH POWER LASERS

N. Lefaudeux, X. Levecq, G. Dovillaire, L. Escolano, S. Theis; Imagine Optic, ISP System; France

We present high power laser focal spot correction method and results. First, usual adaptive optics closed loop using a mechanical deformable mirror is run. Then, in non-amplified configuration, focal spot images and phase retrieval algorithm are used to correct focal spot. Finally, the same wavefront is generated in amplified configuration resulting in a perfect high power focal spot.

ThR4-13 Invited **10:00-10:30**

ADAPTIVE SYSTEM FOR FORMING THE LASER BEAM IN ATMOSPHERE WITH THE USE OF INCOHERENT IMAGES AS THE REFERENCE SOURCES

V.P.Lukin; Zuev Inst. of Atmospheric Optics SB RAS; Russia

In problems of optical location, communication, and energy transmission one frequently runs up against the problem of transporting radiant energy in the form of a light beam to an object located in a random inhomogeneous medium. Here, as a rule, it is necessary to maximize the amount of energy delivered to the object. As is well known, scattering of radiation by refractive index inhomogeneities of the medium leads to a decrease of the average intensity in the near-axial region of the light beam and to the appearance of intensity fluctuations, which taken together substantially degrade the energetic characteristics of the indicated systems.

ThR4-14 Invited **10:30-10:45**

IMPROVING LASER BEAM SHAPING PERFORMANCE BY BINARY BITMAP DRIVED LIQUID CRYSTAL SPATIAL LIGHT MODULATOR

X. Xie, D. Jiang, X. Zeng, L. Ding, Q. Zhu; Science and Technology on Plasma Physics Laboratory; China

A new method is proposed to improve laser beam shaping performance of liquid crystal spatial light modulator(SLM). Drived by binary bitmap instead of traditional 8-bit grayscale bitmap, SLM is able to overcome the nonlinear response of transmission vs gray. It can be use to generate homogeneous laser beam profile with high fidelity in high power laser system.

- COFFEE BREAK -

ThR4-30 **10:45-11:00**

DOPPLER-FREE COMB-SPECTROSCOPY

S. A. Pulkin, V.A. Arnautov, S.V. Uvarova; Saint-Petersburg State Univ., Russia

The numerical calculations of absorption coefficient in atomic vapor contra-propagation fs-trains of pulses are made. The absorption lines with homogenous broadening are obtained. There are many advantages of proposed method before usual Doppler-free spectroscopy with diode lasers. Fs-laser with broad spectrum helps detect many spectrum lines at once, gives us high sensitivity of spectra with shorter time of detection.

ThR4-15 Invited **11:30-12:00**

ADAPTIVE SYSTEM OF COHERENT RADIATION FOCUSING WITH THE USE OF FLUCTUATING "ILLUMINATION" SIGNAL AS THE REFERENCE ONE

L.A.Bolbasova, V.P.Lukin; Zuev Inst. of Atmospheric Optics SB RAS; Russia

Adaptive focusing of a coherent beam in a turbulent atmosphere is considered. Distributions of the mean intensity of the field a coherent laser beam focused in a turbulent medium by means of adaptive phase correction with the use of a point reference source are calculated. The source retains a random position on the object onto which laser radiation is focused. Results of adaptive focusing with the cases of moving and motionless reference sources are compared.

ThR4-16 **12:00-12:15**

COHERENT BEAM COMBINATION OF 400 W NANOSECOND FIBER AMPLIFIER ARRAY USING SPGD ALGORITHM

R. Su, P. Zhou, X. Wang, Y. Ma, X. Xu, J. Chen, Z. Liu; National Univ. of Defense Technology; China

We demonstrate coherent beam combination of 2x2 pulsed fiber amplifier array with a total of 400 W output power. Phase controlling of the 4 amplifiers with ~4 ns pulse duration and 10 MHz repetition rate was performed by running the stochastic parallel gradient descent (SPGD) algorithm on a field programmable gate array (FPGA).

ThR4-17 **12:15-12:30**

SPATIAL FILTRATION OF POWERFUL PULSE LASERS RADIATION WITH ADAPTIVE OPTICS

O. Shanin; FSUE SRI SIA LUCH; Russia

In powerful pulse lasers in struggle for quality of radiation the spatial filtration has major importance. On the example of the four-pass amplifier of the pulse laser spatial filtration of radiation which is carried by the cavity spatial filter consisting of two lenses with a diaphragm placed in a focal plane and an adaptive mirror is considered. The analysis is executed with application of the theory of linear systems and allows to define simply enough design parameters of system of a spatial filtration of radiation of multi-pass pulse lasers.

ThR4-18 **12:30-12:45**

CHARACTERISTICS OF HIGH-ACCURACY METHOD OF LASER BEAM FOCAL PLANE DETECTION.

Ya.I. Malashko, V.M. Khabibulin, A.N. Kleymenov, I.B. Potemkin.; JSC MSDB "Almaz-Antey"; Russia

Results of the numerical simulation and experimental study of accuracy of laser beam waist detection by method of wavefront double frequency spherical modulation are presented. Focusing detection error value was less then 10-5 dioptry. Experimentally determined power share value, transferred to a double frequency signal, was 12%.

ThR4-19 **12:45-13:00**

CRITERIA OF PERMITTED VALUES OF SMOOTH ABERRATIONS FOR LASER BEAMS WITH NONDIFFRACTIONAL QUALITY

Ya.I. Malashko, V.M. Khabibulin.; JSC MSDB "Almaz-Antey"; Russia

Criteria intended for laser beams with low or high radiation power with angular divergence more than 8 diffraction limits. For creation of criteria it was deduced an analytical formulas for combining simultaneously values of angular divergence and smooth aberrations. Numerical simulation results are good agreement with calculations.

ThR4-20 **13:00-13:15**

ON SPECTRUM OF EIGENVALUES OF THE PROPAGATION CONSTANT FOR A PLANAR DIELECTRIC WAVEGUIDE

M. Kovalev; Bauman Moscow State Technical Univ.; Russia

The propagation of monochromatic polarized electromagnetic TE-waves trough a multilayer planar dielectric waveguide is examined. We are interested in qualitative characteristics of the spectrum of eigenvalues of effective refractive index (propagation constant) of a waveguide.

ThR4-21 **13:15-13:30**

SIMULTANEOUS COMPENSATION OF THERMAL EFFECTS IN GGG-BASED CRYOGENIC FARADAY ISOLATOR FOR LASERS WITH HIGH AVERAGE POWER

A. V. Starobor, D. Zheleznov, O. Palashov; Inst. of Applied Physics RAS; Russia

Compensation of thermally induced depolarization for cryogenic Faraday isolator with magneto-optical element made of GGG was demonstrated. Possibility of using glass with negative dn/dT as compensator with simultaneous compensation of thermally induced lens was shown experimentally and theoretically. Faraday isolator with maximum operating power in excess of 20 kW is discussed.

- LUNCH BREAK -

ThR4-22 Invited **15:00-15:30**

LASER GONIOMETERS

Yu. Filatov; St.-Petersburg State Electrotechnical Univ.; Russia

Abstract is not available.

ThR4-23 Invited **15:30-16:00**

HOLOGRAPHIC INTERFEROMETRY IN NANOMETROLOGY AND SPECTROSCOPY

S.A. Pulkin, V.Yu. Venediktov, Yu.I. Anisimov, V. Ivanov, V.I. Korotkov, E.L. Ryabchikov, N.A. Agishev, I.M. Pasechnik, M.A. Solov'ev; St.Petersburg State Univ.; Russia

The method of holographic interferometry with increasing sensitivity was applied for measurements of height of nano-steps (from 10 nm and higher) with standard uncertainty about 0.5 nm. The increasing of sensitivity is obtained because interference of waves with complex conjugated phases. Also we demonstrate the possibilities of Rozhdestvenski Hook method with increasing sensitivity for measuring of oscillator strengths (transition probabilities) for weak atomic transitions. The usage of matrix phase modulator and CCD-camera were used for obtaining digital interferogram.

ThR4-24 **16:00-16:15**

THE APPLICATION OF BINARY RADIAL DOE TO OPTICAL TRAPPING OF MICROPARTICLES

D.G. Kachalov[1], V.S. Pavelyev[1,2], S.N. Khonina[1,2], R.V. Skidanov[1,2], A.P. Porfirev[1,2]; 1-Samara State Aerospace Univ., 2-Image Processing Systems Inst. RAS; Russia

The novel binary radial diffractive optical element (DOE) forming "light bottle" intensity distribution in the zero diffractive order has been designed and experimentally studied. The microparticle's optical trapping is realized by use of manufactured DOE. It is shown that realized "light bottle" can be used for trapping transparent and non-transparent microparticles in viscous medium.

ThR4-25 **16:15-16:30**

NUMERICAL SIMULATION OF MULTI-CHANNEL LASER RADIATION DELIVERY THROUGH THE OPTICALLY INHOMOGENEOUS MEDIUM BASED ON TARGET-IN-THE-LOOP TECHNIQUE

M.V. Volkov, V.A. Volkov, F.A. Starikov; Russian Federal Nuclear Center - VNIIEF; Russia

In this article the efficiency of control multi-channel laser radiation based on target-in-the-loop technique, concentration of his on the target, its link with accurate phase conjugation are investigated by numerical simulation. Efficiency of delivery and concentration of multi-channel laser radiation on the target through the optically inhomogeneous medium, example turbulent atmosphere, is examined when piston and tip/tilt correction in channel is realized using stochastic parallel gradient descent algorithm.

ThR4-26 **16:30-16:45**

SOLUTION FOR THE PROBLEM OF CALIBRATION OF MULTI-ELEMENT PHOTODETECTORS SENSITIVITY SPATIAL DISTRIBUTION. THEORY AND EXPERIMENT

S.E. Stukachev, I.E. Kozhevatov; Inst. of Applied Physics RAS, Radiophysical Research Inst.; Russia

The novel method for calibration of multi-element photodetectors sensitivity spatial distribution is proposed. The method is based on the several measurements of the intensity distribution of the steady light beam in different relative positions of the light beam and photodetector. The theoretical and numerical studies of the method were done. The experiments based on the proposed method were carried out.

ThR4-27 **16:45-17:00**

BEAM SPREADING OF LG0L -BEAMS IN TURBULENT ATMOSPERE

V. P. Lukin, P. A. Konyaev, V. A. Sennikov; Zuev Inst. of Atmospheric Optics SB RAS; Russia

We present some results obtained by numerical modeling of the propagation of vortex beams LG0l through a randomly inhomogeneous medium. The statistically averaged beams <LG0l> conserve the central intensity dip with a nonzero intensity on the beam axis. These beams are found to be broadened less than the Gaussian beam. The higher is the vortex topological charge l, the smaller is the beam broadening.

- COFFEE BREAK -

ThR4-28 **17:30-18:00**

REAL-TIME HIGH-SPEED ADAPTIVE OPTICAL SYSTEM WITH STACKED ACTUATOR DEFORMABLE MIRROR TO CORRECT FOR ATMOSPHERIC TURBULENCE

A. Kudryashov, A. Rukosuev, V. Samarkin; Active optics NightN Ltd, Moscow State Open Univ.; Russia

In this paper we present the commercially available high-speed (up to 200 Hz) closed loop adaptive system to correct for aberrations of the atmosphere. Correct that we used is a atacked actuator mirror with 97 actuarots placed on the aperture of 50 mm. System allows to compensate first 64 Zernike polynomials. The maximum of local stroke for each actuator - about 2 microns. Presented system showed the ability to correct for laser beams propagated through turbulent atmosphere over 2 km.

ThR4-29 **18:00-18:15**

POINT DIFFRACTION INTERFEROMETER BASED ON A SINGLE-MODE FIBER

D. Silin, I. Kozhevatov; Inst. of Applied Physics RAS, Radiophysical Research Inst.; Russia

Interferometric method for measurements of optical fields from remote objects and external sources is presented. The reference beam in this interferometer is produced from an investigated beam by means of filtration of its spatial spectrum by a single-mode fiber. The calibration procedure is proposed to obtain phase distortions of the interferometer and subtract them from the measured phase distributions.

ThR4-30 **18:15-18:30**

EXPERIMENTAL INVESTIGATION OF NEAR-SINGLEMODE OUTPUT BEAM QUALITY THROUGH PASSIVE TAPERED OPTICAL FIBER WITH MORE THAN 100 μm OUTPUT CORE DIAMETER

V.E. Ustimchik[1,2], S.A. Nikitov[1,2],A.E. Ulanov[1,2], V.N. Filippov[3],J. Kerttula[3], Yu.K. Chamorovskii[1]; 1-Inst. of Radio-engineering and Electronics RAS, Russia, 2-Moscow Inst. of Physics and Technology, Russia, 3-Tampere Univ. of Technology, Finland

Experimental investigation of output laser beam quality through the passive double-clad tapered fiber is considered. Insignificance of mode beating in presented transmission spectra over wide wavelengths range 900-1400nm shows that there is no mode coupling into fiber with output core diameter more than 100μm and singlemode input signal. During measurements any specific stacking technology was not used, results demonstrated near singlemode regime under real conditions close to practice.

R5. Super-Intense Light Fields and Ultra-Fast Processes

ThR5-15 Invited **09:00-09:30**

TOWARDS TEV ACCELERATION IN PLASMAS

A. Pukhov; Univ. of Düsseldorf, Inst. für Theoretische Physik I; Germany

Over the last few years there was a significant progress in the physics of relativistic laser-plasma interactions. Monoenergetic electron beams have been obtained and the energy of the accelerated electron bunches has reached the GeV barrier. Most likely, electrons are accelerated in the "bubble" regime. The advantage of the bubble is that it is stable and scalable. The relativistic similarity theory leads to scalings for the maximum electron energy and the number of accelerated electrons. These suggest that if we want to reach the TeV energy, a MegaJoule-class driver is required.

ThR5-16 **09:30-09:45**

LASER DRIVEN STOCHASTIC ELECTRON ACCELERATION BY INTENSE PICOSECOND LASER PULSES

S.G. Bochkarev[1], V.Yu. Bychenkov[1], D.V. Romanov[2], D.V. Torshin[3], V.A. Lykov[3]; 1-Lebedev Physics Inst. RAS, 2-All-Russia Research Inst. of Automatics; 3-RFNC -VNIITF; Russia

We present a study of stochastic electron acceleration in vacuum and underdense plasmas by an intense relatively long ps-range duration laser pulses when plasma waves are excited through self-modulation of laser pulse. Using an analytical approach, test particle approximation and PIC simulations we show that the stochastic acceleration by laser pulse with assistance of plasma waves can be effective mechanism of fast electron generation in the interaction of powerful laser with underdense plasma.

ThR5-17 **09:45-10:00**

RESONANT HIGH-ORDER HARMONIC GENERATION BY LOW-FREQUENCY LASER FIELD

M. A. Khokhlova[1,2], V. Strelkov[1]; Prokhorov General Physics Inst. RAS, Lomonosov Moscow State Univ.; Russia

Very efficient generation of the harmonic resonant with the transition from the bound to the autoionizing state of the generating particle was demonstrated recently in the experiments using plasma plumes and Xe jet. We develop an analytical theory of the resonant HHG. The rapid variation of the matrix element near the resonance precludes the application of the non-resonant HHG theories. Applying different approximate integration methods, we find the time-dependent microscopic dipole moment.

ThR5-18 **10:00-10:15**

POLARIZATION OF HIGH HARMONICS GENERATED IN THE PROCESS OF TWO-COLOR LASER FIELD INTERACTION WITH A SINGLE ATOM

A.V. Andreev, S.Yu. Stremoukhov, O.A. Shoutova; Lomonosov Moscow State Univ.; Russia

We present the results of theoretical study on high-order harmonics effective generation in the process of a single atom interaction with a two-color laser field. This study was performed with the use of the non-perturbative theory. Numerical calculations based on the theory demonstrate the appearance of the new features in dependence of high harmonic spectra on the laser field parameters.

ThR5-19 Invited **10:15-10:45**

LASER INDUCED ACCELERATION OF ORBITAL ELECTRONS FORBIDDEN CAPTURES AND DOUBLE NEUTRINOLESS ELECTRON CAPTURES BY NUCLEI

M.Yu. Romanovsky; Prokhorov General Physics Inst. RAS; Russia

The effect of laser radiation on the rate of atomic electrons forbidden capture by nuclei has been investigated in the simple Slater approximation, necessary intensities are 10^12 - 10^18 W/cm2 for captures of p and d electrons in various atoms. The significant acceleration of double neutrinoless electron capture and the verification of E.Maiorana proposal for the neutrino nature is possible in plasma of neon-like 74Se ions.

ThR5-20 **10:45-11:00**

IONIZATION-INDUCED EXCITATION OF RESIDUAL CURRENT DENSITY IN A PLASMA PRODUCED BY TWO-COLOR LASER PULSE

A. A. Silaev, N. V. Vvedenskii; Inst. of Applied Physics RAS; Russia

This work is devoted to the investigation of the phenomenon of excitation of low-frequency (terahertz) currents due to gas ionization by two-color laser pulses. We develop an analytical model for the description of the considered phenomenon and calculate the efficiency of residual-current excitation as a function of two-color laser pulse parameters.

- COFFEE BREAK -

ThR5-21 Invited **11:30-12:00**

MULTI-PW LASER PEARL-10: STATUS AND APPLICATION

A. Shaykin; Inst. of Applied Physics RAS; Russia

Abstract is not available.

ThR5-22 Invited **12:00-12:30**

COHERENT COMBINING OF PARAMETRICALLY AMPLIFIED FEMTOSECOND PULSES

S. N.Bagaev, V, I. Trunov, S. A. Frolov, E.V.Pestryakov, V.E.Leschenko, A.E. Kokh, V.A. Vasiliev; Inst. of Laser Physics SB RAS; Russia

Optimal schemes for few-cycle femtosecond pulses generation up to petawatt level by parametric amplification with picosecond pump are discussed. Requirements to the main parameters of summated beams for their efficient coherent combining are considered. Being realized for the first time, experimental data for coherent summation of parametrically amplified femtosecond pulses (1-3 mJ, 10 Hz repetition rate) are analyzed.

ThR5-23 **12:30-12:45**

MULTITERAWATT CO2 LASER SYSTEM WITH THE OUTPUT PULSED CHEMICAL DF-CO2 LASER

B.G.Bravy[1], Yu.A.Chernyshev[1], V.M.Gordienko[2], E.F.Makarov[1], V.Ya.Panchenko3, V.T.Platonenko2, G.K.Vasiliev[1]; 1-Inst. of Problems of Chemical Physics RAS, 2-Lomonosov Moscow State Univ., 3-National Research Centre Kurchatov Inst.; Russia

We offered the new approach to realization of multiterawatt (20TW, 40J) level hybrid picosecond (~2ps) laser system operating in the 10mkm region with repetition rate of 0,1Hz. The approach based on non-linear amplification of seed picosecond 10mkm pulse (energy density of 0,5J/cm2) in an intermediate pressure (2.5atm) pulsed chemical wide-aperture DF-CO2 amplifiers. The results of numerical modeling and measurements are presented.

ThR5-24 **12:45-13:00**

HIGH PERFORMANCES DIFFRACTION GRATINGS FOR ULTRA-SHORT PETAWATT PULSE COMPRESSION

A. Cotel, A. Liard, Ya. Bernard, F. Desserouer, J.-L. Domanchin, K. Anikin; HORIBA Jobin Yvon SAS; France

We present an overview of diffraction gratings technology and results for Terawatt to Petawatt laser pulse compression. The two main grating types: gold-coated and Multi-Layer Dielectric (MLD) are introduced and described. Diffraction gratings are a key optical component in a high-intense and high-energy laser. They have to exhibit high performances in diffraction efficiency, damage threshold, wavefront quality.

ThR5-25 **13:00-13:15**

TEMPORAL BRAGG DIFFRACTION-INDUCED LASER PULSE SPLITTING IN A LINEAR PHOTONIC CRYSTAL

S.E. Svyakhovskiy, A.I. Maydykovskiy, V.B. Novikov, V.O. Kompanets, A.A. Skorynin, V.A. Bushuev, S.V. Chekalin, B.I. Mantsyzov, T.V. Murzina; Lomonosov Moscow State Univ., Inst. For Spectroscy RAS, Troitsk; Russia

We experimentally observed the effect of the femtosecond laser pulse splitting in an one-dimensional photonic crystal induced by the dynamical Bragg diffraction at the Laue geometry. This effect is caused by spatially inhomogeneous light localization inside the crystal. A linear dependence of the time splitting of pair pulses on the crystal thickness is demonstrated and is supported by theoretical estimations.

ThR5-26 **13:15-13:30**

LASER PULSE SHAPING IN FEMTOSECOND INSCRIPTION IN FUSED SILICA

A.V. Dostovalov[1,2], S.A. Babin[1,2], A. A. Wolf[2], M. V. Dubov[3], V. K. Mezentsev3; 1-Inst. of Automation and Electrometry SB RAS, 2-Novosibirsk State Univ., Russia; 3-Aston University, UK;

We present the results of numerical modeling of femtosecond pulse propagation focused inside fused silica with asymmetric temporal shape. It was shown that major contribution to plasma formation by pulse with negative (pulse with precursors) or positive (contrariwise) TOD depends on pulse energy.

- LUNCH BREAK -

ThR5-27 Invited **15:00-15:30**

CONCEPT OF MEGAJOULE LASER DRIVER FOR ICF

S.A. Bel'kov, S.G. Garanin; Russian Federal Nuclear Center - VNIIEF; Russia

One of the ICF problems is driver problem. To initiate ICF it is necessary input energy to small target with DT fuel during very short time. Laser and its unique property to concentrate energy into very small space size in short pulse gave us a more suitable type of driver for ICF. New approaches for Russian megajoule facility UFL-2M will be considered.

ThR5-28 Invited **15:30-16:00**

THE EOS STUDY ON LUCH FACILITY

I.A. Belov, S.A. Bel'kov, Yu.A. Voronin, I.N. Voronich, S.G. Garanin, V.N. Derkach, V.A. Izgorodin, A.I. Kedrov, A.G. Kravchenko; ILFI, Russian Federal Nuclear Center - VNIIEF; Russia

Research in isentropic shock compression and release have been conducted on laser facility Luch with impedance-matching technique. Materials were used: Al, Cu, Ti, Pb, Au. For increasing of the developed pressure to 50-60 Mbar the multi-layered targets applied. The precision of shock velocity measuring made <2-3%. This provided precision of hydrodynamic parameters determining <4-5%.

ThR5-29 Invited **16:00-16:30**

MULTIFREQUENCY SMOOTHING BY SPECTRAL DISPERSION DEMONSTRATION ON OMEGA EP FOR NIF POLAR-DRIVE IMPLOSIONS

A. V. Okishev, C. Dorrer, B. E. Kruschwitz, J. H. Kelly, E. Hill, A. Consentino, G. Balonek, J. A. Marozas, M. Hohenberger, A. Shvydky, R. G. Roides, R. Cuffney, W. Bittle, and J. D. Zuegel; Laboratory for Laser Energetics, Univ. of Rochester; United States

Polar-drive implosions on the National Ignition Facility (NIF) require smoothing of the laser-imposed non-uniformities. A laser-speckle smoothing scheme employs multi- frequency modulators in a single dimension. Sub-nanosecond picket pulses with multi-FM are optically combined with a multi-nanosecond main pulse. This combined pulse is amplified in a NIF preamplifier module and injected into an OMEGA EP beamline. A detailed multi-FM seed source design and performance will be presented.

ThR5-30 Invited **16:30-17:00**

PRELIMINARY RESULTS FROM RECENT EXPERIMENTS AND FUTURE ROADMAP TO SHOCK IGNITION OF FUSION TARGETS

D. Batani; CELIA - Université de Bordeaux [1]; France

Shock Ignition is a novel approach to ICF adopted within the HiPER project. It is based on direct drive, it separates the ignition and compression phases, and it is substantially compatible with present day laser technology. A proof of principle of SI can be realized on LMJ within the next decade. In the talk, I will present: i) the results of experiments conducted at PALS to study shock generation and laser-plasma interaction in an intensity regime relevant for shock ignition, and ii) the status of discussion within HiPER on shock ignition roadmap, including the plan for experiments on European laser facilities and for finally approaching SI demonstration on LMJ.

- COFFEE BREAK -

ThR5-31 **17:30-17:45**

SIMULATION OF X-RAY CONVERSION EXPERIMENTS WITH SPHERICAL HOHLRAUMS AT ISKRA-5 LASER FACILITY

S.V. Bondarenko, O.O. Sharov; Russian Federal Nuclear Center - VNIIEF; Russia

We discuss multi-channel experiments on X-ray generation held at Iskra-5 laser facility with several kJ of laser energy and pulse lengths equal to a fraction of ns at the first and second harmonics. We present data on X-ray pulse shape and magnitude, calculated with different values of electron heat flux limiter and allowing for X-ray anisotropy in the reaction chamber.

ThR5-32 **17:45-18:00**

RESONANCE ENHANCED MULTI-PHOTON IONIZATION OF ATMOSPHERIC AIR IN THE FIELD OF HIGH-POWER UV LASER RADIATION

I. V. Smetanin, A.O. Levchenko, A. V. Shutov, N. N. Ustinovskii and V. D. Zvorykin; Lebedev Physical Inst. RAS; Russia

We report the results of experimental and theoretical investigation of multi- photon ionization of atmospheric air in the field of high-power nanosecond GARPUN KrF laser radiation. We have found in experiment that the dominant air ionization process is (2+1) REMPI of molecular oxygen, the ionization yield scales as squared intensity at 4x10^8 to 10^11 W/cm^2. Theory of coherent and incoherent (2+1) REMPI is developed which is in agreement with our experimental results.

ThR5-33 **18:00-18:15**

VOLTAGE-BIASED LASER-EXCITED HIGH-POWER ANTENNA IN ATMOSPHERE

Ch.-H. Chen, K.-Y. Huang, M.-H. Wu, Y.-Ch. Huang; HOPE Laboratory, Inst. of Photonics Technologies, National Tsinghua Univ.; Taiwan

We report a 125-time increased antenna current from a 500-V biased laser- excited microwave antenna over an unbiased one in the atmosphere. By using a Q-switched laser pulse at 1064 nm with 10.2-GW/cm2 intensity incident on the antenna tip, we estimate 12-kW electromagnetic radiation power in a 3.5 ns pulse width generated from a 10.5-cm long antenna. The greatly increased antenna current is explained by Schottky-enhanced multi-photon emission followed by formation of a plasma conduction channel between the voltage-biased antenna electrodes.

ThR5-34 **18:15-18:30**

NONLINEAR BACKSCATTERING OF FEMTOSECOND LASER RADIATION FROM SINGLE WATER MICRODROPLET

A.A. Murzanev, E.S. Efimenko, Yu.A. Malkov and A.N. Stepanov; Inst. of Applied Physics RAS; Russia

Backscattering of femtosecond laser radiation with intensities in the 0.1-10 terawatt per square centimeter range from a single water aerosol droplet was investigated both experimentally and theoretically. We measured the backscattered energy and spectra modification, when the water ionization is important.

ThR5-35 **18:30-18:45**

DIRECT MEASUREMENT OF LASER FLUENCE OF FEMTOSECOND LASER FILAMENT IN AIR

S. I. Mitryukovskiy, Y. Liu, A. Houard, A. Mysyrowicz; Laboratoire d'Optique Appliquée, ENSTA ParisTech, Ecole Polytechnique, CNRS; France

We present a simple direct method to measure the laser fluence distribution inside an intense femtosecond laser filament in air. This method exploits the destructive capacity of a filament to fabricate a well defined diaphragm in a metallic foil. The laser fluence is obtained at different positions along the filament from the measured diaphragm size and the corresponding transmitted laser energy.

ThR5-36 **18:45-19:00**

SPATIAL DYNAMICS OF A STRONG FIELD OF FEW-CYCLE LIGHT BEAM INDUCING PLASMA IN DIELECTRIC MEDIA.

S.A. Stumpf, Yu.A. Shpolyansky, A.A. Korolev, S.A. Kozlov; St.Petersburg National Research Univ. of ITMO; Russia

We report results of an application of a dynamic model of media ionization to an investigation of spatial field structure of strong two-colour light beam, ionizing a dielectric media and generating IR and THz radiation. We show an influence of input beam characteristics on efficiency of experimental setup: an output power can be significantly increased by controlling a filament length.

ThR5-37 **19:00-19:15**

IMPLEMENTATION OF HARMONICS FOR FEMTOSECOND LASER SURFACE NANOPATTERNING THROUGH COLLOIDAL PARTICLE LENS ARRAYS

A. Afanasiev, V. Bredikhin, A. Alexandrov, N. Agareva, A. Pikulin, I. Ilyakov, B. Shishkin, R. Akhmedzhanov, N. Bityurin; Inst. of Applied Physics RAS; Russia

The close-packed arrays of dielectric micrometer-sized spheres deposited on substrates serve as the set of near-field lenses when irradiated by the femtosecond laser pulse. Formation of periodic accurate 100nm pit and hillock nano-structures on different substrates by the single pulses of fundamental frequency, of the second harmonic, and by the bi-chromatic pulses is demonstrated.

ThR5-38 **19:15-19:30**

LOCALIZED FEMTOSECOND LASER NANOSTRUCTURING OF LIGA MASTER-FORMS

A.V.Dostovalov[1,2], S.A.Babin[1,2], V.P. Korolkov[1,2], R.V.Samsonov[1,2], E.F. Reznikova[3], B.G. Goldenberg[3]; 1-Inst. of Automation and Electrometry SB RAS, 2-Novosibirsk State Univ., 3-Inst. Of Nuclear Physics SB RAS; Russia

The task of the presented work is the investigation of the localized femtosecond laser nanostructuring of nickel master-forms to reveal the quantitative dependences of nanostructural parameters on the laser beam intensity and scanning speed, as well as the reproducibility and durability of the nanostructures at replication of the master-form surface in polymers.

R6. Nanophotonics and Biophotonics

ThR6-30 Invited **09:00-09:30**

NEW LASER GLASSCERAMICS

N. Nikonorov; St.Petersburg National Research Univ. of ITMO; Russia

Some novel nanostructured glassceramics doped with rare earth ions and metallic nanoparticles have been developed for photonic and plasmonic applications. Some optical elements and devices based on the materials have been designed: optical amplifiers, volume Bragg gratings, waveguides, 3D structures and microfluidic channels, sensors based on surface plasmon resonance, highly efficient luminophors for LEDs and converters for PV solar cells.

ThR6-31 Invited **09:30-10:00**

OPTICAL AND MECHANICAL INVESTIGATIONS OF NANO-STRUCTURES. A PERSPECTIVE FOR THE INTEGRATION OF ATOMIC FORCE SPECTROSCOPY AND ULTRAFAST OPTICS.

G. Galimberti, F. Banfi, C. Giannetti, S. Pagliara and G. Ferrini; Univ. Cattolica del Sacro Cuore; Italy

The properties of nanostructures, tailored for a host of biomedical and biotechnological applications, depends on both their electronic and mechanical properties. Examples of the ongoing activity towards the integration of ultrafast spectroscopy and mechanical force spectroscopy will be reviewed with the aim of showing their importance for the fields of nano- and bio- photonics.

ThR6-32 Invited **10:00-10:30**

ULTRAFAST NONLINEAR OPTICAL PROPERTIES OF TWO-DIMENSIONAL MOLYBDENUM DISULFIDE NANOSHEETS

J. Wang; Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences; China

We studied the ultrafast nonlinear optical properties of MoS2 nanosheets in liquid-phase dispersions. Under the excitation of 800 nm fs pulses, the MoS2 nanosheets exhibited strong saturable absorption. For the ns excitation at 532 nm, the MoS2 nanosheets showed intensity dependent nonlinear extinction behavior - saturable absorption at lower intensity region and induced nonlinear scattering at higher intensity region.

ThR6-33 Invited **10:30-11:00**

THIRD-ORDER NONLINEAR OPTICAL STUDIES USING NONLINEAR PHOTOACOUSTICS

Ch.S Yelleswarapu; Univ. of Massachusetts Boston; United States

Measurement of third order nonlinear optical parameters is important for many practical applications. Among several methods, conventional Z-scan is a simple and most commonly used technique. Recently we developed photoacoustic z-scan technique to measure the nonlinear absorption coefficients for wide variety of materials. It combines the advantages offered by conventional Z-scan technique and the highly sensitive photoacoustic detection.

- COFFEE BREAK -

ThR6-34 Invited **11:30-12:00**

OPTICAL PROPERTIES AND PHOTOINDUCED TRANSFORMATIONS OF ORGANIC DYE MOLECULES IN THE NEAR FIELD OF PLASMONIC NANOSTRUCTURES

T.A. Vartanyan, N.A. Toropov, A.A. Starovoytov; St.Petersburg National Research Univ. of ITMO; Russia

Metal nanoparticles and polymethine dyes being mixed react upon each other through the electromagnetic fields that they scatter. We report on huge darkening as well as clarification of the hybrid material as compared to a simple composition of the constituents' optical properties.

ThR6-35 **12:00-12:30**

INVESTIGATIONS OF NANOPARTICLES IN THE NANOSECOND AND PICOSECOND TIME DOMAIN

S. Dengler[1], O. Muller[2], G. Ritt[1], B. Eberle[1]; 1-Fraunhofer Inst. of Optronics, System Technologies and Image Exploitation IOSB, Germany, 2-French-German Research Inst. of Saint-Louis, France

Abstract is not available.

ThR6-36 **12:30-12:45**

PHOTON-AVALANCHE-LIKE LOW-ENERGY ULTRAFAST EXCITATION AND OPTICAL SWITCHING IN TRANSPARENT CRYSTALS

A. Ivanov, E.Perlin, A. Popov; St.Petersburg National Research Univ. of ITMO

A new mechanism of photoexcitation of transparent crystals is studied. The mechanism exhibits an exceptionally high degree of optical nonlinearity and shows itself even at moderate laser radiation intensities j ~ 105 W/cm2. An ultrafast optical switching is predicted for moderate laser light intensities.

ThR6-37 **12:45-13:00**

THEORETICAL STUDY OF TIME-RESOLVED SECONDARY EMISSION FROM SEMICONDUCTOR QUANTUM DOTS

M. Yu. Leonov[1], V. K. Turkov[1]; I. D. Rukhlenko[2]; A. V. Fedorov[1]; 1-St.Petersburg National Research Univ. of ITMO, Russia; 2-Monash Univ., Australia;

We develop the theory of time-resolved secondary emission from a multi-level semiconductor quantum dot resonantly excited by a sufficiently broad laser pulse. We reveal conditions that the signal of secondary emission is described by a simple formula regardless of the pulse shape. This formula may prove useful for studying the dephasing and relaxation parameters of the quantum dot electronic subsystem.

ThR6-38 **13:00-13:15**

TERAHERTZ SPECTROSCOPY OF SELECTED CRYSTALLINE FORMS

B.Karolewicz, A.Owczarek, S.Plinska, B.Fuglewicz, K.Nowak[1], P.P. Jarzab[1], M.J. Walczakowski[1], L.Augustyn[1], E.F. Plinski[1]; Wroclaw Medical Univ., 1-Wroclaw Univ. of Technology; Poland

There were selected for terahertz measurements typical components used in pharmacology: fenofibrate, aspirin, ketoconasole, ranitidine, simvastatin, lovastatin, lactose, glucose, pluronic, and others. Another problem considered in the paper is hydration of the pharmacological products in the process of manufacturing. We have showed that it is easy to recognize hydrated substances and non-hydrated.

ThR6-40 **13:15-13:30**

EFFECTS OF SEED LAYER ON THE LASER-INDUCED-DAMAGE-THRESHOLD (LIDT) OF GOLD FOR PLASMONIC ENHANCEMENT OF FIBER LASERS

C. Y. Ngo[1], L. Y. Hong[3], R. F. Wu[3], E. H. Khoo[2], V. Dixit[2], J. H. Teng[1], E. P. Li[2]; 1-Inst. of Materials Research and Engineering, 2-Inst. of High Performance Computing, 3-Defence Science Organisation (DSO) National Laboratories; Singapore

Beam profile of the fiber laser can be improved by integrating gold structures on the fiber facet. However, conventional gold film is unable to withstand the high output power density of the fiber lasers. By inserting a 5nm Ti seed layer, we obtained an mprovement in the laser-induced-damage-threshold (LIDT) value that is ~2.6 times higher than that without seed layer.

- LUNCH BREAK -

ThR6-41 **15:00-15:15**

PHOTOPHYSICAL PROPERTIES OF CSe/ZnS QUANTUM DOTS/ AZODYES COMPLEXES IN TRECK MEMBRANES

Y.A. Gromova, A.O. Orlova, V.G. Maslov, A.V. Baranov, A.V. Fedorov, M.V. Artemiev[1]; St.Petersburg

National Research Univ. of ITMO, Russia, 1-Belarussian State Univ., Belarus;

The process of the formation of semiconductor quantum dots/ azodyes complexes in polymer track membranes is investigated; photophysical properties of complexes in solution, complexes embedded in track membrane from solution and complexes sequentially created in track membrane have been compared. Dissociation of complexes and growing of the QDs fluorescence in presence of metal ions have been demonstrated.

ThR6-42 **15:15-15:30**

LUMINESCENT PROPERTIES OF THE DOPED DIELECTRIC NANOCRYSTALS

K.K. Pukhov[1], T.T. Basiev[1], Ch.-K. Duan[2]; 1-Prokhorov General Physics Inst. RAS, Russia; 2-Univ. of Science and Technology of China, China;

We examine the physical factors that influence the luminescent properties of doped nanosized objects in nanocomposite. The main objective of this work is to reveal to the extent to which changes in the phonon subsystem and electron–phonon interaction caused by spatial confinement effects affect the luminescent characteristics of optical centers in nanocrystals.

ThR6-43 **15:30-15:45**

NON-LINEAR OPTICAL RESPONSE AND SURFACE-MODE INDUCED EXTINCTION OF TITANATE NANOPLATELETS IN NEAR-UV REGION

E.A. Isaeva, D.A. Zimnyakov, A.V. Gorokhovsky, E.V. Tret'yachenko; Saratov State Technical Univ.; Russia

The aim of this work is the examination of shape-caused features of the optical properties of titanate quasi-two-dimensional nanopatricles as a potential raw substance for synthesis of photonic materials with random structure. The results of experimental study and interpretation of nonlinear optical response and surface-mode-induced resonant extinction of potassium titanate nanoplatelets in near UV region were presented.

ThR6-44 **15:45-16:00**

STUDY OF NONLINEAR OPTICAL PROPERTIES OF GOLD NANOPARTICLES USING ATOMIC FORCE MICROSCOPY AND FEMTOSECOND LASER RADIATION

N.V. Ilin, A.I. Smirnov, A.N. Stepanov, D.A. Yashunin; Inst. of Applied Physics RAS; Russia

A nonlinear optical response from a single gold nanoparticle interacting with a tip of an atomic force microscope in a femtosecond laser field was investigated. From the spatial distribution of the nonlinear response the information about the particle shape and the orientation can be inferred with a 30 nm resolution.

ThR6-45 **16:00-16:15**

COHERENT LASER CONTROL OF CURRENT VIA MOLECULAR NANOJUNCTIONS WITH SEMICONDUCTOR CONTACTS

B.D. Fainberg, T. Seideman[1]; Holon Inst. of Technology, Israel; 1-Northwestern Univ., USA;

We propose a new approach to coherent laser control of transport via molecular nanojunctions, which bypasses a number of hurdles to experimental realization of optically manipulated nanoelectronics. The method is based on the application of intrinsic semiconductor contacts and optical frequencies below the semiconductor bandgap. We predict the effect of coherent destruction of induced tunnelling that extends the certain effect.

ThR6-46 **16:15-16:30**

LASER INDUCED AU-CU AND AU-AG NANOPARTICLES DEPOSITION

A. Povolotskaya, A. Povolotskiy, A. Manshina; St.Petersburg State Univ.; Russia

Laser-induced chemical liquid phase deposition (LCLD) method was used for precipitation nanoparticles which consist of Au-Cu and Au-Ag alloys. According to experimental data the thermal or photolytical effect can be realized depending on different laser parameters (dose of laser radiation). The interest to Au-Cu and Au-Ag nanoparticles is induced by their pronounced catalytic activity, luminescence and photovoltaic properties.

ThR6-47 **16:30-16:45**

RESONANCE PHOTONIC CRYSTALS

A.V. Pudovkin[1], V.S. Gorelik[2]; 1-Bauman Moscow State Technical Univ., 2-Lebedev Physical Inst. RAS; Russia

A focus in this effort is on the problem of theoretical and experimental research of resonance photonic crystals. The objects of research were artificial opals containing chromium ions in their pores, which are characterized by sharp resonance at a wavelength of 694.3 nm. Theoretical analysis of dispersion relations of the photonic crystals filled with chromium ions.

ThR6-48 **16:45-17:00**

REFRACTION SENSORS ON THE PHOTONIC CRYSTAL BASE

A.O. Litvinova[1], V.S. Gorelik2; Bauman Moscow State Technical Univ., Lebedev Physical Inst. RAS; Russia

The objective of this paper is to generalize the refractive properties of the reflection spectrum from the surface of a globular photonic crystal filled with water, ethyl alcohol, C2H5OH, and salt, potassium iodide KI. Impregnation of opals with liquid there is a narrowing of the band gap of the photonic crystal. Thus, using reflectance spectroscopy it is possible to implement a new type of sensor for the analysis of introduced molecular connection into the pores of the globular photonic crystal.

- COFFEE BREAK -

ThR6-49 **17:30-17:45**

OPTICAL BISTABILITY AND HYSTERESIS IN THE SYSTEM OF LASER DIODE WITH ABSORBING NANOSUSPENSION

G. Pobegalov, P. Agruzov, I. Ilichev, A. Shamray; St. Petersburg State Polytechnical Univ., Ioffe Physical Technical Inst. RAS; Russia

For the first time an optical bistability and hysteresis were observed in the system of laser diode with external optical feedback comrrising colloidal solution of LaF3: Er,Yb nanocrystals. The influence of the solution concentration, external mirror reflectivity, as well as temporal dynamic of switching have been investigated. The results are of a particular interest for booming area of optofluidic devices.

ThR6-50 **17:45-18:00**

RESONANT LIGHT-CONTROLLED SELF-ASSEMBLY OF ORDERED NANOSTRUCTURES

V.V. Slabko[1], A.S.Tsipotan[1], A.S. Aleksandrovsky[1,2]; 1-Siberian Federal Univ., 2-Kirensky Inst. of Physics; Russia

The possibility of light-controllable formation of heterogeneous nanostructures containing resonant metallic and semiconductor nanoparticles is considered. Interaction energy between light-induced dipole polarization of nanoparticles at modest light intensity can be much more than the thermal motion energy. The configuration of self-assembled nanostructure can be controlled by the frequency and polarization of light.

R7. Lasers in environmental monitoring

ThR7-12 **09:00-09:15**

QUANTITATIVE STANDOFF DETECTION OF THE HASARDOUS MATERIALS USING LASER INDUCED BREAKDOWN SPECTROSCOPY

A.V. Agrafenin; Semenov Institute of Chemical Physics; Russia

Method of homologous concentrations, during a long time successfully applied in forensic science, geology, nuclear industry and in the struggle against the terrorism was improved. Quantitative standoff LIBS with the appropriate accuracy and reproducibility became possible at a different distances from the detector using only one spectrum and with the corrected homologous concentrations.

ThR7-13 **09:15-09:30**

TEST OF THE MOBILE SCANNING FLUORESCENT-AEROSOL LIDAR

M. Makogon; Zuev Inst. of Atmospheric Optics SB RAS; Russia

Results of the testing of the mobile hybrid fluorescence-aerosol lidar intended for expeditious detection of aerosols in the atmosphere and recognition among them of biogenic ones are given. The sensing of aerosols is conducted at a wavelength of 1064 nm, and biogenic aerosols at a wavelength of 266 nm.

ThR7-14 Invited **09:30-10:00**

CHIRPED LASER DISPERSION SPECTROSCOPY – RECENT ADVANCES AND APPLICATIONS IN ENVIRONMENTAL MONITORING

G. Wysocki; Princeton Univ.; United States

Current state-of-the art and recently developed chirped laser dispersion spectroscopy (CLaDS) based techniques are discussed. Several examples of CLaDS detection based on quantum cascade lasers illustrate the capabilities of molecular dispersion spectroscopy in the mid-infrared spectral region targeting the most intense molecular ro-vibrational bands of various molecular species.

ThR7-15 Invited **10:00-10:30**

INFRARED LASER SPECTROSOPIC SENSING IN SURGERY, MEDICAL DIAGNOSTICS AND DRUG TESTING

M.W. Sigrist; ETH Zurich, Institute for Quantum Electronics; Switzerland

Sensing applications of lasers in medicine have gained in interest. This talk presents some recent examples, notably the analysis of in vivo surgical smoke produced in laparoscopic surgery with electroknives by a broadly tunable difference frequency generation (DFG) laser system, quantum cascade laser (QCL) studies towards non-invasive glucose measurements as well as quantitative measurements of cocaine in saliva with QCL and ATR spectroscopy.

ThR7-16 Invited **10:30-11:00**

HANDLING OF SPECTRAL LINES AND CALCULATION OF CONCENTRATIONS UNCERTAINTY OF MEASUREMENT FOR PRIORITY CONTAMINANTS IN ATMOSPHERE

L. Konopelko, V. Beloborodov, D. Rumiantsev; Mendeleyev Inst. for Metrology; Russia

Metrological society started to solve scientific problems of gas analysis without the use of standard reference materials (SRM) for calibration and the results are already achieved. The ozone standard reference photometer is developed (SRP) as an etalon. The SRP uses ozone cross-section at emission wavelength of mercury - 253.7 nm. The task of a project under auspices of the Euromet was an examination of possibility of creation of carbon dioxide etalon working without the use of SRM near wavenumber 4987.3 cm-1. Metrological certification of spectroscopic databases of etalon gases is a task of primary importance for such tasks.

- COFFEE BREAK -

ThR7-17 Invited **11:30-12:00**

GLOBAL ENVIRONMENT MONITORING AND ROLE OF LIDAR MEASUREMENT IN REMOTE SENSING

A. Buznikov; St. Petersburg Electrotechnical Univ.; Russia

The report discusses and analyzes the possibilities of application of lidar systems in the areas of direct relevance to remote sensing of the environment and global environmental monitoring.

ThR7-18 Invited **12:00-12:30**

APPLICATION OF DIRECT ABSORPTION MID IR LASER SPECTROSCOPY FOR ISOTOPE SPECIFIC DETECTION OF GREENHOUSE GASES

L. Emmenegger[1], J. Mohn[1], P. Sturm[1], S. Henne[1], P. Wunderlin[2], J.R. Koster[3], S. Eyer[1], B. Tuzson; 1-Empa; 2-Eawag; 3-Christian Albrechts Univ.; Switzerland

The development of QCL based spectrometers and their ongoing improvement have led to high-precision instruments to determine isotopic ratios, such as d13C-CO2, d18O-CO, d15Na-N2O, d15Nb-N2O and d13C-CH4. Typically, a precision of 0.1 ‰ can be reached, which will be illustrated by a wide range of recent environmental studies.

ThR7-19 **12:30-12:45**

ANALYSIS OF LASER THERMOGRAPHY AND LASER ULTRASONIC INSPECTIONS TO DETECT AND QUANTIFY FLAWS IN LASER POWDER DEPOSITION COMPONENTS

S.P. Santospirito, B. Luo, K. Slyk, R. Lopatka[1]; Kingston Computer Consultancy Limited, United Kingdom, 1-PolKom Badania, Poland;

Laser powder deposition techniques are being adopted within aerospace and automotive manufacturing to produce innovative, precision components. Detecting and quantifying flaws enables performance and acceptance criteria to be verified, improving product safety and reducing ongoing maintenance costs. Software analysis of Laser Thermography and Laser Ultrasonic data provides non destructive validation of the structural integrity of laser powder deposited components.

ThR7-20 **12:45-13:00**

EFFECT OF THERMAL CONDUCTIVITY OF ENVIRONMENT IN THE LASER-INDUCED INCANDESCENCE OF CARBON SURFACE

S. Zelensky, L. Poperenko, O. Kopyshinsky, M. Galushchak, K. Zelenska; Taras Shevchenko National Univ. of Kyiv; Ukraine

We investigated laser-induced incandescence (LII) of polish carbon surfaces in contact with air and covered with a transparent dielectric layer of polystyrene. Obtained values of non-dimensional rate of the surface emission nonlinearity indicate a significant nonlinearity of LII. Correlation between the LII increase and fading under the action of a sequence of laser pulses depends on the laser power density.

ThR7-21 **13:00-13:15**

THE APPLICATIONS OF THE VACUUM ULTRAVIOLET STIMULATED AND SPONTANEOUSLY LIGHT SOURCES

G.Gerasimov, B.Krylov; Vavilov State Optical Inst.; Russia

The most fruitful application of VUV light sources pointed in this report. This application can be made with difference tipe VUV light sources. Current activity target in VUV light sources advanced processes like micro and nanostructuring of solid states surfase, in photochemical and technological applications, in medicine, biology and in air and water purification.

- LUNCH BREAK -

R2. High Power Gas Lasers

ThR2-p01 **09:00-13:30**

THALLIUM HALIDES – THE MATERIAL OF OPTICAL ELEMENTS FOR CO/CO2 LASERS

I.S. Lisitskiy, M.S. Kouznetsov, K.S. Zaramenskikh, G.V. Polyakova, V.F. Golovanov; GIREDMET; Russia

Thallium halide crystals are grown by the Stockbarger method. The dependence of structural perfection, optical and laser characteristics of crystals on the method and extent of the pre-treatment of the raw material and the crystal growth conditions is presented. Low blocking and homogenous polygonization of obtained crystals allowed using them as acousto-optic deflectors.

ThR2-p02 **09:00-13:30**

THE SYSTEM OF DISCHARGE GENERATION IN PULSED-PERIODIC IODINE LASER

S.A. Antsiferov[1], S.D. Velikanov[1], S.Yu. Kazantsev[2], V.V. Kalinovsky[1], I.G. Kononov[2], V.N. Mikhalkin[1], S.V. Podlesnykh[2], I.V. Sevryugin[1], K.N. Firsov[2]; 1-Russian Federal Nuclear Center - VNIIEF, 2-Prokhorov Inst. of Gen. Phys.; Russia

The subject of the present study is the potential to increase efficiency of electric discharge mode of generation of atomic iodine in the medium of iodine pulsed laser. The efficient system of electrodes was developed, having a cathode made of anisotropic-resistive material and flat anode, which ensured generation of stable discharge in the mixtures of iodine (CH3I, C2H5I) with oxygen and nitrogen at specific energy input Wel = 2 J/l and highest possible duration of stable combustion of the isotropic diffuse discharge t =1,5μs. The energy input distribution along the electrode section was qualitatively estimated based on the analysis of plasma glowing intensity distribution.

ThR2-p03 **09:00-13:30**

CAT'S EYE EFFECT UNDER THE LASER EXPLOSIVE BOILING OF WATER

Stepan Andreev, Konstantin Firsov, Sergey Kazantsev, Igor Kononov; Prokhorov General Physics Inst. RAS; Russia

Significant growth of light scattering (so-called "cat's eye effect") under the action of non-chain electric discharge HF-laser radiation on a water below the plasma-formation threshold is observed. Cat's eye effect appears as short flash with duration of several tens microseconds when the laser explosive boiling of water accompanying with multiple bubble creation is recording to high-speed digital camera which requires strong booster light to operate.

ThR2-p04 **09:00-13:30**

PRODUCTION OF IODINE ATOMS IN A SELF SUSTAINED PULSED ELECTRIC DISCHARGE

N. Vagin, N. Yuryshev; Lebedev Physical Inst. RAS; Russia

The concentration of iodine atoms produced by a self sustained pulsed electric discharge from different iodides has been measured using a tunable diode laser as a probe beam. The discharge energy spent to production of a single iodine atom has been obtained for CF3I and CH3I under different experimental conditions. Formation of iodine atoms in an excited state has been observed. The yield of excited state has been evaluated.

ThR2-p05 **09:00-13:30**

PLANAR XE-LASER WITH CW RADIO FREQUENCY PUMPING

A.P. Drozdov, A.P. Mineev, S.M. Nefedov, P.P. Pashinin, P.A. Goncharov, V.V. Kiselev.; Prokhorov General Physics Inst. RAS; Russia

Xe-laser excited by RF discharge with diffusion cooling of active medium and nonselective optical resonator was investigated. Spectral and power characteristic in depends of width of interelectrode gap, gas mixture compounds, pressure, value of input power density was studied. Maximum output power 4 W with ~0,7% efficiency on wavelengths - 2.03; 2.48, 2.63, 2.65, 3.11, 3.37, 3.51 μm is achieved.

ThR2-p06 **09:00-13:30**

MICROWAVE EXCITED PLANAR CO2- AND CO-LASERS

A. P. Mineev, S. M. Nefedov, P. P. Pashinin, P. A. Goncharov, V. V. Kiselev, A. P. Drozdov; Prokhorov General Physics Inst. RAS; Russia

The aim is to study the characteristics for two types of planar CO2-lasers and CO laser, exited by diffusion-cooled microwave discharge. Our experiments allowed us to achieve the maximum CO2 laser power of 37 W for laser 1 and 60 W for laser 2 (10.6 μm). The average output power of CO-laser was 1 W (5-6 μm)with pumping impulse 1400 W, frequency 1000 Hz, the length of pumping impulses - 100 μsec.

ThR2-p07 **09:00-13:30**

EFFICIENT PRODUCTION OF IODINE ATOMS FOR CW IODINE LASER IN OXYGEN-CONTAINING GAS MIXTURES IN RF DISCHARGE

P. A. Mikheyev[1], N. I. Ufimtsev[1], A.V. Demyanov[2], I. V. Kochetov[2], A. P. Napartovich[2]; 1-Samara branch of Lebedev Inst., 2-SRC RF Troitsk Inst. for Innovation and Fusion Research; Russia

Use of iodine atoms instead of molecules in oxygen-iodine laser permits to expand its operational envelope improving power-weight efficiency. Results of experiments and modeling of plasma chemistry relative to CH3I dissociation in a planar 40 MHz discharge to produce iodine atoms are represented, showing that addition of oxygen into Ar:He:CH3I mixtures leads to a noticeable increase in CH3I dissociation efficiency.

ThR2-p08 **09:00-13:30**

SF6 DISSOCIATION SIMULATION BY CO2 LASER USING NEURAL NETWORK

H.R. Dehghanpopur[1]; P. Parvin[2]; 1-Tafresh Univ.; 2-Amirkabir Univ.of Technology; Iran

Dissociation of SF6 molecules by CO2 Laser irradiation was done before experimentally. The rate of dissociation and pressure dependence of that process were investigated in some intervals of those parameters. Here, we have used of neural networks to simulate the process and predicting the results of the regions outside of the examined parameters.

ThR2-p09 **09:00-13:30**

SINGLE GRYSTALS OF SILVER HALIDES – A PROMISING MATERIAL FOR OPTICAL FIBER WAVEGUIDES

G.V. Polyakova, V.F. Golovanov, I.S. Lisitskiy, M.S. Kouznetsov, K.S. Zaramenskikh; GIREDMET; Russia

Increasing of optical characteristics stability of silver halides through using of chloride and bromide solid solutions and deep purification of salt before crystal growth is achieved. Our studies allowed to develop the crystals growth technology in order to produce core-shell crystal pairs for the extrusion of oplical fibers.

ThR2-p10 **09:00-13:30**

SELECTIVE HEAT RADIATION (SHR) OF Er_2O_3 UNDER EXCITATION BY PULSE CO2 LASER

V.M.Marchenko, Yu.A.Shakir; Prokhorov General Physics Inst. RAS, Russia

SHR of polycrystalline Er2O3 target synthesized by laser thermal method was for the first time experimentally investigated under excitation by CO2 laser radiation pulse with duration of 250 ns and wavelength 10.6 μm. Energy region of laser excitation of SHR was measured. Spatial distribution and spectrum of SHR were observed. Values of increment and decay time of SHR were measured and explained.

R3. Semiconductor Lasers, Materials and Applications

ThR3-p01 **09:00-13:30**

DYNAMICS OF A SINGLE-MODE SEMICONDUCTOR LASER WITH INCOHERENT OPTICAL FEEDBACK

I.V. Koryukin; Inst. of Applied Physics RAS; Russia

A novel model of the semiconductor laser with incoherent optical feedback is presented, generalizing Lang-Kobayashi equations to the case when the length of feedback loop exceeds the coherence length of laser radiation. It is shown that transition from coherent to incoherent feedback leads to the replacement of dynamical chaos by almost stationary lasing with slightly fluctuating intensity. Nevertheless, incoherent feedback can lead to chaotic oscillations, but at considerably larger feedback levels.

ThR3-p02 **09:00-13:30**

CATASTROPHIC DEGRADATION OF ELECTRON-BEAM PUMPED PULSED LASERS BASED ON AlGaAs/InGaAs/GaAs HETEROSTRUCTURES

M.M. Zverev[1], N.A. Gamov[1], M.A. Ladugin[2], A.A. Marmaluk[2], D.V. Peregoudov[1], V.B. Studionov[1], V.O. Valdner[1], E.V. Zhdanova[1]; 1- Moscow State Technical Univ. of Radio Engineering, Electronics and Automations, 2- RDI Polyus; Russia

The catastrophic degradation of pulsed room temperature lasers based on the structures of GaAs/AlGaAs/GaAs with different design of active region with the transverse pumping by electron beam was studied. The values of pulse power of 70-90 W and 10-20 W were measured for lasers based on SQW and MQW structures accordingly

ThR3-p03 **09:00-13:30**

E-BEAM PUMPED SEMICONDUCTOR DISK LASER ON Zn(Cd)Se/ZnMgSSe HETEROSTRUCTURE

V.I. Kozlovsky[1], P.I. Kuznetsov[2], D.E. Sviridov[1], Y.K. Skasyrsky[1], G.G. Yakushcheva[2]; 1-Lebedev Physical Inst. RAS; 2-Kotel'nikov Inst. of Radio Engineering and Electronics; Russia

Pulse e-beam pumped semiconductor disk laser based on the heterostructure with 30 Zn(Cd)Se/ZnMgSSe quantum wells grown by metal organic vapor phase epitaxy was realized. Lasing occurred at 465 nm. Peak output power was as high as 1.4 W at electron energy of 42 keV. Pulse time duration was 20-40 ns. Divergence full angle was about 5 mrad.

ThR3-p04 **09:00-13:30**

BROAD AREA SEMICONDUCTOR LASERS WITH INTERNAL DIFFRACTION GRATING

V.V. Zolotarev, A.Yu. Leshko, A.V. Lyutetskiy, S.O. Slipchenko, Z.N. Sokolova, D.A. Vinokurov, N.A. Pikhtin, I.S. Tarasov; Ioffe Physical Technical Inst. RAS; Russia

To narrow the spectrum of high-power Fabry-Perot semiconductor lasers large period (Λ~2 mkm) diffraction grating etched in p-emitter of 1060 nm-laser structure was used. Laser structure with ultra low internal optical loss (<1 cm-1) allowed using long diffraction grating (0.5 – 2.0 mm) with large period. Measurements demonstrated spectrum width as low as 0.3 nm at small drive currents broadening to 1 nm at high currents. Maximum CW RT output optical power was 1.5 W.

ThR3-p05 **09:00-13:30**

SCANNING ELECTRON-BEAM-PUMPED LASER OF PULSE-PERIODIC OPERATION MODE BASED ON ZnSe– CONTAINING HETEROSTRUCTURES

M.M. Zverev[1], N.A. Gamov[1], S.V. Gronin[2], S.V. Ivanov[2], P.S. Kop'ev[2], D.V. Peregoudov[1], I.V. Sedova[2], S.V. Sorokin[2], V.B. Studi; 1-Moscow State Technical Univ. of Radio Engineering, Electronics and Automations, 2-Ioffe Physical Technical Inst. of RAS; Russia

The characteristics of room temperature ZnSe-based green pulse-periodic scanning laser were studied in detail. The scanning rate was 20 Hz with the pulse repetition rate up to 3 kHz. Pulsed electron beam with the energy of 8 keV and pulse duration time of 200 ns was used as a pumping source. The average output power of 1.6 mW (at a pulse power of 2.7 W) has been demonstrated.

ThR3-p06 **09:00-13:30**

HIGH POWER InGaAsP- AND AlGaInAs-BASED 1480 NM LASER DIODES

P.V. Gorlachuk[1], A.A. Marmalyuk[1], Yu.L. Ryaboshtan[1], D.V.Avdoshina[2], K.V. Bakhvalov[2], S.O.Slipchenko[2], N.A. Pikhtin[2], I.S. Tarasov[2]; 1-R&D Inst. "Polyus", 2-Ioffe Physical Technical Inst. RAS

InGaAsP and AlGaInAs devices with various design approaches have been demonstrated. It was shown that AlGaInAs/InP material system has a better potential for 1480 nm high power laser diode applications.

ThR3-p07 **09:00-13:30**

LASER DIODES (940 nm) BASED ON InGaAs/AlGaAs/GaAs HETEROSTRUCTURES

M.A. Ladugin, T.A. Bagaev, E. I. Lebedeva, A.A. Marmalyuk, A.A. Padalitsa, A.S. Sapozhnikov, V.A. Simakov; R&D Inst. "Polyus"; Russia

Efficient geometry of laser diodes based on InGaAs/AlGaAs/GaAs heterostructure emitting at 940 nm was proposed and implemented. Owing to some improvements in active region (quantum wells and waveguide layers) the differential quantum efficiency was increased from 0,98 up to 1,15 and the high thermal stability was obtained.

ThR3-p08 **09:00-13:30**

808 NM LASER BARS FOR SOLID STATE LASERS PUMPING

A.A. Marmalyuk, A.Y. Andreev, M.A. Ladugin, E.I. Lebedeva, S.M. Sapozhnikov, V.A. Simakov, I.V. Yarotskaya; R&D Inst. "Polyus"; Russia

Laser bars based on AlGaAs/GaAs heterostructures with various active region geometry were studied. The output power up to 100W at 100A in QCW mode from 4 mm laser bar was demonstrated.

ThR3-p09 **09:00-13:30**

COMPLEX OF LASER TECHNOLOGIES FOR MANUFACTURE OF FINE-MESHED GRIDS AND FORMING OF EMITTING STRUCTURE OF CATHODES

I.A. Popov, E.L. Surmenko, T.N. Sokolova, A.V. Konyushin, Yu.V. Chebotarevsky; Saratov State Technical Univ.; Russia

Paper describes a complex of laser technologies for manufacture of sheet metal grids. A fine-meshed grid with a concentric arrangement of microhole matrixes is implemented out of high-melting material. The grid with a matrix arrangement of microholes is combined with the multibeam metal porous cathode made with application of a package of laser technologies too.

ThR3-p10 **09:00-13:30**

EXCIMER LASER CRYSTALLIZATION OF SI THIN-FILMS AND ITS APPLICATION TO SOLAR CELLS

W. Yeh, H. Huang; Shimane Univ. Japan, National Taiwan Univ.of Science and Technology, Taiwan

A large grained poly-Si thick film was formed on glass substrate at below 473 K by combining excimer laser annealing (ELA) method and Si sputtering epitaxial growth (SEG) method. The grain size of Si film after ELA was as large as 10μm with these grains periodically and densely arranged. The Si was then thicken to 2 microns by SEG.

ThR3-p11 **09:00-13:30**

SCALING DOWN IN SELECTIVE LASER MELTING TECHNOLOGY

I. Yadroitsev[1], M. Doubenskaia[1], E. Rafailov[2]; 1-Univ. de Lyon, Ecole Nationale d'Ingénieurs de Saint-Etienne (ENISE), DIPI Laboratory, France, 2-Univ. of Dundee; UK

At present selective laser melting (SLM) machines can produce parts in the range from several millimetres up to 350 mm and they are still expensive (> €300k) and difficult to maintain. A relatively low power (~15 W) and good beam quality laser should be able to achieve sufficient power density for melting metal and ceramic powders (energy density flux about 10^7 W/cm^2). A small working area from 1x1 cm^2 to 5x5 cm^2 (that is reasonable size for producing micro-size components)

allows applying short-focal-length optics and a small focal spot diameter (10 μm) should be achievable using laser source with a good beam quality. A fine (<=5 μm) powder and thin (<=10 μm) powder layers will enable production of structural elements ~20 μm and fully functional parts around 100-500 μm

ThR3-p12 **09:00-13:30**

THEORETICAL ANALYSIS OF HYBRID MODE-LOCKED QUANTUM DOT SEMICONDUCTOR LASERS

R.M. Arkhipov[1,2], M. Radziunas[1], A. G. Vladimirov[1,2]; 1-Weierstrass Inst. for Applied Analysis and Stochastics, Leibniz Inst. in Forschungsverbund Berlin e.V, Germany; 2 Physics Faculty, St.Petersburg State Univ., Russia

Hybrid mode-locking in semiconductor quantum dot lasers is investigated theoretically. Simulations have been performed using the approach based on the delay-differential equations mode-locking model. Dependence of the locking range on the modulation amplitude ana shape is considred.

ThR3-p13 **09:00-13:30**

OPTICAL PROPERTIES OF Yb:$(YLa)_2O_3$ CERAMICS, MANUFACTURED USING SELF-PROPAGATING HIGH- TEMPERATURE SYNTHESIS AND MICROWAVE SINTERING

V.V. Zelenogorsky, I.B. Mukhin, O.V. Palashov; Inst. of Applied Physics RAS; Russia

Optical properties (transmittance, absorption, scattering, refraction) of $Yb_{0.1}(Y,La)_{1.9}O_3$ ceramics crystals were investigated. Crystals were produced with help of self- propagating high-temperature synthesis (SHS) technique. Dependence of optical properties from content of lanthanum oxide were measured and discussed. Lasing at 1030 nm was observed in ceramics with $Yb_{0.1}Y_{1.7}La_{0.2}O_3$ composition.

ThR3-p14 **09:00-13:30**

THREE-DIMENSIONAL READOUT OF COHERENT PHONONS OSCILLATIONS WITH TEMPORALLY SHAPED ULTRAFAST LASER PULSES

A.A. Lanin[1], A.B. Fedotov[1], A.M. Zheltikov[1,2]; 1-Lomonosov Moscow State Univ., Russia, 2-Texas A&M University, USA

We demonstrated an ultrafast three-dimensional readout of coherent optical- phonon oscillations from a diamond film using temporally and spectrally shaped ultrashort laser pulses, delivered by a compact, oscillator-only laser system. This system integrates the 13-nJ, 40-fs Cr: forsterite oscillator (with center wavelength at 1.25 μm) with a photonic-crystal-fiber (PCF) soliton frequency shifter and a periodically poled lithium niobate (PPLN) spectrum compressor.

ThR3-p15 **09:00-13:30**

INFLUENCE OF INTRACAVITY NONLINEAR OPTICAL INTERACTION ON PUMPING OF A DUAL-WAVELENGTH VECSEL

M. Yu. Morozov, I. V. Krasnikova, Y. A. Morozov; Kotelnikov Inst. of RadioEngineering and Electronics (Saratov Branch); Gagarin Saratov State Technical Univ.; Russia

Influence of the three-wave nonlinear optical interaction in a dual-wavelength vertical-external cavity surface-emitting laser on the steady-state radiation conditions has been analyzed. In particular, the dramatic changes of the carrier concentration in the quantum wells of the active region of the laser have been demonstrated.

R4. Laser Beam Control

ThR4-p01 **15:00-19:30**

AVERAGE POWER SWITCHING TECHNOLOGY FOR HIGH ENERGY AND REPETITION-RATE LASER SYSTEMS

K. Zheng, J. Zhang, X. Zhang, D. Wu, X. Tian, Z. Wang, J. Zheng, Y. Deng; Research Center of Laser Fusion; China

we propose and demonstrate for the first time, as far as we known, a reflecting Pockels cell (RPC) that has thermal properties that make it advantageous for high energy and repetition-rate laser systems.

ThR4-p02 **15:00-19:30**

WIGNER OPTICS OF ULTRASHORT PULSES

A. Gitin; Max-Born-Inst. fur Nichtlineare Optik und Kurzzeitspectroskopie; Germany

Generation, propagation, transformation and amplification of ultrashort pulses are described using the filter-modulator duality and the powerful mathematical properties of Wigner distribution functions.

ThR4-p03 **15:00-19:30**

GRATING DISPERSIVE DELAY LINES FROM A POINT OF VIEW THE TAUTOCHRONISM PRINSIPLE

A. Gitin; Max-Born-Inst. fur Nichtlineare Optik und Kurzzeitspectroskopie; Germany

Note, the correct determination of the time delay of dispersion delay lines (DDLs) is based on the tautochronism principle: the time delay between any two wavefronts is the same for all rays. This principle does not valid for a single diffraction grating, but a pair of diffraction gratings can be combined so that the tautochronism principle is still valid. This explains the work of Treacy's compressor and Martinez's stretcher.

ThR4-p03 **15:00-19:30**

LUMINESCENCE VISUALIZER FOR LASER BEAM CONVERGENCE IN FOUR-WAVE MIXING, PHOTON ECHO AND RELATED SPECTROSCOPIES

K.R. Karimullin, M.V. Knyazev, Yu.G. Vainer, A.V. Naumov; Inst. for Spectroscopy RAS; Moscow Inst. of Physics and Technology; Russia

New effective and easy-to-use laser beams convergence technique in four- wave mixing, photon echo and other optical pump-probe spectroscopies with non-collinear beams is presented. The method uses an epi-illuminated luminescence microscope with CCD-based multi-channel detection scheme. The technique was approved in experiments on four-wave mixing in a doped polymer film at conditions when exciting beams positions on the sample can not be directly observed (inside of high-pressure optical chamber and cryostat).

ThR4-p05 **15:00-19:30**

ALL-FIBER PHASE MODULATOR

N.A. Koliada[1], D.V. Brazhnikov[1,2], V.I. Denisov[1], B.N. Nyushkov[1,2], V.S. Pivtsov[1]; 1-Inst. of Laser Physics SB RAS, 2-Novosibirsk State Univ.; Russia

We propose and study an all-fiber phase modulator based on electro-optical effect. Modulator has simple design. It can perform continuous modulation of laser radiation phase, making a negligible optical loss, regardless of the state of polarization. This modulator suitable for creation of the optical phase locking loops, active mode locking in long-cavity fiber laser systems and for the other applications.

ThR4-p06 **15:00-19:30**

ADAPTIVE COMPENSATION FOR ATMOSPHERIC INDUCED DISTORTIONS IN MULTICHANNEL LASER SYSTEM WITH COHERENT COMBINING OF RADIATION

F.Yu. Kanev, E.I. Tsyro, D.S. Kuksenok, O.L. Antipov; Zuev Inst. of Atmospheric Optics SB RAS, Inst. of Applied Physics RAS; Russia

In the report an analysis is presented of the current state of investigations concerning multichannel laser systems with coherent coupling of signals. The sources of possible aberrations in the system are listed along with the methods of their active and passive compensation. Numeric simulation was used to study the system. Results characterizing parameters of the light field in the plane of observation with different geometry and number of subapertures are included into report. Propagation of beams was considered in free space and in a turbulent atmosphere. Noise in the optical system was also taken into account. Possibility to employ adaptive correction for the given sources of distortions is discussed.

ThR4-p07 **15:00-19:30**

PECULIARITY OF DEPOLARIZATION IN CRYOGENIC FARADAY ISOLATOR WITH DISK-SHAPED MAGNETOOPTICAL ELEMENT

D.S. Zheleznov, A.V. Starobor, O.V. Palashov; Inst. of Applied Physics RAS; Russia

Component of depolarization related to temperature dependence of Verdet constant was experimentally detected. In cryogenic Faraday isolator with TGG crystalline disk-shaped magnetooptical element the suppression of thermally induced depolarization by heat removal through optical surfaces was developed. Isolation ratio of 33 dB (sapphire disk) with laser power of 1400W and 38 dB (YAG disk) with power of 705W were realized.

ThR4-p08 **15:00-19:30**

FORMATION OF AN OPTICAL SURFACE OF ADAPTIVE MIRRORS

A.V. Chernykh, O.I. Shanin; FSUE SRI SIA LUCH; Russia

A method of formation of the optical surface of adaptive mirrors with use mechanical alignment, simplifying their manufacturing technique is offered and approved. The analysis performed has allowed to obtain the technical solutions for implementation of this method. Efficiency of mechanical alignment of the surfaces of adaptive mirrors has been demonstrated by a specific example.

ThR4-p09 **15:00-19:30**

CONTROLLING A SIGN OF SUBNATURAL-WIDTH RESONANCES IN ATOMIC GAS BY VARYING POLARIZATIONS OF COUNTER-PROPAGATING LASER BEAMS

D.V.Brazhnikov[1,2], A.V.Taichenachev[1,2], A.M.Tumaikin[1], V.I.Yudin[1,2,3], V.M.Entin4, A.N.Goncharov[1,2,3], N.A.Koliada[1], I.I.Ryabtsev4, A.M.Shilov[1,2], A.S.Zibrov[2,5]; 1-Inst. of Laser Physics SB RAS, Russia, 2-Novosibirsk State Univ., Russia, 3- Novosibirsk State Techn. Univ., Russia, 4-Inst. of Semicond. Phys., Russia, 5-Harvard Univ., USA

The new method for controlling a laser beam absorption in atomic gas medium is proposed. It is based on switching the type of electromagnetically-induced subnatural-width resonance (absorption or transparency) with the help of polarization parameters of counterpropagating laser beams. The method also can be exploited for observing an ultra-narrow resonance of electromagnetically-induced absorption under buffer gas.

ThR4-p10 **15:00-19:30**

THE STUDY OF IMAGE QUALITY IN THE PHASE CONTRAST TECHNIQUE USING PHOTOTHERMAL ZERNIKE FILTERS

E. L. Bubis, V. O. Martynov; Inst. of Applied Physics RAS; Russia

Some problems of quality visualized image by phase contrast technique using photothermal Zernike cell considered. Numerical modeling was performed taking into account the nonlocal response of the medium. Thin film geometry with a longitudinal heat sink is proposed to reduce the distortion of the type edge enhancement. In particular, the system can be used to measure plasma density fluctuations.

ThR4-p11 **15:00-19:30**

APODIZING DIAPHRAGM ON THE FARADAY EFFECT

O.V. Palashov, E.A. Mironov, A.V. Voitovich; Inst. of Applied Physics RAS; Russia

In this paper theoretical limit of the fill-factor of magnetic apodizing diaphragms is considered. Calculated, designed and experimentally investigated a prototype of MAD for the light aperture of 30 mm, based on a longitudinal Faraday effect. The MAD is represents the magnetic system, with a magneto-optical element inside.

ThR4-p12 **15:00-19:30**

EMPLOYMENT OF STOCHASTIC GRADIENT ALGORITHM IN THE PROBLEM OF AUTOMATIC ALIGNMENT OF AMPLIFYING SECTION OF UFL-2M FACILITY

R.A. Shnyagin, S.G. Garanin, F.A. Starikov; Russian Federal Nuclear Center - VNIIEF, ILFI; Russia

The numerical simulation of the automatic alignment procedure of 4-pass amplifier section of the UFL-2M laser facility is carried out at aberrations presence in optical tract. The reference method lies in the base of the alignment procedure. The stochastic parallel gradient algorithm is implemented for management of control elements.

ThR4-p13 **15:00-19:30**

DIFFRACTION APODIZING FILTER OF FOCUSED LASER BEAM

A.G. Sedukhin, V. P. Korolkov, A.G. Poleshchuk, and N.Yu. Nikanorov; 1-Inst. of Automation and Electrometry SB RAS, 2-Novosibirsk Instrument Making Plant; Russia

The broad-band diffraction apodizing filter is proposed and investigated for the specified suppression of the parasitic side lobes of a focused laser beam. The filter is implemented in the form of a circular regular amplitude grating on a flat substrate. The local fill factor of the circular lines of the filter is varied in accordance with the design amplitude transmittance. The results of numerical simulation, fabrication, and experimental testing are given for a focused laser beam with the spectral wavelength between 400 and 800 nm.

ThR4-p14 **15:00-19:30**

PRECISION OF SINGULAR WAVEFRONT PARAMETER REGISTRATION BY A SHACK-HARTMANN WAVEFRONT SENSOR

V.P. Aksenov, F. Yu. Kanev, I.V. Izmailov, F.A. Starikov, D.S. Kuksenok; Zuev Inst. of Atmospheric Optics SB RAS, Tomsk State Univ., Russian Federal Nuclear Center; Russia

Intensity zeroes and associated with them wavefront dislocations are characteristic features of laser beams propagating in a turbulent atmosphere. Solution of typical to adaptive optics problems, i.e., reconstruction of phase profile and reproduction of the profile by a flexible mirror becomes very difficult under these conditions. So development of methods intended for singular phase reconstruction and detection of vortices in a laser beam are actual aims of nowadays optics. A Shack-Hartmann sensor is used ordinarily to reconstruct a phase profile of coherent radiation. In the optical schematic of the device wavefront local tilts are measured, and with the use of this information the phase of beam is reconstructed. But information obtained in measurements can also be employed to calculate such characteristics of singular wavefront as its circulation and rotor. In the report we demonstrate application of these parameters in the algorithm of singular point detection. Also we discuss the influence of atmospheric turbulence on statistics of optical vortices and analyse limitations of detection method induced by the sensor finite resolution.

ThR4-p15 **15:00-19:30**

OPTICAL CHARACTERISTICS OF DIFFRACTIVE VARIABLE ATTENUATORS FOR HIGH POWER LASERS

A.G. Poleshchuk, V.P. Korolkov, A.R. Sametov, V.V. Dontsova; Inst. of Automation and Electrometry SB RAS; Russia

Polarization independent diffractive variable attenuators on the base of circular phase grating to control of high power lasers radiation are developed. Theory, design and optical characteristics of diffractive attenuators are presented.

ThR4-p16 **15:00-19:30**

COMPARISON OF ELECTRONIC AND THERMAL INDEX CONTROL IN YB-DOPED FIBERS FOR COHERENT BEAM COMBINING.

M.S. Kuznetsov[1], O.L. Antipov[1], A.A. Fotiadi[2,3]; 1-Inst. of Applied Physics RAS, Russia, 2-Univ. of Mons, Belgium, 3-Ioffe Physical Technical Inst., Russia

The mechanism of optical resonant control in coherently combined fiber amplifiers was numerically studied. The electronic and thermal refractive index changes (RICs) in Yb- doped fibers were examined. The studies highlight predomination of electronic RICs in the pulsed- pumped fibers. The thermal RICs effect can be dominating in saturated amplifiers with high-power CW pumping.

ThR4-p17 **15:00-19:30**

A MICROCHIP LASER WITH ACTIVE OUTPUT MIRROR

V.V. Kiyko, V.I. Kislov, V.A. Kondratyev, E.N. Ofitserov, A.G. Suzdaltsev; Prokhorov General Physics Inst. RAS; Russia

It has been analytically justified, numerically simulated and experimentally confirmed that the use of the active mirror with controlled reflectivity on the basis of Fabry-Perot interferometer as the output mirror enables to control the output performance of microchip laser, such as power, divergence, and the mode composition of radiation, both separately and comprehensively.

ThR4-p18 **15:00-19:30**

EXPERIMENTAL RESEARCH OF LASER BEAMS PHASING WITH APPLICATION THE STOCHASTIC PARALLEL GRADIANT ALGORITHM

S.V. Tyutin, Yu.V. Dolgopolov, F.A. Starikov, A.V. Kopalkin, S.M. Kulikov, S.A. Sukharev; Russian Federal Nuclear Center - VNIIEF, ILFI; Russia

The results of researches the phasing of separate laser beams by means of stochastic parallel gradient algorithm (SPG-algorithm) are presented. For phase modulation we used electrooptical modulators on the basis of cross-section Pokkels effect in LiNbO3 crystals. Experimental iterative dynamic phasing of sixteen laser beams is carried out.

ThR4-p19 **15:00-19:30**

SURFACE PLASMON RESONANSE OF GOLD NANOPARTICLES IN LITHIUM GLASS AND ITS EFFECT ON CRYSTALLIZATION

V.Tsekhomsky; St.Petersburg National Research Univ. of ITMO; Russia

Surface plasmon resonance of gold nanoparticles and its effect on crystallization of lithium silicate glass have been studied. It was shown that X-ray irradiation resulted in a capture of additional electrons by gold nanoparticles, which lead in the increase of nanoparticle size. We suggested that the effect is associated with an attraction of lithium ions to the negatively charged nanoparticles.

ThR4-p20 **15:00-19:30**

DYNAMIC PHASE CORRECTION OF CONTINUOUS LASER BEAM IN CLOSED-LOOP UNSENSOR ADAPTIVE SYSTEM BY STOCHASTIC GRADIENT ALGORITHM

S.V. Khokhlov, S.G. Garanin, A.N. Manachinskiy, M.O. Koltygin, S.M. Kulikov, F.A. Starikov, S.A. Sukharev; Russian Federal Nuclear Center – VNIIEF; Russia

The report is devoted to development of adaptive optical systems in RFNC-VNIIEF and the results of adaptive phase correction of cw laser beams. The report describes experiments with flexible bimorph mirror and tip-tilt corrector. Correction control is based on sensor-less stochastic gradient algorithm.

ThR4-p21 **15:00-19:30**

GENERATING INHOMOGENEOUSLY POLARIZED HIGHER-ORDER LASER BEAMS USING BINARY DOES AS BEAM SPLITTERS

S. V. Karpeev[1,2], S. N. Khonina[1,2], S. V. Alferov[2]; 1-Image Processing Systems Inst. RAS, 2-Korolyov Samara State Aerospace Univ.; Russia

We propose a new approach to generating a pair of initial beams for a polarization convertor that operates by summing up two opposite-sign circularly polarized beams. The conjugated pairs of vortex beams matched with laser modes are generated using binary diffractive optical elements (DOEs). The same binary element simultaneously serves two functions: a beam shaper and a beam splitter.

ThR4-p22 **15:00-19:30**

SENSOR-LESS PHASE CORRECTION OF LASER BEAM BY AN ADAPTIVE MIRROR USING VARIOUS CRITERION FUNCTIONALS

V.A. Bogachev, V.A. Volkov, S.G. Garanin, F.A. Starikov; Russian Federal Nuclear Center - VNIIEF; Russia

The results of numerical investigation of phase correction of laser beams by a bimorph deformable mirror using the stochastic parallel-gradient (SPG) algorithm are presented. The following quality metrics in the far field of the defocused Gaussian and speckled beam are analyzed for adaptive wave-front control: the Strehl number, the fraction of power in the diffraction angle and the beam size.

ThR4-p23 **15:00-19:30**

SURFACE ROUGHNESS MEASUREMENT USING A LASER SCATTERING TECHNIQUE

C.J. Tay, C. Quan, W Choo; National Univ. of Singapore; Singapore

This paper presents a technique for measuring surface roughness of a computer hard disk. The method incorporates a high resolution CCD camera and a low power He-Ne laser to record surface roughness with a high degree of accuracy. The influence of the laser beam size on the accuracy of roughness measured is also discussed.

ThR4-p24 **15:00-19:30**

STUDY OF DRYING PROCESS OF COATINGS BY DYNAMIC LASER SPECKLE TECHNIQUE

R.Balamurugan, S.Muruganand; Bharathiyar Univ.; India

A simple non contact method for monitoring of the drying process of painted surfaces using dynamic laser speckle interferometry is presented. During the drying process of paint, intensity signals and related correlation functions changes significantly.The variation of time history of intensities of dynamic laser speckle pattern helps to monitor the drying process. The peak value reaches maximum when the surface becomes completely dry.

ThR4-p25 **15:00-19:30**

INVESTIGATION OF AN OPPORTUNITY OF MAKING WIDE-SPECTRAL UNCOOLED SENSORS OF A LASER RADIATION ON THE BASIS OF THE ANISOTROPIC THERMOELECTRIC RECEIVERS OF OPTICAL RADIATION

A.V. Shchelykalnov[1], S.V. Ordin4, S.G Egorov[1] ,O.G. Romanov[2], S.S. Terehov3, A.N. Chivanov[2]; 1-DVG Ltd.; 2-JSC Ural Optical & Mechanical plant, 3-Vavilov State Optical Inst., 4-Ioffe Physical Technical Inst. RAS; Russia

Abstract is not available.

ThR4-p26 **15:00-19:30**

LATERAL MODES SELECTION IN BROAD AREA LASER DIODES BY DIGITAL PLANAR HOLOGRAM

V. Svetikov[1], I. Ivonine[1], C. Peroz[2], S. Babin[2], S. Dhuey3, S. Cabrini3, A. Goltsov[1], V. Yankov[1]; 1- Nanooptika LLC, Russia, 2-Abeam Technologies, USA, 3-Molecular Foundry, USA

Experimental results are presented on high order mode selection in broad aperture laser diode coupled with digital planar hologram (DPH) fabricated on SiO2:Ge waveguide. DPH determines spectrum and field distribution at the laser output. Temperature stable spectral narrowing down to 0.6nm is demonstrated. Far field distribution width is shown to decrease from 8° to 1.4° (I=2Ith) and to θ=2.5° (I=3Ith).

ThR4-p27 **15:00-19:30**

LASER OPTICAL SYSTEMS FOR BEAM TRANSFORMING

A.A. Filatov, A.A. Kishslov, A.V. Khabarova, M.S. Shlyahtin, M.V. Volkov.; NPP VOLO Ltd; Russia

For many technological applications use of a circular beam with a Gaussian distribution of the radiation in the cross section is not allowed. We have developed two different optical systems designed for change of the beam shape. Keywords: laser beam shaping, laser beam transforming, laser technologies, laser cleaning, welding and hardening.

ThR4-p28 **15:00-19:30**

AUTOMATIC REMOVAL DISTORTION OF THE OPTICAL ABERRATION IN THE PHASE PATTERN OF DIGITAL HOLOGRAPHIC MICROSCOPY

M. Pakdaman, A. Mousavian, F. T. Golestani, M. A. Semiromi, H. Latifi; Laser and Plasma Research Inst., Shahid Beheshti Univ.

In this paper we present a procedure that compensates the high-order phase aberration in digital holographic microscopy by computing a polynomial phase mask. The phase-mask parameters are computed automatically without knowledge of physical values. We used Lab View software to reconstruct the hologram pattern which recorded by the CCD and compensate the aberration. Finally, by the aim of this method we could have the pure phase of the sample and observe the 3D pattern of the sample.

ThR4-p29 **15:00-19:30**

PRISM TELESCOPE FOR SEMICONDUCTOR LASER

A.I. Abramov, A.A. Zborovsky, B.B. Ivanov; FSPC JSC "S.A. Zverev Krasnogorsk plant", Russia

We have considered an optical scheme of beam collimator for an injection semiconductor laser using prism system with the calculus sustaining device efficiency.

R5. Super-Intense Light Fields and Ultra-Fast Processes

ThR5-p01 **09:00-14:30**

FDTD SIMULATION OF COOPERATIVE EMISSION IN SEMICONDUCTOR LASER UNDER DC PUMPING CURRENT

Y. O. Katsiashou, V. V. Makarevich; Mogilev State Univ.; Belarus

The cooperative laser action in Fabri-Perrot cavity with semiconductor acftive media under continuous pumping was investigated numerically. The number of femtosecond quasimodelocked pulse regimes were found.

ThR5-p02 **09:00-14:30**

ANALYSIS OF CONDITIONS FOR SINGLE HIGH HARMONIC GENERATION IN LASER PLASMA

I. A. Kulagin, R. A. Ganeev, V. V. Kim, T. Usmanov; Arifov Inst. of Electronics; Uzbekistan

The analysis of conditions for an enhanced single high harmonic generated in indium plasma is carried out. It is shown that the effects of harmonic and laser radiation propagation in plasma

lead to change of spectral distribution of the high harmonics and the contrast of the selected harmonic.

ThR5-p03 **09:00-14:30**

HYDRODYNAMIC SIMULATION OF HEAT WAVE PROPAGATION INTO LASER TARGET UNDER HIGH INTENSITY P- POLARIZED IRRADIATION

V.Yu. Politov; Russian Federal Nuclear Center – Institute of Technical Physics (RFNC-VNIITF), Snezhinsk; Russia

The model of high intense P-polarized laser pulse interaction with solid matter plasma is presented. It considers such important electrodynamic phenomena as spatial charge wave generation, ponderomotive force, transmission of some part of the pulse energy to fast electrons. In hydrodynamic approximation there was numerically investigated the evolution of plasma thermal heating for different chemical content of the laser target.

ThR5-p04 **09:00-14:30**

ORIENTATION EFFECTS AT HIGH HARMONICS GENERATION IN MOLECULES

V.V. Kim, I.A. Kulagin, T. Usmanov; Arifov Inst. of Electronics; Uzbekistan

Theoretical investigation of orientation effects in the processes of both above threshold ionization and high harmonics generation of linearly polarized intense laser radiation in diatomic

molecules is presented. Presence of interference effects has been confirmed.

ThR5-p05 **09:00-14:30**

30-TW PICOSECOND LASER FACILITY SOKOL-P

D.S. Gavrilov, D.A. Dmitrov, A.G. Kakshin, I.A. Kapustin, E.A. Loboda; Russian Federal Nuclear Center – Institute of Technical Physics (RFNC-VNIITF); Russia

We report on the phosphate Nd:glass 30TW SOKOL-P laser facility after modernization in 2010-2011. One of the main elements of the laser system, vacuum-pumped optical compressor, was built up. The laser pulse contrast was investigated. The following parameters of laser radiation have been achieved: the compressor output energy 20J, recompressed pulse duration 0.7ps, focal spot diameter 3 microns, experimental on-target intensity <5*10^19W/cm^2.

ThR5-p06 **09:00-14:30**

16 FS GREEN PULSES FROM TWO-STAGE NONLINEAR COMPRESSION OF 300 FS YTTERBIUM LASER PULSES

A.V.Konyashchenko[1,2], P.V.Kostryukov[1,2], L.L.Losev[1], S.Yu.Tenyakov[2]; 1-P.N.Lebedev Physical Institute RAS, 2-Avesta Ltd.; Russia

16 fs, 18 mkJ light pulses at the central wavelength of 515 nm were generated by two-stage nonlinear compression of 300 fs, 150 mkJ ytterbium laser pulses with repetition rate up to 10 kHz.

ThR5-p07 **09:00-14:30**

APPLICATION OF SINGLE-WALL CARBON NANOTUBES FOR PASSIVE MODE LOCKING IN Yb:LYSO LASER

A. A. Burtsev, D. N. Antonov, M. N. Gerke, O. Ya. Butkovsky, D. V. Khudyakov, A. S. Lobach; Vladimir State Univ., Inst. of Problems of Chemical Physics RAS; Russia

In this work we demonstrate passive mode locking of Yb:LYSO laser (λ= 1050 nm) by saturable absorbers based on single-wall carbon nanotubes. The advantages of such devices with SWNTs are subpicosecond recovery times, a wide IR range, and chemical stability.

ThR5-p08 **09:00-14:30**

THE STUDY OF PROTON ACCELERATION AT 20 TW SOKOL-P LASER BY NEUTRON YIELD FROM $Li^7(p,n)Be^7$ REACTION

D.V.Torshin, D.S.Gavrilov, A.G.Kakshin, I.I.Kostenko, A.V.Lipin, E.A.Loboda, V.A.Lykov, A.V.Potapov, K.V.Safronov; Russian Federal Nuclear Center – Institute of Technical Physics (RFNC-VNIITF); Russia

We reports about experiments on irradiation of flat solid Al, Cu, Au targets that have been carried out at the SOKOL-P facility with peak laser intensity on target up to 2.5•1019 W/cm2. The efficiency of laser energy transfer to fast protons was estimated by neutron yield from 7Li(p,n)7Be reaction. All calculation was performed for two kinds of energy distribution of fast protons: exponential and isothermal.

ThR5-p09 **09:00-14:30**

EFFICIENCY OF PHOTO-DEMBER TERAHERTZ EMITTERS EXCITED BY FEMTOSECOND LASER

V. D. Antsygin, V.P.Korolkov, A.S.Konchenko, A. A. Mamrashev, N. A. Nikolaev, O. I. Potaturkin; Inst. of Automation and Electrometry SB RAS; Russia

Different wideband terahertz emitters based on photo-Dember effect usingan excitation of semiconductors by femtosecond Er:doped fiber laser have been developed. Experimental investigation of efficiency of terahertz emission of InSb, InAs, and GaAs semiconductors has been carried out. The mechanisms of terahertz emission from the surface of semiconductors at 1550 nm and 775 nm pump laser wavelengths are discussed.

ThR5-p10 **09:00-14:30**

DYNAMICS OF ONE-DIMENSIONAL LASER PISTON IN THE PRESENCE OF A RADIATING FRICTION FORCE

A.A. Andreev[1], K.Yu. Platonov[2], V.I. Chesnov[2], A.E. Petrov[2]; 1-Vavilov State Optical Inst., 2-St. Petersburg State Polytechnical Univ.; Russia

The one-dimensional equations describing movement of a thin plasma layer with the account of a radiating friction force are received. The obtained analytical and numerical solutions have shown that particles get limited energy from electromagnetic wave of given intensity. Analytical formulas for the energy of a thin target and characteristic time of its acceleration as functions of laser intensity and parameters of plasma of a target are received and compare with the known "light sail" case. It is shown, that only initial stage of acceleration corresponds to approach of "a light sail".

ThR5-p11 **09:00-14:30**

SUPERFLUORESCENCE IN CONTINUOUS WAVE SEMICONDUCTOR LASERS

V. Lebedev, V. Makarevich, Ya. Katsiashou; Mogilev State Univ.; Belarus

Experimental data of superfluorescence from AlGaInP semiconductor injection lasers working in 0.63, 0.65 and 0.67 mcm spectral regions under the DC current pumping are presented.

ThR5-p12 **09:00-14:30**

GENERATION OF ELECTRONS NANO-BUNCHES AND SHORT-WAVE LENGTH RADIATION AT REFLECTION OF A LASER PULSE OF RELATIVISTIC INTENSITY FROM A FOIL

A.A. Andreev, K.Yu. Platonov; Vavilov State Optical Inst.; Russia

The effective scheme of generation of short dense electron bunches is offered at interaction on a big angle of incidence of a laser pulse with thin semi-limited foil. Streams of bunches can be used for simultaneous independent generation of a short pulse x-ray radiation at hitting of fast electrons a secondary target. Dependences of bunch parameters (number of particles, energy and thickness) from angle of incidence and laser intensity are received. It is shown, that at reflection from a target the laser wave of relativistic intensity is effectively converted in sequence of electromagnetic pulses of tens nanometer length, the following one after another through the period of an initial laser wave. Dependence of its parameters on angle of incidence and laser intensity is investigated. It is shown, that is the most effective atto-pulses are generated at the big angle of incidence of a laser pulse on a target.

ThR5-p13 **09:00-14:30**

INFLUENCE OF BEAM INHOMOGENEITIES ON PARAMETERS OF PETAWATT-CLASS LASER SYSTEM BASED ON CASCADED BROADBAND OPCPA

S. A. Frolov, V. I. Trunov, E.V.Pestryakov, V.E.Leschenko; Inst. of Laser Physics SB RAS; Russia

Spatial beam inhomogeneities influence on parameters of ultra-high intensity laser systems based on optical parametric amplification is discussed. Two mutually complementary models of inhomogeneities amplification that take gain saturation and self-focusing effects into account are developed and experimentally verified. Simulations of inhomogeneities growth for petawatt-class laser system based on cascaded broadband OPCPA are performed.

ThR5-p14 **09:00-14:30**

OPTIMIZATION OF THIN FOIL ACCELERATION BY LINEARLY-POLARIZED LASER PULSE OF ULTRAHIGH INTENSITY

A.A. Andreev, K.Yu. Platonov; Vavilov State Optical Inst.; Russia

With help of numerical modeling and analytical estimations it is shown, that at optimal target parameters for given laser intensity, on its front side the peak of ion density coincides with peak of accelerating electrostatic fields. Result of such coincidence is high efficiency of the acceleration, caused by ion acceleration at first in a maximum of the field on front side, and then in a field maximum on foil rear. In such optimum case the narrow high peak of ion distribution function near to the maximum energy is formed. Optimal foil thickness for a wide range of relativistic laser intensities are defined.

ThR5-p15 **09:00-14:30**

DOUBLE RELATIVISTIC ELECTRON ACCELERATED MIRROR (DREAM)

A.A. Andreev[1,2], K.Yu Platonov[1], S. Sadykova[2]; 1-Vavilov State Optical Inst., Russia, 2-Max Born Institute, Germany

High intensity ultra-short laser pulse interacting with thin foil generates over-dense bunch of fast electrons or relativistic electron accelerated mirror (REAM). Maximal energy of REAM can be obtained at optimal combination between target thickness, laser intensity and pulse duration. Second laser target is necessary for ultrathin REAM to separate electrons from laser pulse at late stage (DREAM scheme). Scattering of counter-propagating laser pulse on REAM permits to produces kilo-electron volt coherent radiation with efficiency about 0.1%. Double foil target, used for REAM scheme can be effectively used for consistent ion acceleration in ambipolar field of each target. The simulations have shown that ion energy can be increased in two times in respect to a single target.

ThR5-p16 **09:00-14:30**

EFFECTIVE ABSORPTION OF WAVE FUNCTION IN NUMERICAL SIMULATIONS OF STRONG-FIELD PHENOMENA CAUSED BY ULTRASHORT LASER PULSES

A. A. Silaev, N. V. Vvedenskii; Inst. of Applied Physics RAS; Russia

In the present paper we study the reflection and transmission properties of imaginary potentials when solving the time-dependent Schrödinger equation. We derive analytical expressions for the coefficients of absorption and reflection on the symmetric imaginary potential with one maximum. Also we propose the use of effective absorbing potential, containing several peaks of different width and height.

ThR5-p17 **09:00-14:30**

THE USE OF LOW DIMENSIONAL QUANTUM-MECHANICAL MODELS FOR STUDYING THE COMPUTATIONALLY DEMANDING PROBLEMS OF STRONG-FIELD SCIENCE

A. A. Silaev, M. Yu. Ryabikin, N. V. Vvedenskii; Inst. of Applied Physics RAS; Russia

This work is devoted to the investigation of generation of high-order harmonics and low-frequency residual currents in plasmas produced by ultrashort laser pulses in conditions when full-dimensionality simulation based on the 3D time-dependent Schrödinger (TDSE) solution is very laborious. For numerical calculations we use the developed low dimensional models based on the solution of 1D and 2D TDSE.

ThR5-p18 **09:00-14:30**

NANOMETER SCALE FUSED SILICA SURFACE RAISING AND DEPRESSION BY PROCESSING BULK MATERIAL WITH ULTRA-SHORT LASER PULSES

S. Oshemkov, V. Kruglyakov; Carl Zeiss SMS Ltd.; Israel

We report the possibility of fabricating nanometer scale controllable bumps and holes on the surface of fused silica without damaging the sample surface as a result of processing the bulk material with focused ultrashort laser pulses.

ThR5-p19 **09:00-14:30**

SPATIAL PATTERN OF THE PULSED THZ RADIATION EMISSION FROM A TWO-COLOR OPTICAL BREAKDOWN PLASMA

M. Esaulkov, A. Borodin, I. Kuricyn, A. Shkurinov; Lomonosov Moscow State Univ.; Russia

In this work we study spatial profile of the THz emission from an optical- breakdown plasma using coherent detection in ABCD scheme and noncoherent microbolometer detector array. The spatial profile is found to be conical. Two possible contributions to this profile are discussed.

R7. Lasers in environmental monitoring

ThR7-p01 **15:00-19:30**

TUNABLE DIODE LASER SPECTROSCOPY (TDLS) BASED COMPLEX FOR THE AIRPLAN LABORATORY

A. Kuzmichev[1], A. Nadezhdinskii[2], Ya. Ponurovskiy[2], I. Popov[2], Y. Shapovalov[2], D. Stavrovskii[2], V. Zaslavskii[2], V. Khattatov[1], V. Galaktionov[1]; 1-Central Aerological Observatory, 2-Prokhorov General Physics Inst. RAS, 3-DLSLAB Co. Ltd.; Russia

Some years ago Russian federal program started to build airplane (Yak-42D) laboratory for geophysical and ecological monitoring of the environment. In frame of this program A.M. Prokhorov General Physics Institute of the Russian Academy of Sciences has developed TDLS based complex for simultaneous measurements of three greenhouse gases (CO2, CH4, and H2O) and their isotopologues.

ThR7-p02 **15:00-19:30**

TRACE GAS MULTI-COMPONENT REMOTE MONITORING SYSTEM

A.I. Nadezhdinskii[1], Ya.Ya. Ponurovskii[1], I.P. Popov, Yu.P. Shapovalov, D.B. Stavrovskii, V. M. Semenov; National Research Univ. "Moscow Power Engineering Institute", 1-Prokhorov General Physics Inst. RAS; Russia

Multi-component DL based system was developed for remote monitoring of trace molecules concentration. The system incorporates: DL block with several laser channels; receiving module with telescope; electronics; computer. In order to detect several molecules simultaneously time multiplexing operation regime was applied. The time of single concentrations measurement for all six channels was 1.7 msec.

ThR7-p03 **15:00-19:30**

UNDERWATER TARGET AUTOMATED RECOGNITION ALGORITHM FOR AIRBORNE STREAK TUBE IMAGING LIDAR DATA

W. Zhao, S. Han, Q. Hao; School of Optoelectronics of Bei Jing Inst. of Technology; China

This paper proposed an underwater target automated recognition algorithm for ASTIL data that eliminates surface wave effect by raw data correction, reduces noise effects by Image equalization, identify suspected target area by object size, and affirm the true target by the texture of the target finally. Simulation results show that the algorithm is very useful for underwater target automated recognition.

ThR7-p04 **15:00-19:30**

INTRACAVITY LASER SPECTROSCOPY OF CH_4 AND NH_3 GASES BY USING A PULSE-PERIODIC Cr^{2+}:ZnSe LASER

N. Zakharov; Russian Federal Nuclear Center - VNIIEF;

Intracavity laser spectroscopy (ICLS) is known to be an efficient method allowing analytic detection of low concentrations of substances in gaseous form and measuring weak absorption lines. The ICLS in the 2-3 μm range, which includes intense absorption lines corresponding to vibrational-rotational transitions of a number of molecular gases, such as N2O, NH3, CH4, CO, CO2, etc., is of particular interest. In this report we present the results of studying the characteristics of an intracavity laser spectrometer based on a polycrystalline Cr2+:ZnSe laser operating in a pulse-periodic regime with the pulse-repetition rate of 3 kHz and pulse duration of ~50 ns. Intracavity spectra of absorption of NH3 and CH4 gases in the vicinity of 2.35 μm are measured. The estimate of the spectrometer sensitivity is provided.

ThR7-p05 **15:00-19:30**

HETERODYNING OF A BROADBAND RADIATION IN A NEAR INFRARED REGION USING DIODE LASER

A. Klimchuk[1], A. Nadezhdinskii[2], Ya. Ponurovskii[2], A. Rodin[1,3], Yu. Shapovalov[2]; 1-Moscow Inst. of Phys. and Technology, 2-A.M. Prokhorov General Phys. Inst. RAS, 3-Space Research Inst. RAS; Russia

Development of a near infrared heterodyne receiver is a subject of this paper. The main problem of heterodyning in the near infrared range is the stringent requirements for alignment of the incident radiations fronts. The DFB-laser was used as a local oscillator (LO), λ=1.357 μ. The optical attenuator was used to control the incident to the photodiode power of LO. The other DFB laser excited by current below threshold was used as a source of radiation. The fiber optic beam splitter based on single-mode silica fiber was used to align fronts of both LO and SR radiations. Both signals were detected by photo-detector (pin-diode). A Cell with H2O could be placed between the source of radiation and the fiber splitter. Minimum detectable heterodyne signal achieved was 1.4% of shot noise. Noise equivalent absorbance was found to be 0.033

ThR7-p06 **15:00-19:30**

ACCURATE (~ 0.1 %) SPECTRAL LINE PARAMETERS MEASUREMENTS USING TUNABLE DIODE LASER SPECTROSCOPY

A.Nadezhdinskii; Prokhorov General Physics Inst. RAS; Russia

Accuracy is one of recent challenges for Tunable Diode Laser Spectroscopy (TDLS). Several TDLS applications require measurement accuracy at level of 0.1 %. Several error mechanisms were analyzed and investigated. Accuracy achieved in experiment was found to be 0.11 % - order of magnitude better than best result obtained at the moment.

ThR7-p07 **15:00-19:30**

TEMPERATURE MESUREMENT ERROR OF FLUORESCENCE INTENSITY RATIO SENSORS BASED ON ERBIUM-DOPED NANO-GLASS-CERAMICS

M.A.Khodasevich, G.V.Sinitsyn, Y.A.Varaksa, A.N. Abdrshin, V.A. Aseev; Stepanov Inst. of Physics NAS Belarus, Belarus; National Research Univ. of Information Technologies, Mechanic and Optics, Russia;

Fluorescence intensity ratio sensors on the basis of promising erbium-doped lead-fluoride nano-glass ceramics were considered. The equation for temperature measurement error was deduced and temperature measurement error was calculated. The minimum temperature measurement error is found to be not exceeding ~ 0.1 °C at 450°C for total fluorescence band power 100 mkW.

ThR7-p08 **15:00-19:30**

COMPACT EXCIMER SLAB LASER

O. Khristoforov, V. Borisov; SRC RF Troitsk Inst. for Innovation and Fusion Research; Russia

Excimer slab laser pumped by two opposite sliding discharges on sapphire plates surfaces has been developed and investigated. Such type of diffuse cooled excimer lasers can be high effectively used in compact fluorescent lidars for environmental monitoring. Results of the study of laser induced fluorescent spectrum of different water objects are presented.

ThR7-p09 **15:00-19:30**

PROSPECTS OF CREATION THE LASER SENSOR FOR RADIATION MONITORING

A.S.Griskanich, S.V.Kascheev, S.K.Vasiliev, A.P.Zhevlakov; 1-Inst. for Laser Physics, Vavilov State Optical Inst. , 2-State Corporation "ROSATOM"; Russia

The method of remote detection a radionuclide in atmosphere from container burial places and in places of recycling the fuel waste of the atomic power station is elaborated. Preliminary results of investigation show the real possibility to register of leakage of a radionuclide with concentration at level of 10^8-10^9 cm-3 on a safe distance from the infected object.

ThR7-p10 **15:00-19:30**

SYNTHESIS OF INTERFERENCE COATINGS FOR LASER SYSTEMS

E.N. Kotlikov, E.V. Khonineva, Iu.A. Novikova; State Univ. of Aerospace Instrumentation; Russia

Nowadays laser systems are widely used in the environmental monitoring. To obtain them it's necessary to investigate such interference coatings as achromatic antireflective coatings, narrow-band and band interference filters. In the present paper it's considered the technique of the interference coating's synthesis and of stability's analysis for laser systems. Also it's paid the great attention to the problem of the radiation's strength of elaborated films. For example there are demonstrated the synthesis and stability's analysis of achromatic antireflective coatings in the middle infrared spectral range.

ThR7-p11 **15:00-19:30**

HIGH SENSITIVE AIRBORN RAMAN LIDAR

S.V. Kascheev[1], V.G. Bespalov[1], A.A. Bogoslovsky[2], V.V. Elizarov[1], A.A. Ilyinsky[2], A.P. Zhevlakov[1]; 1-Inst. for Laser Physics, Vavilov State Optical Inst., 2-VNIGRI, Russia

Results of the ultraspectral Raman LIDAR investigations are discussed. This LIDAR on base of a solid-state laser (262 nm, 0.3 J, 6 ns, 100 Hz) has been studied and designed to the airborne prospecting of oil and gas deposits in combination with traditional geological exploration techniques. It has been shown that the reliability of heavy hydrocarbons remote detection may exceed 80% due to the complexation of seismic exploration and laser sensing methods.

ThR7-p12 **15:00-19:30**

LIBS-STUDY OF COMPONENTS REDISTRIBUTION IN STEEL WELD JOIN TS AFTER WELDING WITH GAS FEED

E. L. Surmenko, T. N. Sokolova, I. A. Popov; Saratov State Technical Univ.; Russia

LIBS-study of weld joints of steel rods is described. The welding modes were electric-arc with oxygen and acetylene feed of air. The main purpose was the determination of difference of elemental composition of acetylene and non-acetylene joints. The results showed the enrichment of the central in case of non-acetylene welding and depletion in case of acetylene welding.

ThR7-p13 **15:00-19:30**

LASER BASED FLOW-OPTICAL BIOAEROSOL DETECTORS

A.O. Volchek, E.A. Kochelaev, E.S. Khudyackov; OAO "NPO "Pribor"; Russia

Flow-optical detectors for bio-aerosol analysis are described. Detector constructing schemes, based on lasers with active and passive modulation, are considered. Basic requirements for the laser radiation sources of these devices are formulated. It it shown, that laser radiation sources of these devices should have several mW average power in 250- 290 nm spectral range with impulse frequency about 10 kHz.

ThR7-p14 **15:00-19:30**

OPTICAL WATER BREAKDOWN BY NANOSECOND Nd:YAG LASER AND DETECTION OPTOACOUSTICAL EFFECTS

A.V.Bulanov[1], I.G.Nagorny[2]; 1-V.I. Il'ichev Pacific Oceanologic Institute FEB RAS; 2-Institute for automation and control processes FEB RAS; Russia

Estimations of acoustic radiation power were spent and dynamics of spectral structure of acoustic radiation have been investigated at various modes of plasma fronts movement .

R8. Nonlinear Photonics: Fundamentals and Applications

ThR8-p01 **09:00-13:30**

TRANSIENT BEAM SELF-FOCUSING IN REDUCED PHOTOREFRACTIVE LiNbO3 CRYSTALS

S.M. Kostritskii, M. Chauvet, M. Aillerie and O.G. Sevostyanov; RPC Optolink Ltd., Russia, Institut FEMTO-ST, France, Univ.of Lorraine and Supelec, France, and Kemerovo State Univ., Russia;

Data on transient beam self-focusing using pyroelectric effect in reduced LiNbO3 are presented. The reported effects could potentially be obtained in other crystals reduced at optimal conditions, providing characteristics of pyroelectric field such as a long decay time and large enough amplitude. The self-focusing experiments which are straightforward to realize can also be considered as a non destructive technique to characterize LiNbO3 crystals.

ThR8-p02 **09:00-13:30**

NONLINEAR SUSCEPTIBILITY AND SECOND HARMONIC GENERATION IN PROTON-EXCHANGED LITHIUM NIOBATE WAVEGUIDES

S.M. Kostritskii, Yu.N. Korkishko, V.A. Fedorov, S.V. Rodnov, M.V.Frolova; RPC Optolink Ltd; Russia

The nonlinear optical susceptibility of proton-exchanged waveguides consisting of the different HxLi1-xNbO3 phases was evaluated and correlated to the fabrication conditions and optical properties. Our study opens the new possibilities for fast and easy estimation of performance of any newly developed LiNbO3-based materials for application in nonlinear integrated- optical devices.

ThR8-p03 **09:00-13:30**

GENERATION OF TERAHERTZ WAVES BY OPTICAL RECTIFICATION OF FEMTOSECOND LASER PULSES WITH THE TILTED INTENSITY FRONT

G.S.Rogozhnikov, V.V.Bukin; Russian Federal Nuclear Center - VNIIEF, GPI RAS; Russia

An optical scheme for generation of terahertz waves by optical rectification of femtosecond laser pulses with the tilted intensity front has been designed where in order to get high intensive THz pulses the parametrically amplified chirped laser pulses (λ=911nm, τ=50-70fs) have been used.

ThR8-p04 **09:00-13:30**

SOLITON REFLECTION AND TRANSMISSION IN RANDOMIZED PHOTONIC LATTICES

Ya.V. Kartashov[1,2], V.A. Vysloukh3; 1-ICFO-Inst. de Ciencies Fotoniques, Spain, 2-Inst. of Spectroscopy RAS, Russia, 3-Univ. de las Americas - Puebla, Mexico;

Soliton transmission and reflection by nonlinear photonic lattices of finite width embedded into uniform cubic medium is addressed. We show that randomizing positions of guiding lattice channels, one can achieve transmission of remarkable fraction of soliton energy, even in the case when regular lattice reflects input beam completely. In contrast, for transparent regular lattice, disorder may induce considerable reflection.

ThR8-p05 **09:00-13:30**

ANALYTICAL INVESTIGATION OF THZ RADIATION GENERATION BY LONG TWO-COLOR FEMTOSECOND PULSES IN A DIELECTRIC THIRD-ODER NONLINEAR MEDIUM

K.A. Goroshko, S.A. Stumpf; St.Petersburg National Research Univ. of ITMO; Russia

This paper presents a system of equations, which analytically describes a generation of THz radiation, a generation of third harmonic radiation and combination frequencies by the field of the two-color femtosecond pulses of long duration. In addition, parameters affecting the efficiency of generation of THz radiation are estimated.

ThR8-p06 **09:00-13:30**

TWO-PHOTON ABSORPTION IN STRONTIUM BARIUM NIOBATE CRYSTAL

P.G. Zverev, L.I. Ivleva, A.Ya. Karasik, V.I. Lukanin, D.S. Chunaev; Prokhorov General Physics Inst. RAS; Russia

Two-photon interband absorption in strontium barium niobate photorefractive crystals was investigated under excitation with picoseconds pulses at 523.5 nm. Two- photon absorption

coefficients were measured to be 0.17 - 0.31 cm/GW depending on the excitation polarization and doping elements. The hysteresis in the transmission dependence on the intensity was discovered to be due to the induced one-photon excitation from the excited state.

ThR8-p07 **09:00-13:30**

TWO-PHOTON PICOSECOND INTERBAND ABSORPTION AND UV STIMULATED RAMAN SCATTERING IN INORGANIC CRYSTALS

V.I. Lukanin, L.I. Ivleva, A.Ya. Karasik; Prokhorov General Physics Inst. RAS; Russia

Dynamics of interband two-photon absorption (2PA) and stimulated Raman scattering in AMO4 (A=Pb, Zn, Ca, Ba, KGd; M=W, Mo,) crystals are studied under 523.5 nm and 349 nm picosecond pumping. Kinetics of the generation of electronic excitations, 2PA and Raman gain coefficients are measured for the crystals.

ThR8-p08 **09:00-13:30**

TERAHERTZ TIME-DOMAIN SPECTROMETER USING FEMTOSECOND YB:KYW LASER PULSES AT 1.04 μm WAVELENGTH

G.V. Sinitsyn, A.V. Lyakhnovich, V.L. Malevich; Stepanov Inst. of Physics NAS Belarus; Belarus

Terahertz time-domain spectroscopy system on the basis of Yb:KYW femtosecond laser generating at wavelength of about 1.04 mkm was built. LTG-GaBiAs-based dipole photoantenna are used for generation and coherent detection of terahertz pulses. Spectral dependencies of the refraction index and absorption coefficient of some kind of ceramics and plastics were measured in bandwidth of 0.1…2.5 THz.

ThR8-p09 **09:00-13:30**

DISSIPATIVE OPTICAL SOLITONS IN DENSE MEDIA OF DOPED WAVEGUIDES

M.Yu. Gubin, A.V. Prokhorov, A.Yu. Leksin, A.P. Alodjants, S.M. Arakelian, M.G. Gladush; Stoletov Vladimir State Univ., Inst. for Spectroscopy RAS; Russia

We consider the problem of formation of optical solitons for lambda-scheme of Raman-type atom-field interaction in dense medium doped by 87Rb silica waveguide taking into account dissipative and nonlinear (local) field effects in general.

ThR8-p10 **ia09:00-13:**

RADIAION INDUCED REFRACTIVE INDEX CHANGE EFFECT ON RAYLEIGH SCATTERING BASED TEMPERATURE MEASUREMENTS IN OPTICAL FIBRES

A. Faustov[1,2,3], A. Gusarov[1], M. Wuilpart[2], A.A. Fotiadi[2,4,5], L.B. Liokumovich3, O.I. Kotov3, I. O. Zolotovskiy5, A. L. Tomashuk5,6, T. Deschoutheete7, P. Mégret[2]; 1-SCK-CEN, Belgium, 2-Univ. of Mons, Belgium; 3-St. Petersburg State Polytechnical Univ., Russia, 4-Ioffe Physical Technical Institute RAS, Russia, 5-Ulyanovsk State Univ., Russia, 6-Fiber Optic Research Center of RAS, Russia; 7-Laborelec, Belgium;

In this paper we present radiation effect on Rayleigh scattering based temperature measurements. We carried out irradiation of optical fibres at constant temperature. During the irradiation we observed gradual saturation-like temperature drift measured by means of optical frequency domain reflectometer. We assume that it was caused by radiation induced refractive index change.

ThR8-p11 **09:00-13:30**

NUMERICAL SIMULATION OF OPTICAL LIMITING IN ONE-DIMENSIONAL PHOTONIC BAND-GAP STRUCTURES WITH KERR NONLINEAR DEFECTS

A. A. Ryzhov[1,2], I. M. Belousova[1,2], G. A. Muranova[1]; 1-Inst. for Laser Physics, Vavilov State Optical Inst., 2-St.Petersburg National Research Univ. of ITMO; Russia

The transmittance behaviour of optical Fabry-Perot cavities with Kerr nonlinear medium is investigated. These cavities have narrow lines of transparency in their bands of refraction. If such a structure contains a Kerr nonlinear medium its line of transparency shifts and the transmittance at the resonance wavelength decreases by increasing of the incident light intensity. Thus we find that such structures can be applied for optical limiting.

ThR8-p12 **09:00-13:30**

SURFACE GUIDED WAVE SELFINDUCED WAVEGUIDE AND QUASI – PHASE – MATCHING CONDITIONS OF SURFACE GUIDED WAVE SECOND HARMONIC GENERATIONS IN SBN.

S.A. Chetkin; Prokhorov General Physics Inst. RAS; Russia

We investigate light- induced waveguide (LIW) emergence in photorefractive crystal during surface guided wave (SGW) spreading. Possibility of localization and propagation of coherent radiation in LIW for different wavelength is justified. Conditions for quasi-phase- matching of SGW pumping mode with mode of doubled frequency in such LIW are established. Experimental evidence of LIW in strontium-barium – niobate crystal is reported.

ThR8-p13 **09:00-13:30**

NUMERICAL MODELING OF VISIBLE-BAND UPCONVERSION ERBIUM-DOPED FIBER AMPLIFIER

M. A. Khodasevich, S. A. Koval; Stepanov Inst. of Physics NAS Belarus;

Spectrally and spatially resolved model of upconversion erbium-doped fiber amplifier is presented in the assumption of concentration-independent cooperative effects. Over 40 dB gain at 540 nm can be achieved using 100 mW pump power at 980 nm for 6 cm-long amplifier under suppression of 850-nm emission, which demonstrates the possibility of application of proposed device in polymer optical fiber systems.

R1. Solid-State Lasers and Nonlinear Frequency Conversion

FrR1-39 **09:00-09:15**

COMPARISON OF DEPOLARIZATION LOSSES IN YB DOPED YAG CERAMICS AND CRYSTALS FOR HIGH-AVERAGE POWER LASER SYSTEMS

D. Albach, I. Snetkov, I. Mukhin, O. Palashov, E. Khazanov, J.C. Chanteloup; [1]LULI, Ecole Polytechnique, Palaiseau, France; Inst. of Applied Physics RAS, Russia

Laser grade transparent ceramics offer new scaling possibilities for laser gain media for high average power diode pumped solid state lasers. Thermal effects like depolarization losses are impacted by crystals orientation. This is not the case for ceramics. We compare depolarization loss measurements and simulations in large size Yb3+ doped YAG ceramics and crystals.

FrR1-40 **09:15-09:30**

TECHNOLOGICAL FACTORS EFFECT ON LIMIT CHARACTERISTICS OF NEODYMIUM PHOSPHATE GLASSES FOR BIG-SIZED DISC AND ROD ACTIVE ELEMENTS

V. I. Arbuzov, Yu. K. Fyodorov, S. I. Kramarev, A. V. Shashkin; Research and Technological Institute of Optical Material Science; Russia

Neodymium phosphate glasses of the KGSS-0180 type with neodymium concentrations from 0.4*10+20 to 5*10+20 cm-3 (trade marks from KGSS-0180/4 to KGSS-0180/50) dedicated for manufacturing big-sized disc and rod active elements are investigated. Some functional characteristics of glasses under study are controlled by the technology of glass production. Among these are luminescence life time (quantum yield), coefficient of inactive absorption at the generation wave length, optical quality (optical homogeneity, bubbles, dielectric inclusions) and damage threshold. Limit values of the above characteristics are represented.

FrR1-41 **09:30-09:45**

LASER PHOSPHATE GLASS PRODUCTION AT JSC LZOS

L.I. Avakyanz, T.O. Babina, A.N. Ignatov, E.Y. Krekhova, A.E. Pozdnyakov, V.F. Surkova; Open joint stock company Lytkarino optical glass factory (JSC LZOS), Lytkarino; Russia

In 1960s JSC LZOS started mass production of elements from silicate-based glass activated by neodymium. Laser glass characteristics were largely investigated, new glass compositions with prescribed properties and technology allowing to produce big-sized elements were developed. In the last decade LZOS developed high-performance phosphate-based laser glasses and now the factory continues to generate a complete cycle of producing big-sized elements, including disc ones.

FrR1-42 **09:45-10:00**

LASER PROPERTIES OF ER^{3+} IONS IN FLUORIDE CERAMICS OF CaF_2 AND CaF_2-SrF_2

M.E. Doroshenko[1], T.T. Basiev[1], V.A. Konyushkin[1], V.V. Osiko[1], H. Jelinkova2, J. Sulc2.; 1-Prokhorov General Physics Inst. RAS, Russia; 2-Czech Technical Univ., Czech Republic

Lasing of Er3+ ions in CaF2 and CaF2-SrF2 ceramics under laser diode pumping was realized with slope efficiency up to 2.2%. Using Lio filter tuning within 2700-2760 nm spectral range was obtained.

FrR1-43 **10:00-10:15**

GROWTH, SPECTROSCOPIC AND THERMO-OPTICAL PROPERTIES OF ND-DOPED DISORDERED CALCIUM VANADATE CRYSTALS

P. A. Loiko[1], A. S. Yasukevich[1], A. E. Gulevich[1], M. B. Kosmyna2, B. P. Nazarenko2, V. M. Puzikov2, A. N. Shekhovtsov2; 1-Belarusian National Technical Univ., Belarus; 2-Inst. for Single Crystals NAS Ukraine; Ukraine

Growth conditions, absorption and luminescence spectra and anisotropy of thermo-optical properties were investigated for uniaxial disordered Nd-doped calcium vanadate Ca9Ln(VO4)7 crystals.

FrR1-44 **10:15-10:30**

GROWTH AND INVESTIGATION OF 2" YAG SINGLE CRYSTALS DOPED WITH Cr,Mg; V; OR Co,Si, FOR Q-SWITCHING APPLICATIONS

A.L. Bajor[1], J. Kisielewski[1], K. Kopczynski2, T. Lukasiewicz[1], J. Mierczyk2 and J. Mlynczak2; 1-Inst. of Electronic Materials Technology, 2-Inst. of Optoelectronics; Poland

2' YAG single crystals doped with different ions (either Cr,Mg, or V, or Co,Si) were grown by conventional Czochralski method. Different annealing procedures were developed to get as many active ions as possible. Nonlinear transmission curves were analyzed by the Frantz-Nodvik and Avizonis-Grotbeck theories (the latter gave best fitting results) at usually two different wavelengths (1064 and 1332 nm).

FrR1-45 **10:30-10:45**

THERMAL, THERMO-OPTICAL, AND SPECTRAL PROPERTIES OF LASER CERAMICS Tm:Lu2O3

E.V. Ivakin, I.G. Kisialiou, O.L. Antipov; Stepanov Inst. of Physics NAS Belarus, Inst. of Applied Physics RAS; Belarus

Thermal diffusivity, lifetime of upper lasing level and thermooptical coefficients of laser ceramics Tm:Lu2O3 have been determined by the method of transient gratings recorded at different wavelengths: 213, 266, 355 and 796 nm. The surface relief and bulk gratings in the sample under study were probed by CW laser beam at reflection and transmission mode. All the results were compared with the data obtained elsewhere and were metrologically verified by glass K8 slab testing in parallel.

R8. Nonlinear Photonics: Fundamentals and Applications

FrR8-33 Invited **09:00-09:30**

POLARITON-SOLITONS IN MICROCAVITIES AND PLASMONIC STRUCTURES

D.V. Skryabin[2], D.N. Krizhanovskii[1], M. Sich[1], R. Hartley[2], A.V. Gorbach[2], A. Marini[2], E. Cerda3, K. Biermann3, R. Hey3, P.V.Santos3, M. S. Skolnick[1], O. Egorov4, F. Lederer4; 1-Univ. of Sheffield, UK; 2-Univ. of Bath, UK; 3-Paul-Drude-Inst., Germany; 4-Inst. of Condensed Matter Theory and Solid State Optics, Friedrich-Schiller-Universität Jena, Germany

In this talk I'll review the recent progress achieved in the area of polariton solitons. A particular focus of my presentation will be on polariton solitons in strongly coupled semiconductor microcavities and some of the results to be present on this topic are summarised below. I will also touch on other types of polariton solitons, including, surface plasmon polaritons.

FrR8-34 **09:30-09:45**

DISSIPATIVE SOLITONS IN PLANAR CAVITIES WITH PLASMONIC RESONATORS AND FOCUSING NONLINEARITY

A.V. Yulin[1], V.V. Konotop[1], V. Kuzmiak[2] and S.Eiderman[2]; 1-Univ. de Lisboa, Portugal; 2-Inst. for Photonics and Electronic of Czech Academy of Science, Czech Republic;

The formation of localized structures in the nonlinear cavities containing metallic nanoparticles is considered when the system is pumped by spatially uniform coherent light. The shapes of cavity solitons were found numerically and the corresponding bifurcation diagrams were plotted. To study the development of the instabilities direct numerical modeling of the system was performed.

FrR8-35 **09:45-10:00**

SLOWLY POLARIZATION EVOLVING VECTOR SOLITONS

S. Sergeyev, Ch. Mou, A. Rozhin, S. Turitsyn; Aston Inst. of Photonic Technologies, Aston Univ.; United Kingdom

We observed new types of slowly polarization evolving vector solitons in a carbon nanotube mode locked fiber laser. Fundamental soliton operation has been achieved with anomalous dispersion laser cavity.

FrR8-36 **10:00-10:15**

NUMERICAL MODELING OF A MODE-LOCKED LASER GENERATING SINGLE-CYCLE PULSES

V. V. Kozlov[1], E.B. Kozlova[2]; N.N. Rosanov3,4; 1-St.Petersburg State Univ., Russia, 2-Second Stiftung Schweizerische Sportmittelschule Engelberg, Switzerland; 3-Vavilov Optical Inst., Russia, 4-St. Petersburg National Research Univ. of Information Technologies, Mechanics, and Optics, Russia;

We perform numerical experiments with a laser mode-locked by the technique of coherent mode- locking and show that this laser supports generation of single-cycle pulses in a wide range of laser parameters. We identify the optimal operation regime with respect to the reflection coefficient of the outcoupling mirror under the condition of a given pump.

FrR8-37 **10:15-10:30**

EFFECT OF THE INHOMOGENEOUS CLADDING OF THE GRADED-INDEX OPTICAL WAVEGUIDE ON MODE AND ENVELOPE CHARACTERISTICS OF THE SOLITON PULSE

M.A.Bisyarin; St.Petersburg State Univ.; Russia

An analytical approach is developed for studying nonlinear pulse propagation in graded-index planar waveguides and optical fibers, with longitudinal inhomogeneity of both core and cladding being taken into account. Formulae for the refractive index transverse profile are proposed that enable explicit characterization of the pulse modes. The pulse envelope is shown to obey a generalized Nonlinear Schrödinger equation with coefficients depending on the longitudinal coordinate and expressed via the refractive indices of waveguide and cladding layers. Estimates of the cladding influence on the pulse propagation are presented.

FrR8-38 **10:30-10:45**

NUMERICAL STUDY ON SOLITARY SESAM MODE-LOCKED FIBER LASER BY COUPLED GINZBURG-LANDAU EQUATION

R. Poozesh, K. Hejaz, A. Babazadeh, A. Norouzy, A. Heidariazar, R. Rezaei Nasirabad, A. Roohforouz, N. Tabatabaei Jafari; Iranian National Center for Laser Science and Technology (INLC), Tehran, Islamic Republic of Iran;

We numerically studied solitary SESAM mode-locked fiber laser by coupled Ginzburg-Landau equation. It was found that NLPR has negligible effect in achieving short solitons. At some particular positions of wave plates that pulse width is slightly shorter than other positions, this effect was explained as result of loss introduced by wave plates because nonlinear length is several times longer than cavity length and polarizer element prevents from Nonlinear accumulation effects during pulse build up.

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- High power fiber lasers for material processing applications
- Cutting and welding with kW fibre lasers
- Fiber laser cladding, sintering and heat treatment
- Fiber lasers for automotive applications
- Mid power fiber laser applications
- Pipe and thick section welding
- Marking and engraving
- Mid infra-red, 2 to 3 micron fiber lasers, processing including cutting and welding of plastics
- Visible, uv and ultrafast fiber lasers and applications
- Life Sciences, medical, surgical, food production, agricultural pest and herbal control applications of fiber lasers
- Telecoms and Sensors

Tuesday, June 26

Session 1: New Developments in Fiber Lasers for Material Processing Applications

TuSY1-01 **09:00-09:10**

INTRODUCTION AND OPENING WORDS

V. Gapontsev; IPG Photonics; United States

TuSY1-1.1 **09:10-09:35**

HIGH BRIGHTNESS HIGH POWER 9xx-nm FIBER COUPLED PUMPS

A. Ovtchinnikov, N. Moshegov, P.Trubenko, A.Komissarov, I.Berishev, N.Strougov, V.Chuyanov, V.Gapontsev; IPG Photonics Corp.; United States

We report on high power fiber coupled devices optimized for fiber pumping. Performance of pumps rated for up to 100W CW with and without wavelength stabilization is discussed. These fiber couopled modules have industry highest efficiency and smallest footprint and are perfectly suited for fiber lasers pumping and direct materials processing applications.

TuSY1-1.2 **09:35-09:55**

17kW CW LASER WITH 50 μm DELIVERY

A. Ferin1, V.Gapontsev,[2], V.Fomin1, A.Abramov1, M.Abramov1, D.Mochalov1; 1-IPG Laser GmbH, Germany, 2-IPG Photonics Corporation, USA;

The 17 kW, 1075 nm wavelength laser is based on MOPFA configuration. Booster amplifiers amplify the signal from 4 kW to 17 kW. Pumping with single-mode fiber lasers at 1018 nm wavelength ensures record pump conversion efficiency 94%. 10 meter long 50 μm core output fiber delivers beam parameter product of 2 mm mrad.

TuSY1-1.3 **09:55-10:15**

EVALUATION OF PARAMETERS ALONG FIBER AMPLIFIER BY SPECTRAL AND TEMPORAL SIDE FLUORESCENCE MEASUREMENT

S.Maryashin; IPG Laser GmbH; Germany

The experimental technique to investigate fiber amplifier parameters like temperature distribution and energy amplification along the fiber is proposed. The technique is based on spectrally and temporary resolved measurements of a pumped amplifier side fluorescence.

TuSY1-1.4 **10:15-10:35**

31.5 kW CW FIBER LASER WITH 100 μm DELIVERY

A. Ferin[1], V.Gapontsev[2], E.Shcherbakov[1], V.Fomin[1], A.Abramov[1], M.Abramov[1], M.Mochalov[1]; 1-IPG Laser GmbH, Germany, 2-IPG Photonics Corp., USA; IPG Laser GmbH;

31.5 kW, 1075nm industrial laser with 5m long 100 μm core fiber and beam parameter product 3.8 mm mrad is reported. The laser could be used with internal or remote fiber-to-fiber coupler or beam switch to support a variety of industrial applications.

TuSY1-1.5 **10:35-10:55**

NEW GENERATION OF HIGH POWER AND HIGHLY EFFICIENT INDUSTRIAL GRADE THULIUM FIBER LASERS IN EXTREMELY COMPACT DESIGN

F.Shcherbina[1], A. Mashkin , V. Sergueev[1], N. Platonov[1], V. Gapontsev[2]; 1-IPG Laser GmbH, Germany, 2-IPG Photonics, USA;

We report on the novel design of highly efficient thulium lasers with output power range over 150W pumped by multimode erbium laser. Due to the high efficiency, wide spectral range, high stability of central emission wavelength, compact design and proved multi-thousand hours of problem-free operation the new generation of the thulium lasers is perfectly suited for medical and material processing applications.

- Coffee Break -

TuSY1-1.6 11:20-11:45

DESIGN OF A HIGH POWER LASER DIFFUSION SYSTEM FOR SOLAR CELL FABRICATION

B.Piwczyk, A.Amidon, IPG Photonics Corp.; United States

The technology for the fabrication of Si crystalline solar cells is advancing with the achievement of higher efficiencies of up to 22%, the use of 20cm Si wafers with a thickness down to 30 microns and lower cost down to about 1.0 $/watt. The PV industry continues to improve by employing ever more sophisticated manufacturing technology. One of these improvements in the near future may be the replacement of conventional furnace diffusion for semiconductor junction formation by Gas Immersion Laser doping (GILD) or ion implantation and laser dopant activation and annealing. This paper describes the design of a high power fiber laser exposure system with a novel doping gas source and a potential throughput of up to 3,000 wafers/hr.

TuSY1-1.7 **11:45-12:05**

355nm GENERATION BY TYPE I CRITICALLY PHASE-MATCHED LiB3O5 CRYSTAL BY MEANS OF OPTICALLY ACTIVE QUARTZ CRYSTAL

D.Oulianov[1], V.Tyrtyshnyy[1], O.Vershinin[1,2], B.Davydov[1,2] ,1-NTO IRE-Polus, 2-Moscow Inst. of Physics and Technology; Russia

We present a method of third harmonic generation (THG) at 355 nm by frequency mixing of fundamental and second harmonic radiation of an ytterbium nanosecond pulsed fiber laser in type-I phase matched LiB3O5 crystal where originally orthogonal polarization planes of fundamental and second harmonic beams are aligned by optically active quartz crystal. 7 W of ultraviolet light at 355 nm was achieved with 32.6 % conversion efficiency from 1064 nm radiation, which was 1.75 times higher than the conversion efficiency obtained in the type-II phase matched LiB3O5 THG crystal scheme at similar experimental conditions. In comparison to traditionally used for polarization alignment half-wave plates the optically active quartz crystal has much lower temperature dependence and requires simpler optical alignment.

TuSY1-1.8 **12:05-12:25**

FUSED FIBER COMPONENT FABRICATION AND AUTOMATION FOR HIGH POWER FIBER LASERS

B. Wang; Vytran LLC; United States

In this paper, we review fabrication techniques in the manufacturing of fiber fused components for high power fiber lasers with a focus on interconnecting dissimilar fibers, mode- field adapting devices and fiber combiners. We describe fundamental waveguide optics in fiber coupling between different fibers, present fiber fusion process and fabrication techniques in detail, show some application examples, and also discuss hardware challenges for producing these high performance fiber components for high power fiber lasers.

TuSY1-1.9 **12:25-12:45**

SUB-NANOSECOND MW Yb FIBER LASER FOR MICROMACHINING APPLICATIONS

D. Myasnikov[1,2], A.Baranov[1,2], M.Vyatkin[1], V.Tranev[1], S.Larin[1], A. Unt[1]; 1-NTO IRE-Polus, 2-Moscow Inst. of Physics and Technology; Russia

We report on an all-fiber single-mode laser delivering sub-ns pulses with 1 MW peak power designed for micromachining applications. The laser consists of a gain-switched semiconductor laser used as a seed, two preamplifiers and a tapered fiber booster amplifier which is pumped by a high power single-mode Nd fiber laser operating at 920 nm.

TuSY1-1.10 **12:45-13:10**

NEW SYSTEM APPROACHES FOR MATERIAL PROCESSING USING FIBER LASERS

J.Dallarosa; IPG Photonics Corp.; United States

Although laser sources have been around for over 50 years having high brightness and high power lasers at a low cost with low operating costs have increased the demand in the material processing world. System integration of fiber lasers is now easier and customers are looking at new applications. This paper will talk about some of the new applications and new approaches to systems that are now being considered or used from applications in the oil field, ship building to marking.

TuSY1-1.11 **13:10-13:30**

THE CRYSTALS FOR WAVELENGTH CONVERSION OF FIBER LASER LIGHT BASED ON MgO DOPED LITHIUM NIOBATE WITH PERIODIC DOMAIN STRUCTURE

V.Shur, I.Baturin; Labfer Ltd.; Russia

Production and application of the periodically poled MgO:LN crystals for effective second harmonic generation of the laser light have been demonstrated. The conversion efficiency up to 70% and average power of conversed irradiation up to 10W have been achieved for out of cavity conversion of pulse fiber laser (about 20% - for CW).

- Lunch & Posters Session -

TuSY1-1.12 **15:00-15:20**

SELF-HETERODYNING OF BACKSCATTERED RADIATION IN SINGLE MODE MULTIFREQUENCY ER^{3+} FIBER LASER: PROSPECTS FOR LASER SURGERY AND MATERIAL PROCESSING.

A. Konovalov, A. Dmitriev, V. Ul'yanov; Inst. on Laser and Information Technologies RAS; Russia

In this work self-heterodyning effect in single mode ER3+ fiber laser (wavelength 1.56 μm, output power up to 5W) was theoretically and experimentally investigated.

TuSY1-1.13 **15:20-15:45**

PROGRESS IN CR^{2+} AND FE^{2+} DOPED II-VI MID-IR MATERIALS AND LASERS

S.Mirov[1,2], V.Fedorov[1,2], D.Martyshkin[1,2], I.Moskalev[2], S. Vasilyev[2], M.Mirov[2], V. Gapontsev[3]; 1-Univ. of Alabama at Birmingham, 2-IPG Photonics Mid-IR Lasers, 3-IPG Photonics Corp.; United States

Recent progress in fabrication and mid-IR lasing of transition metal doped II-VI thermo-diffusion doped polycrystalline ceramic gain media as well as nano and micro-crystalline laser active powders, powders in the liquid suspension, polymer-film, thin film waveguides and chalcogenides glass composites is reported.

TuSY1-1.14 **15:45-16:05**

NEW GENERATION OF HIGH POWER GREEN FIBER LASER

Y.Grapov, V.Gapontsev, A.Avdokhin; IPG Photonics Corp.; United States

170W of continuous wave, single mode single frequency green fiber laser. Results obtained using IPG pump source - high power single frequency linearly polarized Ytterbium fiber laser. External SHG conversion resonator base on pump enhancing technology.

TuSY1-1.15 **16:05-16:30**

BEYOND EXPECTATIONS - THE SIASUN LASER TECHNOLOGY APPLICATIONS AND LASER PRODUCTS IN CHINA

F. Xing; Shanghai SIASUN Robot & Automation Co., Ltd.; China

SIASUN Robot & Automation has formed four major leading industries: advanced manufacturing equipment, rail transit automation, energy equipment and advanced robot industries. We will report on the laser technology department developments including laser welding, tailor welding, laser heat treatment, laser re-manufacturing, remote laser welding systems, laser hybrid and braze welding, and plastic welding.

Session 2a: Cutting and Welding With kW Fiber Lasers

TuSY1-2a.1 **16:05-16:30**

CUTTING WITH HIGH POWER FIBER LASERS

B. Kessler, K.Klinker, M.Grupp; IPG Laser GmbH; Germany

After several years of development it shows that the fiber laser is an ideal source for 2D and 3D laser cutting. The advantage of the shorter wavelength at 1070nm compared to longer wavelength of CO2-laser at 10600nm is obvious at thinner material cutting. The recent progress shows that in case of equal laser power the fiber laser is superior to CO2-laser in the full range of thickness from 1-20mm. Latest developments in high power cutting heads and special nozzle designs are resulting in perfect cuts with 4 kW laserpower in the thickness range of 30-40mm with oxygen supported laser cutting process.

- Coffee Break & Poster Session -

TuSY1-2a.2 **17:25-17:50**

LATEST DEVELOPMENTS IN LASER HYBRID GAS SHIELDED METAL ARC WELDING: HIGH-PERFORMANCE PROCESSES FOR JOINING HIGH-STRENGTH STEELS OF GREATER WALL THICKNESS AND SINGLE-SIDED FULL PENETRATION WELDING OF BULB BAR PROFILES

H.Staufer, C.Kammerhuber, S.Egerland, Fronius International GmbH, Germany

Being one of the most welding-intensive sectors, shipbuilding strives for reducing costs, by increasing manufacturing precision. The Laser Gas Metal Arc hybrid welding with over 10kW power lasers provides technological benefits to achieve single side full penetration joining of bulb bar profiles at high welding speeds.

TuSY1-2a.3 **17:50-18:15**

MISCROPROCESSING WITH QCW FIBER LASERS

T. Westphaeling; IPG Laser GmbH; Germany

Presentation about industrial applications of users that replaced flashlamp pumped Nd: YAG lasers by more cost effective, more compact and more reliable QCW fiber lasers.

TuSY1-2a.4 **18:15-18:40**

HANS LASER: APPLICATIONS OF HIGH POWER FIBER LASERS

F. Chen; Hans Laser; China

Company introduction, fiber laser applications in cutting field, fiber laser applications in welding field.

TuSY1-2a.4 **18:40-19:05**

THE SPECTRUM OF TEMPERATURE PULSATIONS OF THE MELT IN GAS-ASSISTED CUTTING WITH FIBER LASER

Y. Zavalov, A. Dubrov, V. Dubrov, A. Gryzev, N. Grezev; Inst. on Laser and Information Technologies RAS; Russia

Measurements of the temperature behavior in zone of action of the laser- radiation on the molten metal have been performed. The results are reported for different speed values of cutting of 3 mm mild-steel plate with high-power fiber laser; oxygen was used as an assisted gas. The spectrum of capillary waves on the melt's surface is formed under the effect of assisted gas jet and has a function of ω^-3, ω is cycle frequency.

Session 2b: Cutting and Welding With kW Fiber Lasers

WeSY1-2b.1 **09:00-09:25**

LASER WOBBLING WELDING TECHNIQUE

F. Salina; IPG Photonics (Italy);

Industrial market is requiring more and more advanced welding technology for continuing high productivity, low thermal input and good gap tolerances. In several cases, laser wobbling welding technique is the natural answer. The wobbling solution investigated here presents benefits if compared to traditional linear wobbling. A new welding tool is presented, for creating high quality joints characterized by smooth and clean surface even for complex process paths.

WeSY1-2b.2 **09:25-09:50**

DEVELOPMENT OF TECHNOLOGY FOR POWERFUL FIBER LASER WELDING FOR ITER APPLICATIONS

V. Mirgorodsky, A.Lapin, A.Makhankov, S.Mazaev, S.Natochev; Efremov Scientific Research Inst. of Electrophysical Apparatus (NIIEFA); Russia

ITER is the international project in the framework of which the world's largest and most advanced experimental fusion reactor Tokamak is currently being built at Cadarache in the South of France. NIIEFA participates in the ITER project and have developed technologies of laser welding, orbital and TIG welding for ITER components. The quality of the welded joints complies with the ISO standards.

WeSY1-2b.3 **09:50-10:15**

VAPOUR-PLASMA PLUME AND ITS INFLUENCE ON LASER RADIATION DURING HIGH POWER FIBER LASER WELDING OF MATERIALS

P. Shcheglov[1,2,3], A. Gumenyuk[1], M. Rethmeier[1], V. Petrovskiy[2]; 1-Bundesanstalt fuer Materialforschung und -pruefung (BAM), Germany, 2-National Research Nuclear Univ. "MEPhI", Russia, 3-BAM Federal Inst. for Materials Research and Testing, Germany;

The talk describes the structure and parameters of welding plume induced by high-power fiber laser metal welding. Attention paid to measurement of plasma parameters, to demonstration of metal vapour condensation effect and to estimation of the influence of small condensed metal particles on laser beam.

WeSY1-2b.4 **10:15-10:40**

LASER WELDING FOR CU-AL ELECTRODE OF LI-ION BATTERY

Y. Han[1], J. Park[1], S. Oh[1], B. Kim[2], B. Kam[2], 1-IPG Photonics (Korea) Ltd., Daejeon, South Korea, 2-MDI Technology, Ulsan, South Korea

The using of aluminum and its alloys receives wide spread in an industry. We inform about results of automated laser-arc welding of aluminum-magnesium alloys AlMg3 and AlMg4.5 with powder fluxes feed.

WeSY1-2b.5 **10:40-11:05**

THE EXPERIENCE IN THE DEVELOPMENT AND APPLICATION OF LASER PROCESSING EQUIPMENT BASED ON IPG HIGH POWER FIBER LASERS FOR WELDING OR STEELS AND ALLOYS

A. Ignatov, S. Foteev, A. Streltsov, B. Afanasiev, A. Novinsky, S. Uspenskiy, V. Shtamm, NTO IRE-Polus, Fryazino, Moscow Region, Russian Federation

The results of the development and implementation of equipment and technology laser welding of IPG high power fiber lasers for the production of industrial applications. We used radiation power from overhead lines: 2, 5, 10, 15 and 30kW. The works were carried in MiFi (Moscow, Russia) and LRNWC & Efremov Institute (St. Petersburg, Russia) and IPG Laser GmbH (Burbach, Germany).

- Coffee Break & Posters Session -

Session 3: Fiber Laser Cladding, Sintering, Heat Treatment, Marking and Engraving

WeSY1-3.1 **11:35-12:00**

SUPERSONIC LASER DEPOSITION OF HARD FACING MATERIALS

W. O'Neill; Univ. of Cambridge; United Kingdom

We present the latest developments of the deposition of metals including Ti, Al, Incone and Stellite coatings on steel and aluminium substrates using supersonic powder streams and impact site fiber laser heating. Metallic deposits are obtained without the need for exceeding the melting point of the deposit or substrate leading to enhanced characteristics compared to traditional deposition methods. Experimental approach is presented along with the general characteristics of coatings, including a discussion of novel applications for wear resistance.

WeSY1-3.2 **12:00-12:25**

LASER CLADDING WITH HIGH POWER - A REVIEW OF THE TRILASER PROJECT

J. Tuominen[1], J. Näkki[1,2], H.Pajukoski [1], T.Peltola[2], P.Vuoristo[1]; 1-Tampere Univ. of Technology, 2-Technology Centre Ketek Ltd.; Finland

Advances in laser technology have resulted in increasingly powerful lasers. This presentation introduces their performance in cladding at power levels up to 15kW.

WeSY1-3.3 **12:25-12:50**

NEW APPLICATIONS OF PULSED FIBER LASERS FOR MARKING, ENGRAVING AND CUTTING OF METALS

S. Gorny, K. Yudin, M. Patrov, "Laser Center", St. Petersburg, Russian Federation

We discuss new applications of pulsed fiber lasers in a wide range of technological fields. This includes 3D imaging in metal surfaces, and possible applications of the results obtained in practical marking applications, 3D engraving and cutting of various metals and alloys, as well as metal ceramics and semiconductors. Examples of effective use of pulsed fiber lasers in different industries will be presented.

WeSY1-3.4 **12:50-13:10**

LASER ABLATION AND SYNTHESIS OF NANOPARTICLES OF YTTRIUM OXIDE BY HIGH POWER FIBER LASER

V.V. Osipov, V.V. Lisenkov, V.V. Platonov; Inst. of Electrophysics UD RAS; Russia

We present the results of research on the refractory oxide nanopowders production by laser ablation method with use of Ytterbium fiber.

Session 4a: Life Sciences, Medical, Agricultural and Special Applications of Fiber Lasers

WeSY1-4a.1 **13:10-13:35**

HIGH POWER FIBER LASERS FOR SPECIAL APPLICATIONS

A. Graf; Rheinmetall Waffe Munition GmbH; Germany

A fiber laser based mobile system for humanitarian mine and UXO clearing will be presented. From the basic requirements of mine and UXO cleaning the parameters for the laser source and the mobile platform will be derived. Based on the parameters the system concept including the cooling and power supply will be explained. The contribution will also show first experiments of UXO clearing.

- Lunch Break-

WeSY1-4a.2 **15:00-15:25**

POTENTIAL POSSIBILITIES OF MODERN LASER TECHNOLOGIES IN MEDICAL ENSURING SPORTS OF THE HIGHEST

V. Minaev; NTO IRE-Polus; Russia

Low-invasive simultaneous surgical treatment with use of lasers allows to solve a problem of nasal breath normalization, which is actual for athletes. Medical laser technology allows treatments of the aftermath of strenuous physical activity injuries such as diseases of intervertebral cartilage, osteomyelithis, non-union of fractures, problems with cartilages and joint ligaments, and varicosity. In the majority of cases treatment can be conducted on the outpatient basis or in an office clinic environment.

WeSY1-4a.3 **15:25-15:50**

FIBER 1.56-1.9 µm LASERS IN TREATMENT OF VASCULAR TUMORS AND MALFORMATIONS IN CHILDREN AND ADULTS

A. Lappa[1], I. Abushkin[2], V.Privalov[2], V. Minaev[3]; 1-Medical Physics Center at the Chelyabinsk State Medical Academy and Chelyabinsk State Univ., 2-Photomed Ltd., 3-NTO IRE-Polus; Russia

Two fiber lasers, 1.56 and 1.9 µm, were applied to treatment of more than 300 patients (children - 90%) with hemangiomas, lymphangiomas, and vascular malformations. Excellent and good results have been achieved in coagulation of venous and venous-arterial malformations with the 1.56 µm laser, and in excision of angioneoplasms and ablation of lymphangiomas with the 1.9 µm laser.

WeSY1-4a.4 **15:50-16:15**

LASER-INDUCED HYDRODYNAMICS IN WATER AND BIOTISSUES NEARBY OPTICAL FIBER TIP

V. Bagratashvili[1], V.Yusupov[2], V.Chudnovskii[2]; 1-Inst. of Laser and Information Technologies RAS, 2-Il'ichev Pacific Oceanological Inst.; Russia

We present research on hydrodynamic effects ,induced by a medium power (1-5W) laser radiation in the vicinity of the heated fiber tip surface in water and water-saturated tissues.

WeSY1-4a.5 **16:15-16:45**

SUTURELESS HEMORRHOIDECTOMY WITH THULIUM FIBER LASERS.

A. Lappa[1], V. Privalov[2], A. Dryga[2], I. Krochek[2], V. Minaev[3]; 1-Interacademic Medical and Physics Center at the Chelyabinsk State Medical Acad. and Chelyabinsk State Univ., 2-Photomed Ltd., 3-NTO IRE-Polus; Russia

A new surgical low invasive technology for treatment of 3-4 stage sof haemorrhoids with fiber Thulium laser (1.9 µm wavelength), and results of its application to more than 100 patients presented in this work.

WeSY1-4a.6 **16:45-17:00**

RESULTS OF LASER TRANSMIOCARDIAL REVASCULARIZATION BY DIODE AND FIBER LASERS WITH DIFFERENT WAVELENGTHS (EXPERIMENT.

V. Kozlov, L.Bockeria, Z.Mahaldiani; Bakoulev Scientific Center for Cardiovascular Surgery RAMS; Russia

Results of preliminary experiment, in which by means of fiber and diode laser devices LSP-"IRE-Polus" with wavelengths of 0.97; 1.56 and 1.9 µm perforations of a myocardium of not purebred dogs was performed. CW radiation with output power of 12W was used. The purpose of channels formation was to stimulate revascularization in a myocardium for improvement of its blood supply.

- Coffee Break -

Thursday, June 28

Session 5: Fiber Lasers for Automotive and Aerospace Applications

ThSY1-5.1 **09:00-09:30**

APPLICATION AND ADVANTAGES OF FIBER LASER TECHNOLOGY IN THE AUTOMOTIVE AND AEROSPACE INDUSTRIES

W. Shiner; IPG Photonics Corp.; United States

Successful applications will be discussed pointing out the performance, cost and technical advantages that fiber lasers bring to the manufacturing environment. Unique attributes of high power CW and QCW lasers will be presented along with examples of their acceptance on the production line.

ThSY1-5.2 **09:30-10:00**

FIBER LASERS FOR AUTOMOTIVE HSS CUTTING - A BRIGHT PERSPECTIVE

M. Gattiglio; Prima Industrie S.p.A.; Italy

Author is presenting the last technological trend on automotive high strength steel cutting with tri-dimentional laser systems with high power fiber lasers.

ThSY1-5.3 **10:00-10:25**

SECOND GENERATION OF LASER SEAM STEPPER (LSS-2)

A.Ferin, E.Shcherbakov, V.Fomin, A.Abramov, A.Starovoytov, A.Dronov, A.Shemet, S.Volkov, A.Fuchs; IPG Laser GmbH; IPG Laser GmbH; Germany

The second generation LSS-2 provides the laser safety class 1 that allows operation in open areas without any laser cells. Welding with LSS-2 has numerous advantages over resistance spot welding: doubled process speed, enhanced seam stiffness and reduced flanges. Novel, lightweight design allows installation of LSS-2 with small robots (payload up to 50kg).

ThSY1-5.4 **10:25-10:50**

DIFFERENT MONITORING SOLUTIONS IN LASER MATERIAL PROCESSING WITH HIGH POWER FIBER LASERS

B. Previtali, D. Colombo, B. Valsecchi, Politecnio di Milano, Mechanical Engineering Department, Milan, Italy

The paper presents the most recent results of a research activities aimed at investigating the potentialities of innovative and traditional monitoring solutions applied to the laser welding and cladding processes with fiber laser sources. In particular the monitoring of the gap during remote laser welding in the automotive and the monitoring of the entire life of the protective glass of the cladding head during laser of moulds and die are illustrated.

- Coffee Break -

ThSY1-5.5 **11:20-11:45**

THE MODULAR CONCEPT OF CONSTRUCTION OF SYSTEMS OF LASER PROCESSING OF MATERIALS

V. V. Zharsky; Ruhservomotor LLC; Belarus

The report proposed to consider a variant of the choice of optical, electromechanical and software and hardware components of the laser equipment by minimizing both the mechanical and electrical interfaces and information exchange protocols.

Session 4b: Life Sciences, Medical, Agricultural, and Special Applications of Fiber Lasers

ThSY1-4b.1 **11:45-12:15**

COMPARISON OF CONTINUOUS WAVE AND PULSED IR LASER INTERACTION IN TISSUE USING HIGH SPEED THERMAL IMAGING FOR THE OPTIMIZATION OF VARIOUS CLINICAL APPLICATIONS

R. Verdaasdonk[1], V. Lemberg[2]; 1-VU University Medical Center, The Netherlands, 2-Optomix, USA;

A large range of infrared laser wavelengths (Diode, Thulium, Erbium, CO2) are available for medial treatments. Depending on the required tissue effect, energy, pulse length and delivery device (spot size) can be optimized for application in e.g. ENT, urology, neurosurgery and dentistry.

ThSY1-4b.2 **12:15-12:40**

DYNAMICS OF BLOOD OPTICAL PROPERTIES DURING LASER HEATING WITH 1.56 AND 1.68 MICRONS

K. Zhilin[1], V. Minaev [1], A. Sviridov[2], A.Uzhakov[2]; 1-NTO IRE-Polus, 2-Inst. of Laser and Information Technologies RAS; Russia

This work is devoted to study of optical properties of whole (hct=45%) blood for wavelengths 1.56 and 1.68 μm. The description of experimental setup and methodology of measurements are provided. Absorption and scattering coefficients defined by inverse Monte-Carlo method.

ThSY1-4b.3 **12:40-13:05**

NONABLATING CORRECTION OF REFRACTIVE SIGHT DISORDERS IN CHILDREN. A PROSPECT OF USING FIBER LASERS.

E.Sidorenko[1], V.Minaev[2]; 1-Scientific Center of Medical Care to Children with Developmental Anomalies of Craniofacial Area and Congenital Diseases of the Nervous System, DZO of Moscow, 2-NTO IRE-Polus; Russia

Possibility of treatment of a congenital mismatch of optical force of eyes of a child is considered by non-ablative laser thermokeratoplasty. The mismatch over certain amount can not be compensated by the brain. In this case the brain disregards one of eyes which leads to its degradation. The carried-out research with device "OKO-1" based on a Ho:YAG laser (2.1 μm) proved the efficiency of the method. However lasers with lamp pumping are bulky, insufficiently reliable and not convenient at work. Device study for realization of this method employing thulium fiber lasers (1.9 ... 2.1 μm) is presented and treatment of children is executed.

ThSY1-4b.4 **13:05-13:30**

ROOT CANAL TREATMENT WITH YSGG AND ER:YAG LASERS IN CARBONATED LIQUID ENVIRONMENT

V. Lemberg [1], R. Verdaasdonk[2], A. Van der Veen[2], D.Boutoussov[1]; 1-Biolase Technology, Inc., USA, 2-VU Univ. Medical Center, The Netherlands

YSGG and Er: YAG pulsed lasers have shown to be effective for the root canal treatment. High water absorbtion of these laser wavelengths within the root canal result in effective cleaning and sterilization mechanism. We study various conditions regarding laser parameters and fiber tips to optimise settings for root canal treatment. The experiments were performed in a transparent root canal model with a tapered and curved canal ending in small opening at the side resembling the apex.

- Lunch Break-

ThSY1-4b.5 **15:00-15:25**

INVESTIGATIONS INTO THE USAGE OF DIFFERENT LASER SYSTEMS FOR WEED CONTROL

C. Marx[1,2], M. Hustedt[1], S.Kaierle[1], T.Rath[2], H.Haferkamp[1]; 1-Laser Zentrum Hannover e.V., 2-Leibniz Universitaet Hannover; Germany

Weed control is important for food production. As alternative to herbicide application, the laser combined with sophisitacted image processing and beam steering can be used.

ThSY1-4b.6 **15:25-15:50**

MOBILE LASER TECHNOLOGICAL COMPLEXES BASED ON FIBER-OPTICAL LASERS

A. Krasukov, S.Durmanov, V.Cherkovetgs; Troitsk Inst. for Innovation and Fusion Research; Troitsk Inst. for Innovation and Fusion Research; Russia

A mobile, fast deployment of MLTK-20 complex is reported which consists of three units with the 8 kW fiber laser each and a block-container with the three-channel formatting telescope with systems of pointing, positioning and control. Cutting metal objects at 20-70m distance is possible to stop burning of oil and gas fountains in high smoke and temperature conditions.

ThSY1-4b.7 **15:50-16:15**

LASER TECHNOLOGIES OF SURGICAL CORRECTION OF THE AESTHETICAL AND FUNCTIONAL NOSE PROBLEMS

S.Ageeva[1], V.Eliseenko[1], I.Petrov[2], V.Minaev[3]; 1-State Scientific Center of Laser Medicine, 2-Moscow Center of the Cosmetic Correction "EKLAN", 3-IRE-Polus Ltd.; Russia

Results of surgical treatment of patients with violation of nasal breath, physical and esthetic deformation of a nose are described. During surgical interventions we used single- (970nm) and dual-wavelength (970nm & 1.56 μm) lasers. 1-2 days hospitalization was required with a subsequent aftercare of 7-15 days and supervision from a half to 7 years. 89.3% of patients showed good functional and esthetic results, 10.7% - satisfactory results. Small specific complications were eliminated by a laser surgical treatment in the conditions of office clinic.

ThSY1-4b.8 **16:15-16:40**

LASER METHODS OF SURGICAL TREATMENT OF PROSTATE HYPERPLASIA OF THE PROSTATIC GLAND AND THEIR DEVICE REALIZATION

A.Z.Vinarov[1], V.P. Minayev[2]; 1-R&D Inst. of Uronefrologiya and Reproductive Health of the 1-st MGMU of I.M.Sechenov, 2-IRE-Polus Ltd.; Russia

Earlier work on BPH treatment by laser vaporization with Ho:YAG: (2.09μm, 60 W) confirmed advantages of the laser technology due to blood loss reduction, operational traumas, pain and hospitalization time reduction. Introduction of these methods in the health care requires domestic medical equipment. We consider industrial IPG lasers at 970nm (diode) and 1.9μm (Tm). Comparative research of the two wavelengths for optimal treatment is described.

16:40

SYMPOSIUM CLOSING WORDS.

Tuesday, June 26

Poster Session

TuSY1-p1

LOW-COST ALL FIBER COMBINER FOR HIGH POWER FIBER LASER

S. Hann[1], Y.-E. Im[1], Yu. H. Kim[1], S.-J. Kim[2], S. Y. Cho[2], B. H. Kim3; 1-Korea Photonics Technology Inst., 2-LS Tech Co., 3-Gwangju Inst. of Science and Technology; South Korea

We proposed and demonstrated the all fiber combiner using a low-cost fiber fused machine. We can apply and deploy the combiner with above at 93% throughput efficiency.

TuSY1-p2

ALL-NORMAL DISPERSION Yb-DOPED ULTRAFAST FIBER LASER AT 1067 nm

A. Borodkin3, D. Khudyakov[1], A. Lobach[2], S. Vartapetov3; 1-Optosystems Ltd., 2-Inst. of Problems of Chemical Physics RAS, 3-Physics Instrumentation Center of Prokhorov General Physics Inst.; Russia

Construction of an all-fiber Yb-doped oscillator generating hardly chirped pulses with duration of 12 ps and up to 10 nJ pulse energy at wavelength 1067 nm with pulse repetition rate 16.7 MHz is proposed. To provide self-starting and passive mode locking in the laser an in-fiber saturable absorber based on polymer composite film with single wall carbon nanotubes (SWNTs) is used.

TuSY1-p3

EXPERIMENTAL MEASUREMENT AND THEORETICAL MODELING OF EQUIVALENT TEMPERATE OF NONLINEAR-OPTICAL CRYSTALS BY LASER RADIATION

O. A. Ryabushkin[1,2], D.V. Myasnikov[1,2]; 1-NTO IRE-Polus, 2-Moscow Inst. of Physics and Technology; Russia

Method and resonant ultrasound spectroscopy is applied to measure temperature of the piezoelectric crystals interacting with high-power lasaer radiation. Piezoelectric resonance frequency shift under action of laser radiation in most cases is directly related to true volume-averaged crystal temperature, which we call equivalent temperature. Theoretical model proposed validates correctness of the crystal equivalent temperature conception.

TuSY1-p4

PIEZOELECTRIC RESONATOR FOR LASER POWER MEASUREMENT WITH BEAM QUALITY RETAINING

O. A. Ryabushkin[1,2], A. V. Konyashkin[1,2], V. A. Tyrtyshnyy[1], V. Halaburdin[1,2]; 1-NTO IRE-Polus, 2-Moscow Inst. of Physics and Technology; Russia

Quartz crystal piezoelectric resonator is used for laser power measurement of high-power Yb-doped fiber laser. Laser power of the radiation transmitted through the crystal is directly determined from the crystal piezoelectric resonance frequency shift in respect to frequency at zero power using calibration dependences of resonance frequency on temperature and laser power Such piezoelectric resonator has advantage of measuring power without spoiling beam quality of laser radiation.

TuSY1-p5

1MW PEAK POWER Yb FIBER AMPLIFIER

D.V. Myasnikov, A.I. Baranov, I.E. Samartsev; NTO IRE-Polus; Russia

We report on a single-mode MW-level peak fiber amplifier pumped by a high power single-mode Nd fiber laser operating at 920nm. The amplifier is Yb-doped fiber taper spliced to a single-mode fiber at the thin end. Picosecond and sub-nanosecond pulses with 1MW peak power at 1020 nm were obtained. Theoretical model of the amplifier is considered.

TuSY1-p6

PIEZORESONANCE SPECTROSCOPY OF NONLINEAR-OPTICAL CONVERSION OF LASER READIATION IN CRYSTALS

O. A. Ryabushkin[1,2], D.V. Myasnikov[1], A. V. Konyashkin[1], V. A. Tyrtyshnyy[1]; 1-NTO IRE-Polus, 2-Kotelnikov Inst. of Radio-engineering and Electronics RAS; Russia

Most crystals applied for nonlinear-optical conversion possess piezoelectric properties. Crystal temperature precise determination and control during nonlinear-optical conversion of the laser radiation is provided by measurement of the crystal equivalent temperature. In presence of the pump and converted-radiation powers equivalent temperature of the crystal is determined directly from its piezoelectric resonance frequency shift.

TuSY1-p7

OPTIMIZATION OF HYBRID FEMTOSECOND Er/Yb FIBER LASER

A. I. Baranov, D. V. Myasnikov, D. A. Oulianov; NTO IRE-Polus; Russia

Different regimes of ultrafast all-fiber source at 1 μm consisted of passively mode-locked Er fiber oscillator, Er amplifier, dispersion shifted fiber wavelength converter and Yb fiber amplifier were studied theoretically and experimentally. Er fiber oscillator was passively mode-locked through nonlinear polarization rotation. The optimum set of parameters of Er oscillator, Er amplifier and wavelength converter was selected to maximize 1 μm output.

TuSY1-p8

POLARIZATION PROPERTIES OF SUPERCONTINUUM FIBER SOURCE

A. V. Doronkin, M. A. Bukharin, P. A. Panas, D. A. Oulianov; NTO IRE-Polus; Russia

Polarization properties of optical supercontinuum generated in isotropic and polarization maintaining PCF were investigated down to 450 nm wavelength. Spectral dependence of temporal power stability in two polarization states of generated supercontinuum was investigated. The degree of residual polarization of generated supercontinuum was measured for pumping with either depolarized or randomly polarized laser radiation.

TuSY1-p9

EXCITATION OF HIGH ORDER MODES IN POLARIZATION MAINTAINING FIBER AMPLIFIER

O. I. Vershinin, V. A. Tyrtyshnyy; NTO IRE-Polus; Russia

In narrow bandwidth polarization maintaining fiber amplifiers threshold of mode instability is observed. Instability is caused by excitation of higher order modes in large mode area fibers and results in output power decrease and beam quality degradation. Dependence of instability threshold on input radiation parameters, pump direction and length of active fiber is observed together with influence of auxiliary oppositely directed radiation power and wavelength.

TuSY1-p10

MECHANISM OF PPLN CRYSTAL DEGRADATION DURING SECOND HARMONIC GENERATION AT 532 NM

O. I. Vershinin[1], E.S. Manuelovich[2], A.V. Doronkin[1], P.A. Panas[1], S.V. Larin[1]; 1-NTO IRE-Polus, 2-Moscow Inst. of Physics and Technology; Russia

Second harmonic generation at 532 nm in PPLN crystal was investigated. 1.65 W of green light with efficiency 45% was obtained in 10 mm-long MgO:PPLN. Further increase in pump power led to crystal destruction. Mechanisms and causes of this effect were investigated. The influence of green-induced infrared absorption (GRIIRA) was researched by a photothermal absorption measurement technique. Effect of photorefraction was estimated.

TuSY1-p11

SECOND HARMONIC GENERATION AT 589 nm IN MgO:PPLN CRYSTAL PUMPED BY ALL-FIBER RAMAN LASER

A.A. Surin[1,2], S.V. Larin[1]; 1-NTO IRE-Polus, 2-Moscow Inst. of Physics and Technology; Russia

A single-mode, linearly polarized, 1070 nm ytterbium fiber laser was applied to pumping of a short-length fiber, polarization-maintaining Raman cavity, resulting in a 0.08 nm linewidth, 25 W CW source at 1178 nm. Efficient, single-pass frequency doubling of the Raman source in MgO doped PPLN crystal was performed resulting in 6 W CW output power at 589 nm. With this approach watt-level second harmonic generation can be achieved at any desired wavelength in the range from 560 nm to 690 nm.

TuSY1-p12

PASSIVELY Q-SWITCHED TM FIBER LASER

V.E. Sypin[1,2], S.V. Larin[1]; 1-NTO IRE-Polus, 2-Moscow Inst. of Physics and Technology; Russia

Tm-doped silica fiber laser implementing passively Q-switched mode is introduced. Cr2+:ZnSe was used as a saturable absorber. Measurement of the saturable absorber bleaching is presented and pulse parameters are estimated. Laser operates at 1940 nm wavelength and generates pulses with 1.1 μs duration, 100 kHz repetition rate (duty cycle 1:10).

Tuesday, June 26

Poster Session

TuSY1-p13

RADIOFREQUENCY SPECTOSCOPY METHOD OF TEMPERATURE MEASUREMENTS IN ACTIVE FIBER

O. A. Ryabushkin[1,2], R.I. Shaidullin[1,2]; 1-NTO IRE-Polus, 2-Moscow Inst. of Physics and Technology; Russia

In this paper a new method of temperature measurement in the protective polymer jacket of active fiber is introduced. Measuring polymer dielectric constant change in radio-frequency domain allows us to determine polymer heating. In combination with Mach-Zehnder interferometric method of temperature measurement in the fiber core we can obtain temperature distribution in the fiber cross-section.

TuSY1-p15

LASER TECHNOLOGY FOR TREAD HARDENING OF A PIPE

A.A. Kishslov, M.V. Volkov.; NPP VOLO Ltd; Russia

The main goal of this work is developing of thread hardening technology using laser irradiation, for increasing durability of tubing thread. Feature of the thread surface hardening is that tread surface has a difficult form with teeth and cavities. Thickness of the hardened layer on the teeth should be maximal to ensure the better durability. Thickness of the hardened layer in the cavities should be minimal to protect thread from cracking. Problem of forming this kind of hardened layer is solved in this work.

2nd International Symposium on Light in Conservation of Artworks

(L'ICONA 2012)

June 26-27, 2012

Co-chairs

M. Martini

Universita' di Milano-Bicocca, Italy

V. Parfenov

St.Petersburg State Electrotechnical University, Russia

Organizers

Fund for Laser Physics
St. Petersburg, Russia

Institute for Laser Physics of the Corporation "S.I.Vavilov State Optical Institute"
St. Petersburg, Russia

St.Petersburg State Electrotechnical University
Russia

Union of Restorers of St.Petersburg
Russia

Tuesday, June 26

10:30-11:00 Opening remarks

Session 1: Analysis and diagnostics of artworks 1

TuSY2-**01 Invited** **11:00-11:40**

SCANNING MULTI-SPECTRAL INFRARED REFLECTOGRAPHY UNVEILS NEW SECRETS OF OLD MASTERS

L. Pezzati, R. Fontana, M. Barucci; Istituto Nazionale di Ottica - INO CNR; Italy

Scanning multi-spectral infrared reflectography (SMIRR) is a new diagnostic tool for painting analysis developed at INO CNR in the framework of the project EU-Artech. Due to its enhanced visibility, SMIRR is helping to solve old problems of art history, like the use of the underdrawing by Caravaggio.

TuSY2-**02 Invited** **11:40-12:20**

LUMINESCENCE DATING: RECENT RESULTS AND NEW PERSPECTIVES IN THE STUDY OF GLASS MOSAICS

A. Galli[1,2], M. Martini[2,3], E. Sibilia[2,3]; 1-CNR-IFN, Istituto di Fotonica e Nanotecnologie Dipartimento di Scienza dei Materiali, 2-Universita degli Studi di Milano-Bicocca, 3-INFN; Italy

Crystalline inclusions (quartz and feldspars, principally) contained in ceramics act as thermoluminescence (TL) dosimeters, the irradiation source being the natural radiation environment. On this grounds various ceramic materials (pottery, bricks, cooked clays, bronze clay-cores) have been dated by TL. Similarly, Optically Stimulated Luminescence (OSL) has been exploited in more recent applications where light instead of heat detraps electrons previously excited by the ionising radiation. In principle, luminescence Dating, both TL and OSL, should apply also to glass materials. The lack of crystallization and the transparency which causes optical bleaching are the main drawbacks to the application of Luminescence Dating to glasses. During the last decade we have been studying the feasibility of Luminescence Dating to a particular kind of glass, i.e. mosaic glass tesserae. Glass mosaics are often considered to be the most outstanding and elaborate form of mural and floor decoration in antiquity. The production technology for mosaic glass was different and more complex than for transparent glass, due to the need for additives to the basic mixture of coloring and opacifying components. Different compounds were used through the centuries to make opaque glass, namely antimony –based opacifiers (yellow lead antimoniates and white calcium antimoniate), tin-based opacifiers. In some cases also quartz was intentionally added in order to increase the light scattering, acting as opacifier. Recent results gave evidence that the dosimetric properties of mosaic glasses depend on the presence of microcrystals in the silica network, confirming the dependence of TL sensitivity on the crystallinity degree of the glass. Using specific techniques typical of the analysis of TL glow curves, like the "initial rise" following series of "partial cleanings" it has been possible to distinguish the TL emission due to the vitreous base of the tesserae from the emission given by crystalline micro-inclusions. Various samples have been analysed through their TL glow-curves and emission spectra and OSL signal. TL protocols have been developed to test the sensitivity and the sensitivity changes, the optical bleaching and the signal regeneration by sunlight. Problems arisen in correctly calculating the archaeological dose are still to be solved, due to difficulties in separating the signal of the vitreous component, strongly affected by anomalous fading, from the dosimetric component due to the crystalline micro-inclusions.

TuSY2-**03 Invited** **12:20-13:00**

THE JOINED USE OF XRF AND VISIBLE REFLECTANCE SPECTROMETRY AS A PRELIMINARY QUICK AND VERSATILE ANALYSIS FOR PIGMENTS, INKS AND DYES IN SITU. A REVIEW OF APPLICATIONS

G. Poldi; Univ. degli Studi di Bergamo; Italy

X-Ray Fluorescence (XRF) is one of the most known and used analytical methods to study works of art, in particular polychromous ones. Among its advantages, it grants non-invasive exams and the possibility to perform in-situ measurements, its drawbacks consist mainly in the difficulty or impossibility to study light elements in situ (below Al, generally), in the fact that the same elements can sometimes be associated to many different pigments, in the difficulty or impossibility to know to which layer/depth the pigment belongs. The associated use of some other technique, possibly based on molecular spectroscopy, can allow a proper characterization of the material: among these techniques, Reflectance Spectroscopy (RS) in the visible (vis-RS), or infrared or ultraviolet range represents a simple tool that can be applied without great limitations to many objects and contexts, giving important information on surface materials also when vibrational techniques can't assure. The use of both XRF and vis-RS is widely recommended, at least to obtain a first representative screening of a large quantity of colouring materials on easel or mural paintings, on drawings and miniatures, on coloured sculptures, on mosaics and glasses, on textiles, on wooden inlays, on some metals, from antiquity to contemporary era. In this work, the joined use of vis-RS and XRF is briefly discussed, together with a survey among analyses carried out by the author on different kind of objects of artistic interest, in Italy and abroad, in order to show advantages and limits of the method. For some case studies, the necessary extension to other non-invasive or invasive techniques (Raman, FTIR, cross-section exams) is shown.

TuSY2-**05** **14:00-14:20**

LASER INDUCED FLUORESCENCES APPLICATION TO THE ANALYSIS OF CRUST IN MONUMENTS

P. Ortiz[1], R. Ortiz[1], J.M. Martнn[1], F. Colao2, L.Caneve2, R.Fantoni2, M.A. V6zquez3, M.A. Gymez4; 1-Univ. Pablo de Olavide, Department of Physical, Chemical and Natural Systems, Spain; 2-ENEA, Technical Unit Development of Applications of Radiations, Italy; 3-Univ. of Seville, Department of Crystallography, Mineralogy and Q.A., Spain; 4-Andalusian Inst. of Cultural Heritage, Spain;

Abstract is not available.

TuSY2-**05** **14:20-14:40**

RESONANCE MICRO-RAMAN INVESTIGATION OF PIGMENTS IN ENDANGERED AND PRECIOUS CORALS AND IN MARINE SHELLS

L. Bergamonti, S. Mantovan, D. Bersani, P.P. Lottici; Chemistry Department, University and Physics Department, Univ., Parma; Italy

Micro-Raman mapping in resonance conditions give insigth into the polyenic or carotenoid nature of the pigments in corals and shells. Mistures of polyenes with different lengths and simple carotenoids are found. Apparent blue shift of the main stretching C=C and C-C vibrations at 473.1 nm seem due to selective resonance enhancements of shorter chains.

TuSY2-06 **14:40-15:00**

LASER CLEANING OF POLYMERIC AND PAPER MATERIALS

S. Arif, O. Armbruster, V. Ljubic, T. Nagy, W. Kautek; Univ. of Vienna; Austria

Visible 532 nm radiation was employed in order to guarantee minimum substrate interaction and maximum cleaning efficiency. Polymethyl methacrylate, polycarbonate, and polystyrene and cellulose paper served as model substrates whereas graphite powder and PS beads as model contaminant dust. Evaluations were performed by electron microscopy, optical microscopic evaluations of modification areas, a light scattering technique, and laser-induced plasma breakdown spectroscopy.

Session 2: Artworks conservation by laser

TuSY2-07 **15:00-15:20**

LASER CLEANING OF METAL THREADS IN HISTORIC TEXTILE

M.A. Gómez[1], P. Ortiz[2], G. Ferrera[1], L. Fernandez[1], C. Ángel[1], R. Ortiz[2], J.M. Martín[2]; 1-Andalusian Inst. of Cultural Heritage; 2-Univ. Pablo de Olavide, Spain;

Abstract is not available.

TuSY2-08 **15:20-15:40**

STUDY OF THE LASER CLEANING ON PLASTER SCULPTURES. THE EFFECT OF LASER IRRADIATION ON THE SURFACES

D. Fodaro [1], C. Pelosi [2], A. Rubino [1], L. Sforzini 3; 1-Istituto Superiore per la Conservazione e il Restauro; 2-Univ. of Tuscia; 3-Restauro e conservazione; Italy

In this paper the study of the effects caused by laser irradiation on some 19th and 20th century plaster sculptures will be related. Before applying the laser cleaning on the sculptures, it was tested on laboratory samples prepared according both to the results of the analysis carried out on the artifacts and to the instructions of the ancient technical manuals

Session 3: Analysis and diagnostics of artworks 2

WeSY2-09 Invited **10:20-11:00**

THE FLUORESCENCE HYPERSPECTRAL LIDAR FOR THE DIAGNOSTICS AND DOCUMENTATION OF THE CULTURAL HERITAGE

V. Raimondi, G. Cecchi, D. Lognoli, L. Palombi; IFAC-CNR; Italy

The fluorescence hyperspectral lidar is a remote sensing instrumentation used to carry out fluorescence spectroscopy in the outdoor on remote targets. This paper introduces the basics about the technique and focuses on main applications for the diagnostics and documentation of the cultural heritage, such as the characterisation of lithotypes, detection and classification of biodeteriogens, of protective treatments and masonry materials.

WeSY2-10 Invited **11:00-11:40**

3D LASER SCANNER APPLICATION IN DOCUMENTATION OF HERITAGE RISKS: SOME EXPERIENCES, HISTORICAL TOWNS AND MONUMENTS IN ITALY, MALTA AND RUSSIA.

S. Bertocci[1], S. Parrinello2; 1-Univ. of Florence, 2-Univ. of Pavia; Italy

The preparation of the reconstruction plan for Acciano, a small historical Italian town near L'Aquila in Abruzzo region, born from the need to govern the timing of the planned reconstruction process after the earthquake of 6 April 2009 and to provide a s Was identified by the municipal Department of Architecture, Design, History, Design, University of Florence for the conduct of activities in support of the municipal Acciano, in agreement with the STM (Technical Mission Structure), the preparation of the The purpose of the plan is to identify the actions necessary to begin a recovery process of accommodation and safety of the town centres affected by the earthquake, as well as to equip the local municipal structure of regulatory and operational methods t The 3D modeling of the underground archaeological site of roman catacombs of st. Paul in Mdina, Malta, for the singularities of these architectures and the problems that the detection of these places, even in connection with the use of new technologies a The work of the study it's on the Pogost Complex and on the landscape of Kizhi Island, the big UNESCO protected area of the Open Air Museum of Kizhi. The investigations carried out are varied: a framework and analysis of the geographical and political c The proposal for these operations is focused on choosing a type of survey performed by 3D laser scanner for processing three-dimensional media are able to join a high degree of reliability and reduced time for data acquisition. The definition of related diagnostic pictures of the church appears to be a fundamental activity to define concretely the state of deterioration and structural condition of the building.

WeSY2-11 Invited **11:40-12:00**

SAINT PETERSBURG AND ITS ARCHITECT: NON INVASIVE ANALYSES OF THE ARCHITECTURAL AND LANDSCAPE DRAWINGS OF GIACOMO QUARENGHI

G. Poldi; Univ. degli Studi di Bergamo; Italy

Giacomo Quarenghi (Rota d'Imagna, Bergamo 1744 – Saint Petersburg 1817) was the foremost and most prolific practitioner of Palladian architecture in Imperial Russia, particularly in Saint Petersburg. The largest collection of drawings by Giacomo Quarenghi is held in the Angelo Mai public library of Bergamo (Italy): it is made up of about seven hundred sheets, basically divided into seventeen albums, containing architectural designs, landscapes and caprices. About 20 sheets belonging to Angelo Mai library were examined, for the occasion of this Congress, with non invasive techniques, both imaging and spectroscopic ones, i.e. Infrared Reflectography (IRR) and Transmitted IR (TIR), False Colour IR (IRC), UltraViolet Fluorescence (UVF), X-ray Fluorescence (XRF) and Reflectance Spectrometry in the range 360-740 nm (vis-RS) and colorimetry. All the analyses were performed using portable instruments in situ, avoiding the artworks to be carried in a laboratory outside their place of conservation, with the aim to understand the technique and materials (inks and pigments) of both architectural and landscape drawings, to check their conservative conditions and to acquire information possibly useful to assess a chronology to some undated sheets. Besides, the study provided a better knowledge of materials used in 18th-19th century drawings and watercolours, mainly in Russia, in a kind of multi-technique research which is quite unusual. In the presentation, the used analytical techniques are shortly described, and the main results are diffusely shown.

WeSY2-12 **12:00-12:20**

OCT TECHNOLOGY FOR NON-INVASIVE DIAGNOSIS OF ART OBJECTS

E.V. Zhukova, I.P. Gurov; St.Petersburg National Research Univ. of ITMO; Russia

The paper presents the results of materials investigation as well as substances microstructure that are the most important in study of decorative art objects and paintings. The main diagnostic tests were performed using the Michelson Diagnostics EX1301 OCT microscope (United Kindom), which implements the swept-source Fourier-Domain OCT method.

WeSY2-13 **12:20-12:40**

LOCAL MEASUREMENTS OF THE POROSITY OF PAPER SAMPLES WITH FOXINGS USING THE OPTOACOUSTIC METHOD

I.A. Balakhnina[1], N.N. Brandt[1], A.Yu. Chikishev[1], I.M. Pelivanov[1], N.L. Rebrikova2, and Yu.S. Yurchuk[1]; 1-Physics Department and International Laser Center, Lomonosov Moscow State Univ.; 2-State Research Inst. for Restoration; Russia

The optoacoustic method is employed in the study of the porosity of four paper samples with foxings. The theory of the two-phase mixture is used for the calculation of the porosity of paper samples from the measured velocities. The porosity of paper in foxings is greater than the porosity of the foxing-free paper. Vibrational spectra are measured using the ATR-FTIR spectroscopy to prove the structural modifications of paper.

WeSY2-14 **12:40-13:00**

L. Giuntini; Istituto Nazionale di Fisica Nucleare, Sezione di Firenze, Italy; Istituto Nazionale di Fisica Nucleare;

Abstract is not available.

WeSY2-15 **14:00-14:20**

SOLID IMMERSION IMAGING INTERFEROMETRIC NANOSCOPY TO THE LIMITS OF AVAILABLE FREQUENCY SPACE

Yu. Kuznetsova, A. Neumann, S. R. J. Brueck; Univ. of New Mexico; United States

Extension of the resolution limits of Imaging Interferometric Microscopy up to 2nsub/l using a full immersion with both illumination and collection light coupled into the substrate is demonstrated. Algorithm for high frequency image restoration of phase distortions is presented. Use of high index substrate will allow resolution to 50 nm which is comparable with SEM resolution. This technique can be used for artworks investigation.

Wednesday, June 27

Session 4: Case studies and presentation of international projects

WeSY2-16 **14:20-14:40**

LASER CLEANING OF MARBLE SCULPTURES OF THE SUMMER GARDEN IN ST.PETERSBURG

A.Baruzdin[1], O.Ivanov[1], A.Kazanova[1], P.Lazarev[1], V.Parfenov[2], B.Toporkova[1]; 1-State Russian museum, 2-St.Petersburg State Electrotechnical Univ.; State Russian museum; Russia

Laser cleaning of artworks is used at the State Russian museum since 2007. For last 5 years it has been used in conservation of many marble sculptures, most of them are from the collection of Summer Garden. Summer Garden has been found by Peter the Great and now it is the out-door part of the State Russian museum. Its collection of marble sculptures consists of almost 100 masterpieces of XVIII century sculptured by very famous Italian artists (i.e., G.Bonazza, A.Tarsia, A.Corradini). During the recent restoration of these sculptures laser treatment has been used for removal of dirt, black gypsum crust, biological growth and cement.

WeSY2-17 **14:40-15:00**

THE PRACTICE OF LASER-CLEANING METHOD IN RESTORATION OF THE 18TH CENTURY NECROPOLIS MONUMENTS (ST. PETERSBURG) AND IN RESTORATION OF TRUVOR CROSS IN IZBORSK (PSKOV REGION)

S.L.Petrova[1], Yu.A.Loginova[2]; 1-State Hermitage museum, 2-State museum of Urban Sculpture; State Hermitage museum; Russia

Abstract is not available.

WeSY2-18 **15:00-15:20**

THE EU FUNDED FP7 PROJECT "MEASUREMENT, EFFECT ASSESSMENT AND MITIGATION OF POLLUTANT IMPACT ON MOVABLE CULTURAL ASSETS. INNOVATIVE RESEARCH FOR MARKET TRANSFER"- MEMORI

E.Dahlin, T.Grontoft, S.Lopez-Aparicio, P.Bellendorf, A.Schieweck, K.Drda-Kühn, M.P.Colombini, P.Vandenabeele, R.Larsen, A.Potthast, O.Marincas, D.Thickett, G.Andrade, M.Odlyha, S.Hackney, C.McDonagh, J.Ackerman; George Enescu Univ. of Arts; Romania

A new early warning technology for preventative conservation of movable cultural heritage will be developed through the MEMORI project for the evaluation of the quality of indoor environments from museums, galleries, collections. The effect of organic acids on diverse organic materials is investigated. MEMORI is undertaking research to improve measures for mitigation of degradation caused by air pollution inside enclosures.

15:20-15:30

Closing remarks

15:30-16:30

Guided Visit to Peter & Paul Fortress

17.00-18.00

Visit to research laboratories of the St. Petersburg State Electrotechnical University

Tuesday, June 26

Poster Session

TuSY2-p01 **16:00-17:00**

X-RAY ANALYSIS (USEFUL TOOL) FOR DAMAGE ASSESSMENT OF WOOL HERITAGE FABRICS

O. Marincas[1], F. Brinza[2], V. Nica[2], S. Lopez-Aparicio3, T. Grontoft3, E. Dahlin3; 1-George Enescu Univ., 2-Al.I. Cuza Univ., Romania; 3-Norwegian Inst. for Air Research (NILU), Kjeller, Norway;

In this paper we report the influence of acetic acid vapors upon model woven wool fabrics. The samples were exposed to a monthly average concentration of acetic acid of 400 mg/m3 at 75% RH and 4 different doses were obtained by the use of exposure times of 1, 2, 3 and 4 weeks. Using an X-ray diffractometer, the samples was investigated in the 2 theta-interval 10-70 degrees diffraction angle. From the resulted diffractograms, the peak of glycine, glutamic acid, serine and cystine as major aminoacids constituents of wool was analyzed. The influence of ageing agent upon crystallization of major aminoacids from wool composition revealed and the mechanism of damage was proposed.

TuSY2-p02 **16:00-17:00**

CHANGES OF IR AND RAMAN SPECTRA OF WHITE OIL PAINTS WITH TIME

I.A. Balakhnina[1], N.N. Brandt[1], A.Yu.Chikishev[1], Yu.I. Grenberg[2], I.A. Grigorieva[3], I.F. Kadikova[2], and Ya.S. Kimberg[1]; 1-Lomonosov Moscow State Univ., 2-State Research Inst. for Restoration, 3-The State Hermitage Museum; Russia

The dating of artworks is often based on the methods of IR and Raman spectroscopy.Spectral features of binding materials and pigments of paints on artworks are time- dependent in general and, therefore, can also be used for dating of the artworks.In this work, we discuss the problems in IR and Raman measurements and analysis of the spectra of white oil paints aimed at dating of the artworks.

TuSY2-p03 **16:00-17:00**

SPECTROSCOPIC STUDY OF AQUEOUS EXTRACTS FROM PAPER

I.A. Balakhnina[1], N.N. Brandt[1], A.Yu. Chikishev[1], V.N. Kruzhilin[1], N.L. Rebrikova[2]; 1-Lomonosov Moscow State Univ.; 2-State Research Inst. for Restoration; Russia

This work is devoted to spectroscopic study of substances extracted in water from foxings on old papers and foxing-free fragments. We also consider the possibility of determining the age of paper based on differences of spectral lines of aqueous extracts.

TuSY2-p04 **16:00-17:00**

SPECTROSCOPY OF THE LASER IRRADIATED OLD PAPER

I.A. Balakhnina[1], N.N. Brandt[1], A.Yu. Chikishev[1], and N.L. Rebrikova[2]; 1-Lomonosov Moscow State Univ., 2-State Research Inst. for Restoration; Russia

The effect of laser radiation on a German geographic map printed in 1846 is discussed. The sample is irradiated with pulsed and cw laser radiation at a wavelength of 532 nm. Spectroscopic (ATR FTIR and fluorescence) techniques are employed for the diagnostics of molecular changes.

TuSY2-p05 **16:00-17:00**

LASER REMOVAL OF MICROFUNGI FROM PAPER, LEATHER AND WOOD

A.N.Gerashchenko[1], I.Yu.Kirtsideli[2], V.A.Parfenov[1]; 1-Saint Petersburg State Electrotechnical Univ., 2-Komarov Botanical Institute RAS; Saint Petersburg State Electrotechnical Univ.; Russia

Microfungi play the most important role in processes of biodeterioration of cultural-historical heritage objects made from organic materials (wood, paper, leather). In this work technology of laser cleaning has been used to resolve this problem. Experimental results of laser removal of Aspergillus Chaetomium, Cladosporium, Penicillium, Trichoderma, Ulocladium from model samples are presented in this paper.

2nd International Symposium on Lasers in Medicine

June 26, 2012

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Tuesday, June 26

Section 1: Optical Biomedical Diagnostics

TuSY3-01 Invited **09:00-09:25**

THE HEAVY PATH OF OPTICAL BIOPSY

L. Avramov; Inst. of Electronics, Bulgarian academy of sciences;

Abstract is not available.

TuSY3-02 Invited **09:25-09:50**

AUTOFLUORESCENCE OF SKIN CANCER - TOOL FOR INITIAL DIAGNOSIS AND MONITORING OF THERAPY

E. Borisova[1], E. Pavlova[2], P. Troyanova[2], B. Nikolova[3], I. Tsoneva[3]; 1-Inst. of Electronics , Bulgarian Academy of Sciences, 2-Univ. Hospital "Queen Jiovanna-ISUL", 3-Inst. of Biophysics and Biomedical Engineering, Bulgarian Academy of Sciences;

In the current report we will present several practical applications of LIAFS system as an initial diagnostic tool, as well as a tool for therapeutic monitoring and a decision tool for treatment planning for skin cancer diagnosis and therapy.

TuSY3-03 Invited **09:50-10:15**

SPATIALLY RESOLVED MULTIMODALITY SPECTROSCOPY FOR IN VIVO DIAGNOSIS OF SKIN PRECANCER: RECENT DEVELOPMENTS IN DATA EXTRACTION AND CLASSIFICATION

W.C.P.M. Blondel[1], F. Abdat[1], M. Amouroux[1], Y. Guermeur[2]; 1-Centre de Recherche en Automatique de Nancy (CRAN), 2-Laboratoire Lorrain de Recherche en Informatique et ses Applications (LORIA); France

The current paper presents some of the most recent developments in multidimensinal spectrosocpic data extraction and classification of non- and pre-cancerous skin tissues using Spaatially Resolved Multiple Excitation AutoFluorescence and Diffuse Reflectance Spectroscopies .

TuSY3-04 Invited **10:15-10:40**

AUTOFLUORESCENCE ENDOSCOPICAL DIAGNOSIS IN ONCOLOGY

V. Sokolov; Hertzen Moscow Research Oncological Inst.; Russia

In endoscopical department of P.A. Hertzen Moscow Research Oncological Institute autofluorescence laryngoscopy, bronchoscopy, esophagogastroscopy and colonoscopy are used since 1998. Analysis of the true and false positive results in revealing of early stage cancers, comparison with other endoscopical modalities, indications to using of this method are presented and discussed.

TuSY3-05 Invited **10:40-11:05**

AUTOFLUORESCENCE SPECTROSCOPY IN EARLY STAGE LUNG CANCER DIAGNOSIS

N.N. Bulgakova[1], V.V. Sokolov[2] , K.A. Vereschagin[1]; 1-Prokhorov General Physics Inst. RAS, 2-Hertzen Moscow Research Oncological Inst.; Russia

This study presents application of the autofluorescence spectroscopy to recording and analyzing of laser-induced autofluorescence emission spectra from normal and pathological bronchial epithelium in vivo. The aim was to reveal quantitative spectral characteristics, which analysis in the course of in vivo recording of autofluorescence emission spectra allows improving the detection accuracy of autofluorescence bronchoscopy for early stage lung cancer. Comparative analysis of the nine basic spectral characteristics shown that the diagnostically informative ones for early stage lung cancer detection purposes under 532 nm excitation are the two magnitude characteristics and, additionally, four characteristics of shape. Real-time monitoring and assessment of the complex of all these diagnostically informative characteristics in the course of in vivo spectroscopy examinations can promote eliminating of false-positive results of the autofluorescence bronchoscopy for intra-epithelium lesion detection.

- Coffee Break -

TuSY3-06 Invited **11:30-11:55**

SMALL ANIMAL FLUORESCENCE IMAGING IN VIVO

I.V. Turchin; Inst. of Applied Physics RAS; Russia

Abstract is not available.

TuSY3-07 Invited **11:55-12:20**

SPECTRALLY RESOLVED FLUORESCENCE LIFETIME IMAGING IN PDT - NEW DEVELOPMENTS AND APPLICATIONS

A. Rueck, R. Steiner, S. Kalinina, C. Hauser; Inst. of Laser Technologies in Medicine and Metrology at the Univ. of Ulm; Germany

Spectral resolved fluorescence lifetime imaging can improve fluorescence guided diagnosis. Molecular imaging helps to visualize cell metabolism, to enhance specificity, to avoid false positive signals, to discriminate between inflammatory and tumour tissue and also to determine the tumour state.

TuSY3-08 Invited **12:20-12:45**

HIGH SENSITIVE LASER BASED ANALYSIS OF ENDOGENOUS CO IN BREATH: NEW APPROACH TO LUNG DIFFUSION CAPACITY DIAGNOSTICS

E. Stepanov; Prokhorov General Physics Inst. RAS; Russia

A new approach for evaluation of diffusion properties of alveolar-capillary lung membrane was developed. It is based on high sensitive analysis of endogenous CO in exhaled air with help of tunable diode lasers. The dynamic of endogenous CO release was demonstrated to be defined only by the diffusion capacity of lung membrane itself. “Blood” component is not significant.

TuSY3-09 **12:45-13:00**

APPLICATION OF THZ SPECTROSCOPY FOR THE STEROID ANALYSIS

O.P Cherkasova[1], M.M. Nazarov[2], I.N. Smirnova[2], A.P. Shkurinov[3]; 1-Inst. of Laser Physics SB RAS, 2-Inst. on Laser and Information Technologies RAS; 3-Lomonosov Moscow State Univ.; Russia

The terahertz time-domain spectra of corticosteroid hormones in the region of 0.1-3.0 THz have been measured. The corticosteroid hormones have several intense and specific absorption features in the THz frequency region. The features are uniquely determined by a hormone structure. This allows us to determine steroids in complex samples such as pharmaceuticals, foodstuffs and biological fluids, and in process of the pharmacological and chemical synthesis.

TuSY3-10 **13:00-13:15**

ACTIVE LASER THERMOGRAPHY AS A PROBE OF MICROVASCULAR BLOOD FLOW IN LIVING TISSUE AND MASS TRANSFER IN POROUS MEDIA

S.A. Yuvchenko, D.A. Zimnyakov, A.P. Sviridov, and M.V. Alonova; 1-Saratov State Technical Univ., 2-Inst. on Laser and Information Technologies RAS; Russia

An approach to characterization of the thermal and optical properties of multiple scattering random media such as living tissues is discussed. Also, this approach can be applied to analysis of mass transfer in random dispersive media.

TuSY3-11 **13:15-13:30**

WIDE-BANDWIDTH TIME OF FLIGHT SPECTROSCOPY OF TURBID MEDIA

D. Khoptyar, S. Andersson-Engels; Lund Univ.; Sweden

We report on the performance characteristics of ultra-wide bandwidth time of flight spectrometer for biomedical and pharmaceutical applications. The unique spectrometer is capable to deliver absorption/scattering spectra of turbid samples in the visible and close near infrared range up to 1400nm. We illustrate outstanding performance of the instrument by reviewing number of applications in pharmaceutical analysis and for biomedical diagnostics.

- Lunch -

Section 2: Advanced Laser Systems for Medicine and Clinical Laser Applications

TuSY3-13 Invited **15:00-15:25**

MODERN LASERS FOR MICROSURGERY OF CORNEA

S.K. Vartapetov[1], K. P. Takhchidi[2], I. A. Shcherbakov[1]; 1-Prokhorov General Physics Inst. RAS, 2-Fyodorov Eye Microsurgery State Inst.; Russia

Abstract is not available.

TuSY3-14 Invited **15:25-15:50**

LASER PHOTO THERAPY – DOES IT HAVE TO BE A LASER?

L. Hode; Swedish Laser-Medical Society; Sweden

Abstract is not available.

TuSY3-15 **15:50-16:15**

NEW LASER TREATMENT TECHNOLOGIES IN UROLOGY

O. V. Teodorovich[1,2], D. G. Kochiev3, S. A. Naryshkin[1,2], G. G. Borisenko[1]; 1-Russian Medical Academy of Postgraduate Education, 2-Central Clinical Hospital, 3-Prokhorov General Physics Inst. RAS;

In report are presented new laser techniques: laparoscopic partial nephrectomy (LPN), interstitial laser coagulation (ILC) of localized kidney and prostate tumors, endoscopic treatment of staghorn nephrolithiasis. Results of pre-clinical studies revealed optimal laser parameters for clinical usage. Safety and efficacy of techniques involved are proved by results of clinical use.

TuSY3-16 **16:15-16:30**

COMBINATION OF LASER AND STEM CELL THERAPY IN OPHTHALMOLOGY

A. Lukashev[1], N. Gavrilova[2], N. Tankovich[1], P. Tornambe3; 1-Stemedica Cell Technologies, USA, 2-Moscow Medical Univ., Russia, 3-Retina Specialists, USA;

Review of current and perspective ophthalmic laser systems are discussed for combination of laser and stem cell therapy in ophthalmology.

TuSY3-17 **16:30-16:45**

A METHOD OF TREATMENT MICROBE NATURE DISEASE USING MULTIWAVE DIODE PUMPED SOLID STATE LASER

G.P.Kuzmin[1,2], A.G.Kuzmina[3], O.V.Lovachova[2,4], A.A.Sirotkin[1,2]; 1-Prokhorov General Physics Inst. RAS, 2-Advanced Energy Technologies Ltd; 3-First Moscow State Medical Univ., 4-Central TB Research Inst. RAMS; Russia

Multiwave laser medical device "Livadia" has been developed either for bactericidal or for therapeutic impact on the affected organism parts . This device is on the diode pumped solid state laser and main wavelength radiation conversion 1064 nm into the second harmonic 532 nm and fourth harmonic 266 nm. Therapeutic effect of the device use is achieved by multiwave radiation function.

TuSY3-17 **16:45-17:00**

LASER DESTRUCTIVE TREATMENT OF THE CERVIX DISEASES ASSOCIATED WITH HUMAN HIGH RISK ONCOGENIC PAPILLOMAVIRUS

S.V.Belov[1], Yu.K.Danileiko[2], V.V.Yeshov[1], A.A.Manykin[3], V.V.Osiko[2], V.A.Salyuk[1]; 1-Advanced Energy Technologies, LLC, 2- Prokhorov General Physics Inst. RAS; Russia

Abstract is not available.

- Coffee Break -

Section 3: Laser Tissue Interaction

TuSY3-18 Invited **17:30-17:55**

EQUIPMENT, LIGHT DELIVERY SYSTEMS AND METHODS FOR FLUORESCENT DIAGNOSIS AND PHOTODYNAMIC THERAPY. NEW SOLUTION.

V.B. Loschenov; Prokhorov General Physics Inst. RAS, JSC "BIOSPEC"; Russia

The report presents new and modified versions of the previously developed devices and instruments for fluorescent diagnostics and photodynamic therapy of cancer. Particular attention is paid to light delivery systems, estimation of the tissue-absorbed light dose, methods of the photosensitizers concentration measurements and the possibility of using pulsed light sources for PDT.

TuSY3-19 Invited **17:55-18:20**

MEDICAL APPLICATIONS OF NIR-LASERS

R. Steiner, D. Russ, K. Stock, R. Hibst; Inst. of Laser Technologies in Medicine and Metrology at the Univ. of Ulm; Germany

The potential of medical applications of NIR (Near Infrared) and Mid-IR lasers is still not at its end. Continuous research of laser-tissue interactions steadily opened new fields of medical applications for diode lasers, Holmium Lasers and the Er:YAG laser at 2,94 µm wavelength, due to the high absorption of this wavelength in water, for ablation of soft and hard tissue.

TuSY3-20 Invited **18:20-18:45**

FLUORESCENCE DIAGNOSTICS AND PHOTODYNAMIC THERAPY IN ONCOLOGY

E.V. Filonenko; Hertzen Moscow Research Oncological Inst.; Russia

The most actual directions in oncology are development and adoption of new high-technological techniques for early diagnosis and treatment of tumors, and fluorescence diagnostics (FD) and photodynamic therapy (PDT) are among them. In the P.A.Hertzen Moscow Research Oncological Institute the main methodological approaches to FD and PDT with different photosensitizers were developed.

TuSY3-21 Invited **18:45-19:10**

CLINICAL EXPERIENCE AND PERSPECTIVES OF OPTICAL BIOPSY IN SURGERY OF SPINAL TUMORS

P.V. Zelenkov[1], T.A. Savelieva[2], I.N. Shevelev[1], A.A. Potapov[1], N.A. Konovalov[1], Yu.V. Kushel[1], A.G. Nazarenko[1], D.Golbin; 1-Burdenko Neurosurgical Inst., 2-Prokhorov General Physics Institute RAS; Russia

Fluorescent-guided resection with 5-ALA allows differing tumor tissue or borderline zone from normal of ischemic brain, and multiple biopsies confirm high specificity of the technique. The specific cases were investigated which demonstrate advantages of optical biopsy with He-Ne-induced fluorescence of protoporphyrin IX after 4-ALA administration.

TuSY3-22 **19:10-19:25**

SINGLE MODE ER-LASERS TREATMENT OF HARD TOOTH TISSUES. THEORY AND EXPERIMENTS.

A. Belikov, A. Skrypnik, K. Shatilova; St.Petersburg National Research Univ. of ITMO; Russia

We describe new model of hard tooth tissues ablation by erbium laser radiation, technology of laser texturing and it's influence of bond strength and microleakage between tooth tissues and composite filling material. New diode-pumped YLF: Er laser is described. We demonstrate the effects on hard tooth tissue after YLF: Er laser treatment. Microhardness of hard tooth tissues after YLF: Er laser radiation impact is investigated.

TuSY3-23 **19:25-19:40**

A COMPARATIVE STUDY: EVOLUTION OF PHOTOTHERMAL DAMAGE AT DIFFERENT WAVELENGTHS

F. Yildiz[1,3], A. S. Sarp[2], Ç.Gök[2], M.Gülsoy[2], I. Çilesiz[3]; 1-Hakkari Univ., 2-Bogaziçi Univ., 3-Istanbul Technical Univ.; Turkey

We compared CW laser irradiation at 980 nm, 1070 nm, and 1940 nm on bovine liver in vitro. We studied onset of coagulation, carbonization and ablation. We estimated damaged tissue volumes. Carbonization depth and coagulation depth are comparable at 1070 nm. Moreover, carbonization depth is independent of applied power density at 1940 nm (at 1W, 2 W, 3 W).

TuSY3-24 **19:40-19:55**

LASER FABRICATION AND STABILIZATION OF BIOFUNCTIONAL COMPOSITE

A.I.Omelchenko[1], E.N.Sobol[1], Yu.M.Soshnikova[2], V.V.Lunin[2], Y.A.Sukhov[3], A.V.Simakin[3], G.A.Shafeev[3]; 1-Inst. on Laser and Information Technologies RAS, 2-Moscow State Univ., 3-General Physics Inst. RAS; Russia

Laser fabrication and stabilization of biofunctional nanoparticles of iron oxide have been presented. Nanoparticles synthesis by laser ablation of metals in liquid are considered as alternative method of usual nanoparticles fabrication by chemical synthesis. Laser treatment of nanoparticles in starch aqueous solution resulted in formation composite of magnetite nanoparticles with starch nanogranules. The composite nanoparticles are stable relating to agglomeration and sedimentation.

Poster Session

TuSY3-p01 **15:00-19:30**

CHANGES IN THE PARAMAGNETIC PROPERTIES OF ALBUMINES ANDER THE ACTION OF THE TERAHERTZ RADIATION

E. Nemova[1], G. Dultseva[2], A. Mamrashev[3], N. Nikolaev[3]; 1-Inst. of Laser Physics SB RAS, 2-Inst. of Chemical Kinetics and Combustion SB RAS, 3-Inst. of Automation and Electrometry SB RAS; Russia

It was shown that exposure of THz laser causes conformational changes of albumin molecule that appear in the concentration and mobility of oxidation centers.

TuSY3-p02 **15:00-19:30**

PULSE Nd:YAG LASER APPLICATION ON PATIENTS WITH RENAL CELL CARCINOMA

O. Teodorovich, S. Naryshkin, G. Borisenko, D. Kurochkin, D. Kochiev, E. Rasshchupkina; Russian Medical Academy of Postgraduate Education, Central Clinical Hospital [11] JSC RZhD "Russian Railways";

The efficiency of pulse Nd:YAG interstitial laser coagulation on patients with renal tumor was studied. During 2007-2011 9 patients have been underwent to this treatment. In 6 patients tumor was fully replaced by scar tissue. In the last 3 cases, the observation time is less than 6 months. ILC can be used as a treatment method of renal tumors.

TuSY3-p03 **15:00-19:30**

LASER TECHNOLOGY IN THE SURGICAL TREATMENT OF BLADDER CANCER

O. Teodorovich, G. Borisenko, S. Naryshkin, D. Kochiev, M. Shatokhin, D. Kurochkin, A. Dudarov; Russian Medical Academy of Postgraduate Education, Central Clinical Hospital [11] JSC RZhD "Russian Railways";

We studied the efficiency of Nd:YAG laser coagulation in the treatment of bladder cancer after transurethral resection (TUR). From 2010 till 2011 42 patients underwent TUR with subsequent laser coagulation of the tumor bed and 45 patients underwent TUR only. After the combination of TUR with laser coagulation the 1 year recurrence appeared in 2,3% of cases, and after the standard TUR - in 13.3%.

TuSY3-p04 **15:00-19:30**

LIGHT AND HEAT PROPAGATION IN BIOLOGICAL TISSUES. METHODS OF THEIR CONTROL AND EVALUATION OF TISSUE CRITICAL STATES.

P.V. Grachev[1], M.N. Holodcova[1], K.G. Lin'kov[1], A.N. Okushko[2], E.V. Filonenko[2]; 1-Prokhorov General Physics Inst. RAS, 2-Moscow Research Oncological Inst.; Russia

Hyperthermia and photodynamic therapy are the methods of tumors and metastases treatments. These methods are based on the interaction of laser radiation with biological tissues. The applying of the optimal light intensity and heat distribution and the monitoring processes occur with the biological tissue during irradiating are the methods to increase efficiency of treatment.

TuSY3-p05 **15:00-19:30**

NEW INORGANIC GD-,B-CONTAINING NANOMATERIALS DOPED WITH RE FOR THE THERANOSTIC AND NEUTRON-CAPTURE CANCER THERAPY

A.V. Ryabova[1], V.A. Krut'ko[2], M.G. Komova[2], P.V. Grachev[1], D.S. Pominova[1], V.V. Volkov[1], V.B. Loschenov[1]; 1-Prokhorov General Physics Inst. RAS; 2-Kurnakov Inst. of General and Inorganic Chemistry, RAS; Russia

Proposed development of nanoparticles with high sensitivity for both the NMR, fluorescence spectroscopy, as well as neutron capture therapy based on complex oxide polycrystalline RE compounds. After conjugation obtained nanoparticles with the photosensitizers are obtained unique nanoscale therapeutic agents that allow to transform deeply penetrating infrared light into the energy of singlet oxygen.

TuSY3-p06 **15:00-19:30**

UP-CONVERSION LUMINESCENT FEATURES OF $NaYF_4$: REI NANOPARTICLES EXCITED IN THE NIR-RANGE FOR BIOMEDICAL APPLICATIONS

A.V. Ryabova[1], S.V. Kouznetzov[1], P.V. Grachev[1], D.S. Pominova[1], A.I. Klimov[2], M.N. Mayakova[1], D.S. Los'[1], V.B. Loschenov[1], P.P. Fedorov[1]; 1-Prokhorov General Physics Inst. RAS, 2-Lomonosov Moscow State Univ.; Russia

The series of monodisperse crystalline inorganic fluorides crystal nanoparticles with matrices NaYF4, CaF3, doped with rare-earth elements Yb3+-Er3+, Yb3+-Tm3+ and Yb3+-Ho3+with the ability to conjugate the organic compounds on the surface, ranging in size from 20 to 400 nm was obtained by method of co-precipitation from aqueous solutions. The emission intensity of the luminescence up-conversion, in some cases reaches 7%.

TuSY3-p07 **15:00-19:30**

COMBINED SPECTROSCOPY GUIDED BRAIN TUMOR RESECTION: PHYSICAL BASIS AND CLINICAL EXPERIENCE

T.A. Savelieva[1], M.N. Kholodtsova[1], V.B. Loschenov[1], S.A. Goryajnov[2], P.V. Zelenkov[2], A.A. Potapov[2]; 1-Prokhorov General Physics Inst. RAS, 2-Burdenko Neurosurgical Inst., Moscow; Russia

Brain glial tumors are characterized by diffuse infiltrative growth along the normal myelinated axons that lead to extension of perifocal region with mixed features of tumor tissues and normal white matter. The combination of the measurements of fluorescent and diffuse-reflected light and their mathematical modelling allows to determine the neoplasm grade and malignization level in the perifocal areas.

TuSY3-p08 **15:00-19:30**

BIOMEDICAL APPLICATIONS OF DIODE-PUMPED CONTINUOUS-WAVE 0.5 W THULIUM LASER

L. Batay[1], A.I.Vodchits[1], V.A. Orlovich[1], N. Gorbunova[2], T. Kuznetsova[2], V.S. Ulastchik[2]; 1-Stepanov Inst. of Physics NAS Belarus, 2-Inst. of Physiology of NAS of Belarus; Belarus

Application of diode-pumped CW 0.5 W laser based on Tm:KYW crystal for precise tissue coagulation is discussed. Effective coagulation of small blood vessels and liver tissue under influence of 2 μm laser radiation at powers from 250 to 500 mW is demonstrated. Possible systemic effects at organism level arising under influence of low-intensity 2μm laser radiation are also considered.

TuSY3-p09 **15:00-19:30**

SOFT TISSUE ABLATION AT 6,45 μm WITH NANOSECOND AND PICOSECOND LASER PULSES

N. Hendaoui[1,2] , Andre Peremans[1], A.Esteban[3], M. Ebrahim-Zadeh[3], S.Been[4], R.M. Verdaasdonk[4], P.G. Schunemann[5], K.T. Zawilski[5], V.Petrov[6]; 1-Centre de Recherche en Physique de la Matière et du Rayonnement, Univ.of Namur, Belgium; 2-Centre de développement des Technologies Avancées(CDTA), Algeria; 3-ICFO - Inst. of Photonic Sciences, Mediterranean Technology Park, Spain; 4-Univ. Medical Center, Heidelberglaan, The Netherlands; 5-BAE Systems Inc., USA; 6-Max Born Inst. for Nonlinear Optics and Ultrafast Spectroscopy, Germany

Although the use of the free electron laser (FEL) has shown much promising results for biological tissue ablation, it is a long facility which prevents its use in medical applications at point of care locations. The research is currently focused on the d In our work, we report the results of the comparison of liver tissue ablation using either picoseconds or nanoseconds laser pulses at 6,45 μm. The picoseconds pulses are generated by a synchronously pumped CdSiP2 based optical parametric optical (OPO).

TuSY3-p10 **15:00-19:30**

ENDOVENOUS LASER TREATMENT (EVLT): SIMULATION AND LASER-TISSUE INTERSECTION USING DIFFERENT LASER WAVELENGTH AND FIBER TIPS

A. Khabarova, V. Zhurba, A. Filatov; NPP VOLO; Russia

The paper is devoted to simulation of endovenous laser treatment. Detailed analysis of two EVLT methods is considered. Usage of different types of fiber is discussed.

6th International Conference on Laser Optics for Young Scientists and Engineers

June 26, 2012

Co-Chairs

Scientific Secretary

Organizing Committee

Tuesday, June 26

09:30-09:45 - Opening remaks

TuYS-01 Invited Lecture **09:45-11:00**

THZ WAVE IMAGING

X.-C. Zhang; The Institute of Optics, Univ. of Rochester, United States, Wuhan National Laboratory for Optoelectronics, Huazhong Univ. of Science and Technology, China;

Historically, THz technologies were mainly used within the astronomy community for searching far-infrared radiation (cosmic background), and the laser fusion community for the diagnostics of plasmas. Since the first demonstration of THz wave time-domain spectroscopy in the late 80's, there has been a series of significant advances (particularly in recent years) on the development of intense sources and sensitive detectors. I review recent development of science and technology of THz wave imaging and sensing.

Section 1:

TuYS-02 **11:30-11:45**

THE DENSITY OF PHOTON STATES IN DYE–DOPED CHIRAL NEMATIC LIQUID CRYSTAL CELLS IN THE PRESENCE OF ABSORPTION AND GAIN

T. Mavrogordatos, S. Morris, F. Castles, H. Coles, T. Wilkinson; Univ. of Cambridge; United Kingdom

In this paper we study the transmission properties and the density of photon states of normal modes in dye-doped chiral nematic liquid crystal cells in the presence of absorption and gain. We relate our conclusions to experimental results and extend our analysis to other DFB structures as well as to the propagation characteristics of defect and oblique modes.

TuYS-03 **11:45-12:00**

NONLINEAR POLARIZATION CONTROL IN SILICON-ON-INSULATOR WAVEGUIDES

I.N. Strelnikov, V.V. Kozlov; St.Petersburg State Univ.; Russia

Theoretical calculations are carried out to solve the problem of a polarizer based on silicon for use in optical data transmission channels. Silicon polarizers have very high potential because of its properties, and availability of knowledge in industrial use.

TuYS-04 **12:00-12:15**

GLASS TRANSITION TEMPERATURE AS A CRITERIUM OF GLASS MODIFICATIONS BY THE ULTRA-SHORT LASER PULSES

A.V. Melnikov[1], E.A. Romanova[1], Y.S. Kuzutkina[1], A.I. Konukhov[1], A. Mouskeftaras[2], S. Guisard[2]; 1-Saratov State Univ., Saratov, Russia; 2 Laboratoire des Solides Irradiйs, CNRS-Ecole Polytechnique, Palaiseau, France;

We propose an analytical approach to analyze heating of a glass sample by a focused ultra-short laser pulse. The permanent change of refractive index is assumed to result from heating of the glass sample above the glass transition temperature. In experiment, the interferometric pump-probe method was used to study refractive index change in chaclogenide glass samples.

TuYS-05 **12:15-12:30**

ELECTROMAGNETICALLY INDUCED GRATING IN A MEDIUM WITH TRIPOD CONFIGURATION OF LEVELS

M. Gordeev[1], E. Efremova[1], Yu. Rozhdestvensky[2]; 1-St.Petersburg State Univ., 2-St.Petersburg National Research Univ. of Information Technologies, Mechanics, and Optics; Russia

In this work we studied the electromagnetic induced phase and amplitude grating in the tripod configuration. We demonstrated the opportunity to control and manage by diffraction picture manipulating of the set of the parameters. So one can suppress any diffraction orders and amplify the others.

TuYS-06 **12:30-12:45**

COMPARISON OF CONVERSION EFFICIENCY FOR TYPE I AND TYPE II SECOND HARMONIC GENERATION AT MULTI- AND SINGLE-FREQUENCY PUMPING

M. O. Politko, S. I. Kablukov, S. A. Babin; Inst. of Automation and Electrometry SB RAS; Novosibirsk State Univ.; Russia

In this paper we study frequency doubling of fiber laser radiation in crystals with type II and type I phase matching. Linearly polarized multi-frequency ytterbium laser with 1063.85 nm wavelength was assembled for this purpose. The active fiber of the laser is also used for amplification of a single-frequency Nd:YAG laser with 1064.35 nm wavelength. As a result, we obtained increase of the efficiency of multi-frequency doubling of the signal compared to single frequency in the PPLN crystal up to 90%. In KTP crystal, this value was approximately 50%.

TuYS-07 **12:45-13:00**

STRUCTURAL AND OPTICAL CHARACTERIZATIONS OF YAG:EU^{3+} PHOSPHORS

I.Kolesnikov[1], T.Medvedeva[2], D.Mamonova[2]; 1-St.Petersburg State Univ., 2-St-Petersburg State Polytechnical Univ.; Russia

Structural characterizations of nano-sized Eu3+-activated yttrium garnet phosphors sintered at different temperatures were measured by X-ray diffraction (XRD). It has been shown that YAG powders crystallize around 900oC. The luminescence intensity's dependence of ligand concentration was studied. The optimal concentration of europium was found. Emission spectra of YAG:Eu3+with different sintering temperatures were investigated. Excitation spectrumof the most efficient phosphor was shown. Kinetics of luminescence monitored by 5D0-7F1 transition was measured and life-time of 5D0 level was determined.

TuYS-08 **13:00-13:15**

PECULIARITIES OF SELF-ACTION OF SINGLE-CYCLE LIGHT PULSES

A.A. Drozdov[1], S.A. Kozlov[1], A.A. Sukhorukov[2], Yu.S Kivshar[2]; 1-St.Petersburg National Research Univ. of ITMO, Russia; 2-Australian National Univ., Australia;

We investigate both analytically and numerically the self-action peculiarities of spatiotemporal paraxial light pulses during unidirectional propagation in instant cubic nonlinear media with normal group dispersion and reveal new feature of suppression of third-harmonic generation for single-cycle light pulses.

TuYS-09 **13:15-13:30**

INTERACTION OF CONTRADIRECTIONAL LIGHT WAVES IN DIELECTRIC COATING ON THE METAL MIRROR

E.M. Buyanovskaya, S.A. Kozlov; St.Petersburg National Research Univ. of ITMO, Russia

The interaction of contradirectional light waves in the dielectric coating on the metal mirror was studied. It was shown that the radiation on the triple frequencies is possible.

Section 2:

TuYS-10 **15:00-15:15**

SYMMETRY-PRESERVING GENERALIZATION OF THE QUANTUM RABI MODEL

V.V. Albert; Yale Univ.; United States

The quantum two-state Rabi model describes the simplest interaction between a two-level system and a quantized radiation field in a cavity. I will describe an N-state extension of the Rabi model that generalizes the symmetry of the two-state case and introduces a novel class of quantum optical systems.

TuYS-11 **15:15-15:30**

STUDY OF DNA USING PULSED TERAHERTZ SPECTROSCOPY

M. Tsurkan[1], E. Sobakinskaya[2], N. Balbekin[1], O. Smolyanskaya[1], V.G. Bespalov[1], V.L. Vaks2; 1-St. Petersburg National Research Univ. of ITMO, 2-Inst. for Physics of Microstructures RAS; Russia

The aim of this work was the detailed study of the spectrum of DNA in the range of 0.1-1.3 THz. With the help of a terahertz spectrophotometer, which is implemented based on photoconductive antenna, the spectrum of degraded herring DNA (in form of dry powder) was studied.

TuYS-12 **15:30-15:45**

USAGE OF PHOTORESIST LAYER OF CdS(1-x)SE(x) CRYSTALS FOR CONTROL OF TERAHERTZ RADIATION

Ya.V. Grachev[1], I.A. Boginskaya[2], A.S. Meshkov[2], A.S. Ilyin[2], V.G. Bespalov[1], I.A. Rygikov[2].; 1-St. Petersburg National Research Univ. of ITMO, 2-Inst. for Theoretical and Applied Electrodynamics RAS; Russia

We show that photoresist layer crystals of CdSe and CdS can change index in terahertz spectral region caused by applying voltage and light. We study CdS(0.65)Se(0.35) absorption with time-domain spectroscopy and it has no changes in absorption in range of 0.01 to 1.5 THz in case of applying voltage and light. But in pulse waveform there is difference in delay of pulses passed through the sample under influence and in normal state. Shown delay dependence from luminous intensity. This make CdS(1-x)Se(x) promising material for terahertz phase modulators.

TuYS-13 **15:45-16:00**

INVESTIGATION OF TEMPERATURE DEPENDENCE OF CESIUM ATOMS KINETICS IN ALKANE AND ALKENE COATED CELLS

M.V. Balabas[1,2], O.Yu. Tretiak[2]; 1-Vavilov State Optical Inst., 2-St.Petersburg State Univ.; Russia

Abstract is not available.

TuYS-14 **16:00-16:15**

INFLUENCE OF CERIUM IONS CONCENTRATION IN PHOTO-THERMO-REFRACTIVE GLASS ON CHARACTERISTICS OF PHASE VOLUME ULTRA-DEEP HOLOGRAMS

A.D.Ibrayeva, V.A.Aseev, N.V.Nikonorov; St.Petersburg National Research Univ. of ITMO; Russia

The study of characteristics of volume phase ultra-deep holograms on the photo-thermo-refractive glass was carried out. The effect of the cerium ions concentration in PTR glass on the holographic and spectral characteristics of the samples was shown. Also there was defined optimal conditions of thermal treatment for each investigated cerium concentration.

TuYS-15 **16:15-16:30**

UP-CONVERSION LUMINESCENCE OF YTTERBIUM-ERBIUM DOPED NANO-GLASSCERAMICS

Y. Nekrasova, V. Aseev, E. Kolobkova, N. Nikonorov; St.Petersburg National Research Univ. of ITMO; Russia

Up-conversion luminescence in ytterbium-erbium doped transparent nano-glassceramics has been investigated. The effect of erbium concentration and heat treatment time on the up-conversion luminescence of the Er:Yb:glassceramics excited by InGaAs laser diode is reported. With different concentration of Er3+, the up-conversion luminescence intensity, the intensity rations of green and red lights are different. The detailed mechanism of up-conversion luminescence are analyzed.

TuYS-16 **16:30-16:45**

SCATTERING MEDIA CHARACTERIZATION WITH THE USE OF SPATIALLY RESOLVED SPECKLE CORRELOMETRY

A.A. Isaeva, D.A.Zimnyakov; Saratov State Technical Univ.; Russia

In this study the method of spatially resolved speckle correlometry to the characterization of random multiple scattering dynamic media is discussed. The basic idea of the approach consists in using localized light source and annular spatial filtration of partial components of scattered optical field.

TuYS-17 **16:45-17:00**

QUANTUM DOTS SIZE DISPERSION INFLUENCE ON THE SPECTRUM OF FLUORESCENCE

A.S. Zlatov, V.A. Polischuk, A.V. Baranov, A.V. Fedorov; St.Petersburg National Research Univ. of ITMO, Russia;

Spectral properties of fluorescent labels based on nanostructures of different size were investigated. Guidelines for making appropriately working fluorescent quantum dots (QD) labels were derived.

TuYS-18 **17:00-17:15**

RELATIVE INTENSITY NOISE OF MODE-LOCKED LASERS UTILIZING SINUSOIDALLY CHIRPED FIBER BRAGG GRATING

E. Ersoy, N. Dogru; Univ. of Gaziantep, Turkey;

The noise of mode-locked hybrid soliton pulse source (HSPS) utilizing sinusoidally chirped-Gaussian apodized fiber Bragg grating (FBG) is investigated including spontaneous and carrier density noises. It was found that for generating shorter pulses with and without noise HSPS utilizing sinusoidally chirped FBG is better than the linearly chirped FBG.

17-30 Round table discussion

Section 3:

TuYS-19 **18:15-18:30**

TWO- AND FOUR-STATE PROTOCOL IMPLEMENTATION ON A SIDEBANDS-BASED QUANTUM CRYPTOGRAPHY SYSTEM

A. Ivanova, S. Kynev, A. Gleim, A. Rupasov, V.I. Egorov; St.Petersburg National Research Univ. of ITMO; Russia

The authors introduce an implementation of the four-state (BB84) and two- state (B92) protocols in a sidebands-based quantum cryptography system along with the latest experimental results.

TuYS-20 **18:30-18:45**

KILOHERTZ RATE PICOSECOND PULSES AMPLIFIER FOR OPCPA SYSTEM PUMPING

K. Michailovas[1,2], V. Smilgevicius[2], A. Michailovas[1,2], A. Aleknavicius[1,2]; 1-Inst. of Physics, Center for Physical Sciences and Technology/ UAB EKSPLA, 2-Laser Research Center, Vilnius Univ., Lithuania;

We demonstrate a 3-stage amplifier system operating at 1 kHz repetition rate producing 50ps pulses of more than 70 mJ output energy. Smooth beam profile and good stability make this amplifier a good pump source for OPCPA systems.

TuYS-21 **18:45-19:00**

3D SCANNING METHODS AND ALGORITHMS

V. Tishkin; St.Petersburg National Research Univ. of ITMO; Russia

Several methods of 3D scanning and data editing techniques will be discussed.

TuYS-22 **19:00-19:15**

LASER TECHNOLOGY FOR COMPLEX SHAPES WITH INCREASED MICROHARDNESS OF SURFACES

B.V. Farmakovsky[1], A.V. Tereshchenko[1], I.V. Kudryavtseva[1], I.Ch. Mashek[1,2]; 1-CRISM "Prometey", 2-St. Petersburg State Univ., Russia;

Practical implementation of one of the most promising methods of selective laser sintering is discussed. The report presents examples of using the SLS method and a way to increase the microhardness of the sintered material.

TuYS-23 **19:15-19:30**

SPECKLE CORRELATION PROBES OF SUPERCRITICAL FLUIDIC DISPERSIVE SYSTEMS

S. P. Checkmasov[1], D.A. Zimnyakov[1], V.N. Bagratashvili[2], and N.V. Minaev[2]; 1-Saratov State Technical Univ., 2-Inst. on Laser and Information Technologies RAS; Russia

We consider a novel approach to diagnostics of multiphase systems with supercritical components with the use of statistical and correlation analysis of speckle-modulated laser light, which is multiply scattered by a probed system in the course of slow controllable variations of its thermodynamic parameters (the temperature and the density of supercritical component).

Poster Session

Tuesday, June 26

WeYS-p01 **09:00-13:30**

MULTICHANNEL DATA TRANSMISSION BY QUASIDISCRETE SPECTRAL SUPERCONTINUUM AT THE RATE OF 70 TBIT/S

A. Tsypkin, A. Drozdov, S. Putilin, V. Bespalov, S. Kozlov; St.Petersburg National Research Univ. of ITMO; Russia

Physical principles of encoding and data transmission by quasidiscrete spectral supercontinuum obtained by the interference of phase-modulated light pulses with superbroadened spectra are evaluated experimentally. The possibility of ultrafast data transmission at the rate of 70 Tbit/s is demonstrated.

WeYS-p02 **09:00-13:30**

SPECTRAL AND SPATIAL INVESTIGATION OF HARD X-RAY SOURCE CREATED BY SUB- RELATIVISTIC FEMTOSECOND LASER PULSE ONTO THE MELTED GALLIUM TARGET

A.S.Lar'kin, D.S.Uryupina, A.B.Savel'ev; International Laser Center at Moscow State Univ.; Russia

In the talk we present the results of experimental investigation of spectral properties, spatial size and micro structure of the x-ray radiation source created by femtosecond laser pulse with intensity of 3*10^17 W/cm^2 onto the surface of the melted gallium target.

WeYS-p03 **09:00-13:30**

ON THE INTERRELATION BETWEEN LIGHT TRANSPORT PARAMETERS OF TURBID MEDIA AND CHARACTERSTICS OF THIN SAMPLES OF A MEDIUM

J. S. Sina, D. A. Zimnyakov; Saratov State Technical Univ.; Russia

The results of analysis of relationships between the light transport parameters of bulk turbid media and boundary field characteristics of optically thin samples are presented. These results can be useful for various applications in biomedical optics and material science.

WeYS-p04 **09:00-13:30**

UP-CONVERSION LUMINESCENCE PROPERTIES OF ER^{3+}-DOPED ALUMINUM-SILICATE GLASS CERAMICS

N.A. Scoptsov, A.M. Malyarevich, K.V. Yumashev, O.S. Dymshits, A.A. Zhilin, I.P. Alekseeva; Research Center for Optical Materials and Technologies, Belarusian National Technical Univ.;

Up-conversion luminescence spectra of Erbium-doped aluminum-silicate glass ceramics, containing (ErYb)2(Ti,Zr)2O7 nanocrystals, have been studied. Influence of Erbium concentrations and temperature of secondary heat treatment on characteristics of up-conversion green and red luminescence has been analyzed.

WeYS-p05 **09:00-13:30**

NONLINEAR REFRACTION IN CHALCOGENIDE GLASSES NEAR THEIR BANDGAP FREQUENCIES

Yu.Kuzutkina[1], A.Melnikov[1], E.Romanova[1], N.S.Abdel-Moneim[2], D.Furniss[2], A.Seddon[2]; 1-Saratov State Univ., Russia, 2-University of Nottingham, UK;

Chalcogenide glasses are very prospective nonlinear optical material. They have Kerr coefficient (n2) 2-3 orders of magnitude greater than that of fused silica. In the work, dispersion characteristics of the linear and nonlinear refraction index of the As-S-Se system have been studied in theory and experiment. The results have been validated via comparison with available values of linear refraction index for As2Se3 and As2S3 glass samples. Optical bandgap energy Eg of each sample has been estimated by Tauc method.

WeYS-p06 **09:00-13:30**

STRETCHER-COMPRESSOR OF HIGH POWER FEMTOSECOND LASER SYSTEM BASED ON DIODE PUMPED YB^{3+}-DOPED MEDIA

A.V. Laptev, K.V. Polyakov, V.V. Petrov, E.V. Pestryakov; Inst. of Laser Physics SB RAS; Russia

In present work we theoretically and experimentally studied the system of stretcher-compressor based on diffraction gratings. This system is used for chirped pulse amplification (CPA). We defined the parameters of stretcher-compressor for creation of high power femtosecond laser system based on diode pumped Yb3+-doped media.

WeYS-p07 **09:00-13:30**

GENERATION OF UNIPOLAR PULSES FROM NONUNIPOLAR OPTICAL PULSES IN A MEDIUM WITH QUADRATIC NONLINEARITY

P. Kolesnichenko, V. Kozlov; St.Petersburg State Univ.; Russia

A unipolar electromagnetic pulse is a pulse with nonzero value of the static component of the Fourier spectrum of its real electric field. Here a way to generate unipolar pulses from nonunipolar optical pulses incident normally on a layer of a quadratic nonlinear medium is proposed.

WeYS-p08 **09:00-13:30**

TEMPERATURE DEPENDENCE OF SPECTRAL-LUMINESCENT PROPERTIES OF NANOGLASSCERAMICS DOPED WITH CHROMIUM

A. N. Abdrshin, V. A. Aseev, E. V. Kolobkova, N. V. Nikonorov; St.Petersburg National Research Univ. of ITMO; Russia

The temperature dependence of the luminescence of chromium ions in the lead-fluoride nanoglassceramics was investigated. The lifetime of the luminescence of the samples was obtained. The possibility of effective use of material under study as the active medium in fluorescent temperature sensors was discussed.

WeYS-p09 **09:00-13:30**

USAGE PACKAGE COMSOL FOR THE NUMERICAL NONSTATIONARY NONLOCAL PLASMA MODELING

Z.S. Burkova; St.Petersburg State Univ.; Russia

Software package COMSOL is well adapted to simulate wide range of systems. One of the numerous models in COMSOL is the plasma module. In this work has been carried out the simulation of DC Discharge with argon. Software Wolfram Mathematica was used to compare the results due to COMSOl can simulate only one task in a session.

WeYS-p10 **09:00-13:30**

ROZHDESTVENSKI INTERFEROMETER BASED ON MODERN SOURCES OF LIGHT AND PHOTODETECTORS

N.A. Agishev, E.L. Ryabchikov; St.Petersburg State Univ.; Russia

Rozhdestvenski interferometer coupled with spectrograph is used for research of discharge tubes produced by EDD technology. It also can have promising application in laser technology, for example for creating new active media. Modernization of the experimental assembly has touched sources of light and photodetectors. To simplify analysis of observations CCD-matrixes were chosen. Also extra-bright LEDs were used as the optical light source.

WeYS-p11 **09:00-13:30**

REGULAR AND CHAOTIC NONLINEAR DYNAMICS IN A PICOSECOND LASER CONTROLLED WITH A COMBINATION OF POSITIVE AND NEGATIVE OPTOELECTRONIC FEEDBACKS AT TIME SCALE LESS THAN A ROUND TRIP TIME

M.V. Gorbunkov, Yu.Ya. Maslova, Yu.V. Shabalin; P.N.Lebedev Physical Institute RAS; Russia

We propose a simple laser system controlled by optimally adjusted combination of inertial negative and positive feedbacks capable to demonstrate extremely high speed nonlinear dynamics at time scale less than a laser cavity round trip time.

WeYS-p12 **09:00-13:30**

CW THZ SPECTROMETER SOFTWARE MODULE TO CONTROL PARAMETERS OF IR LASER

E. Gurvitz, E. Sedykh, M. K. Khodzitskiy; St.Petersburg National Research Univ. of ITMO; Russia

Special software to control IR laser parameters has been developed in LabView development environment. The software is a simple-to-use program designed for THz researchers and application developers who need to study materials properties at THz frequencies with high resolution. It allows modifying of IR laser wavelength, power, modulation mode and other laser parameters. The software can sweep from 100 GHz to 2.5 THz in a single linear rapid scan with frequency resolution better than 0.125 GHz or can 'frequency hop' between frequencies of interest to scan specific regions of the spectrum with varying degrees of resolution.

WeYS-p13 **09:00-13:30**

INVESTIGATION OF TEMPERATURE DEPENDENCE OF RELAXATIONS TIMES IN ALKANE AND ALKENE COATED CELLS

M. V. Balabas[1,2], O. Yu. Tretiak[2]; 1-Vavilov State Optical Inst., 2-St.Petersburg State Univ.; Russia

Abstract is not available.

WeYS-p14 **09:00-13:30**

RESEARCH OF SPECIFIC PECULIARITIES OF THZ REFLECTION SPECTRA OF ABNORMAL HUMAN TISSUES

A.A. Ezerskaya, O.A. Smolyanskaya, E.A. Strepitov; St.Petersburg National Research Univ. of ITMO; Russia

THz reflection spectra of human tissues (skin with various pathologies, vessels with atherosclerotic plaques) was investigated. It was ascertained of characteristic absorption lines. The possibility of non-invasive diagnosis of in-vivo was shown.

WeYS-p15 **09:00-13:30**

COMPARATIVE PUMP-PROBE STUDY OF THIRD HARMONIC AND THZ GENERATION IN PLASMA OF OPTICAL BREAKDOWN

A.A.Ushakov[1], V.V.Bukin[2], P.A.Chizhov[2]; 1-Lomonosov Moscow State Univ., 2-Prokhorov General Physics Inst. RAS; Russia

In this paper we present experimental data that reveal certain similarities and differences between two processes relying on the same third order susceptibility tensor – THz production and third harmonic (TH) generation. The experiments were performed with output radiation of the laser system on the Ti-Sa crystal with pulse duration of 50fs and a wavelength of 800nm. In our experiment the first femtosecond pulse at the fundamental frequency generates plasma in air and the second two-color pulse (fundamental plus second harmonic) generates THz or TH radiation in plasma.

WeYS-p16 **09:00-13:30**

LIMITING OF LASER RADIATION BY DISPERSIONS OF CARBON NANOTUBES

D.V. Ruppel[1], D.A. Videnichev[1,2], A.V. Venediktova[3], M.D. Kuznetsova[4]; 1-St.Petersburg National Research Univ. of ITMO, 2-Vavilov State Optical Inst., 3-St.Petersburg State Univ., 4-St-Petersburg Electrotechnical Univ.; Russia

The aim of the work was to investigate the effect of optical power limiting (OPL) of laser radiation in suspensions of single walled carbon nanotubes (SWCNTs) stabilized with amphiphiles. As the use of the optical power limiters require thermal stability, we have chosen binary polar mixture "water+glycerol" eutectic composition as a solvent. We got sample transmittance vs incident energy of pulse radiation profiles at 3 wavelengths (355 nm, 532 nm, 1064 nm) in pulse-periodic regimes (0.1, 10 Hz). The OPL effect in water and eutectic suspensions of SWCNT was compared. Also the dependency of OPL parameters against matrix properties and composition was analyzed.

WeYS-p07 **09:00-13:30**

DEFORMABLE MIRROR DM100-31 FOR THE CORRECTION OF ATMOSPHERE ABERRATIONS OF LASER RADIATIONON A HORIZONTAL PATH

N. Botygina, O. Emaleev, P. Konyaev, E. Kopylov, V. Lukin, V. Lavrinov; Zuev Inst. of Atmospheric Optics SB RAS; Russia

The control radiation of phase is realized by means of deformable mirrors in the adaptive system. The test on laboratory model adaptive system showed that the RMS wavefront decreased factor by 100. The test mirror DM-100-31 decreased standard deviation from flatness of the wavefront down to 36 times. Correction of atmospheric distortions wavefront aberration was decreased by a factor of 2.5.

WeYS-p18 **09:00-13:30**

EFFICIENT GENERATION OF X-RAYS USING HIGH POWER FEMTOSECOND LASER PULSES

M. Sedov, A. Goryaev, V.Yu.Venediktov, I.Ch.Mashek; St.Petersburg State Univ.; Russia

The aim of the present work is to obtain monochromatic X-ray source based on laser plasma and to study the possibility of increasing the conversion rate of the laser pulse into X-rays through the use of nano-sized and shaped targets.

WeYS-p19 **09:00-13:30**

NONLINEAR OPTICAL POWER LIMITER OF LASER RADIATION BASED ON CARBON NANOPARTICLES FOR LASER SYSTEMS ELEMENTS PROTECTION.

I. Sheyko; St.Petersburg National Research Univ. of ITMO; Russia

In this paper we present results we have obtained during study of optical limiting in suspensions, solutions and solid composites of carbon nanoparticles with different optical properties and analyze the data. The results of the study is a basis for construction of a nonlinear-optical power limiter system, capable to limit a nanosecond laser pulse with an energy >= 0.1 J at a wavelength 1,06 μm, that we propose to protect elements of laser systems.

WeYS-p20 **09:00-13:30**

THE PROSPECTS OF PRODUCTION DEVELOPMENT OF THE LASER PHOSPHATE GLASS AT LZOS

A.N. Ignatov, A.E. Pozdnyakov, E.Y. Krehova, L.I. Avakiants, V.F. Surkova, T.O. Babina; JSC LZOS; Russia

JSC LZOS has long-term experience on development and manufacturing application of laser glasses activated by neodymium. At the moment it solves the large-scale task of generating of the complete manufacturing cycle of production of large-scale disk elements of dimensions 40x420x790 mm for the project of generation of the laser unit of controlled nuclear fusion.

WeYS-p21 **09:00-13:30**

SPACE LOCATED DEVICE FOR FREQUENCY STABILITY TRANSFER FROM OPTICAL TO RADIO RANGE

V.V. Vitkin, D.I. Lychagin, V.M. Polyakov; St.Petersburg National Research Univ. of ITMO; Russia

Current work describes methods and principles for frequency stability transfer from optical to radio range device. The basic processes occurring in this scheme, and the device parameters correlations are shown. Here we present the optical scheme, the femtosecond laser characteristic and the feedback controller.

WeYS-p22 **09:00-13:30**

SIDE-PUMP SYSTEM OPTIMIZATION FOR COMPACT DPSSL

V.V. Vitkin, V.M. Polyakov, D.I. Lychagin; St.Petersburg National Research Univ. of ITMO; Russia

The methods for optimizing side-pump system for compact DPSSL are presented. The pump system for Phobos-Ground laser is taken as an original design. A comparative analysis of the various pumping systems used in compact solid-state lasers is given.

WeYS-p23 **09:00-13:30**

CREATING A MEASURING SYSTEM BASED ON THE LASER MODULE TO CONTROL THE LASER OPTICAL ELEMENTS.

E. Katolichenko, V. Vitkin; St.Petersburg National Research Univ. of ITMO; Russia

The report presents a scheme of the measuring system, which includes a laser module, designed on the basis of solid-state laser crystal Nd: YVO4. The proposed scheme has a high measurement accuracy (0.01%). We present the performance of the laser module and preliminary experimental data.

WeYS-p24 **09:00-13:30**

MODEL OF FULLERENE-OXYGEN-IODINE LASER WITH A CLOSED CYCLE OF ACTIVE MEDIUM

D. Stentsov; St.Petersburg National Research Univ. of ITMO, Vavilov State Optical Inst.; Russia

Developed and manufactured model of fullerene-oxygen-iodine laser with a closed cycle of active medium with a singlet oxygen generator of gas-flowing type based on porous ceramic structures with fullerene C60 coating is present. Results of preliminary tests of the model are given.

WeYS-p25 **09:00-13:30**

SINGLET-OXYGEN GENERATOR ON THE BASIS OF POROUS FULLERENE-CONTAINING STRUCTURES

S. Makeev; St.Petersburg State Electrotechnical Univ., Vavilov State Optical Inst.; Russia

The description of the upgraded singlet oxygen generator of gas- flowing type with a closed circulation system of oxygen on base of porous solid-phase fullerene-containing structures, operating in continuous mode, optically pumped fullerene by means LED matrix is presented. The experimental results of the developed device are shown.

A1. Advanced laser technology in industrial applications

June 27, 2012.

St. Petersburg, Moscow av. 97A,
Hotel Holiday Inn, Stenberg Hall (3rd floor)
10:00-17:30
Registration 9:30 to 10:00
17:30-18:30 Exhibition tour

Chair

Sergey Gorny
Laser Center, LTD; Russia

A1. Внедрение передовых лазерных технологий и оборудования в промышленность

27 июня 2012 года

г. Санкт-Петербург, Московский проспект 97а
гостиница Holiday Inn , зал Стенберг (3-й этаж).
Регистрация с 10-00 до 10-30
Начало работы семинара: 10-30
Окончание работы семинара 17-30.
17-30 – 18-30 Посещение выставки.

Руководитель семинара

Сергей Горный
Лазерный центер; Россия

A2. French innovations in the field of optics and photonics with the participation of Optitec cluster, Astrophysics laboratory of Marseille, Condensed matter physics laboratory and companies Imagine Optics, Ivea, Kerdry, Optiwave, Phasics and Sagem Défense Sécurité

26 June 2012 at 11:30 the Levinson Lounge

Workshop facilitator – Ubifrance French agency for international business development (French Embassy) with the support of the OPTITEC competiveness cluster

Speakers :

OPTITEC CLUSTER

The community of more than 188 highly committed members, who play key roles in industrial development, research and higher education in optics/photonics and image processing

- ***Katia MIROCHNICHENKO***

ASTROPHYSICS LABORATORY OF MARSEILLE

One of the most important public research institutes in Europe in the area of astrophysics

- ***Jacques BOULESTEIX***

CONDENSED MATTER PHYSICS LABORATORY

Research center in the different fields of optics

- ***Marc de MICHELI***

SAGEM DÉFENSE SÉCURITÉ

A world or European leader in solutions and services in optronics, avionics, electronics and critical software for the civilian and military markets

- ***Hervé VAYSSADE***

IMAGINE OPTICS

One of the world's leading providers of Shack-Hartmann wavefront sensing hardware and software, adaptive optics technologies and professional services in applied optics

– ***Caroline ADAM***

IVEA

The innovative French company offering complete solutions for elemental analysis by LIBS (Laser Induced Breakdown Spectroscopy)

- ***Dominique GALLOU***

KERDRY

The french company that develops solutions in the fields: metallic coating, photolithography, dielectric coating

- ***Jean-Claude KEROMNES***

OPTIWAVE

The French company that develops optical design software for various industries such as fiber optics, photonics, fiber optic components, photonic band gap

– ***Audrey LE LAY***

PHASICS

French company specialized in high resolution wavefront sensing

- ***Marie Begoña LEBRUN and Yoann PRIOL***

The workshop will be followed by a wine and cheese reception in Levinson lounge.

If you are interested to register to the workshop and/or to have pre-arranged B2B meeting with one of the participant of the French delegation please contact us at pavel.soubbotine@ubifrance.fr, daria.mochalova@ubifrance.fr tel.: +7 495 937 24 71, +7 495 937 24 47.

A3. Nanostructured materials in industry and medicine

CO-CHAIRS:

PONOMAREV A.N. *STC OF APPLIED NANOTECHNOLOGIES, RUSSIA*

BELOUSOVA I.M. *INST. FOR LASER PHYSICS OF VAVILOV SOI CORP., RUSSIA*

29 June 2012 at 09:00 the Petrov-Vodkin 3

09:00-9:20

NANOSTRUCTURED COMPOSITES POLYMER AND MINERAL BINDER BASED AND SYNERGISM OF ITS COMMON USING IN BUILDING INDUSTRY

A.N.Ponomarev; STC of Applied Nanotechnologies Inc., St.Petersburg, Russia

Giant resonance increasing the electric field on the surface of torus-like carbon nanoparticles- Astralenes® are possible to improve the inter phase interaction between the different kinds of mezostructures in matter. It is especially important for the high quality composite concretes and for the polymer composite reinforcing.

In this report same results of application the new light nanoconcretes, its nanocomposite fiber reinforcements and polymer composite coatings are discussed. The main conclusion – the possibilities of using the phenomena of giant forces disperse interactions in concrete solutions and in polymer composites is a very potential tool for developing the high quality new building materials. As it seems to author, the synergism of action of this both factors together is a new possibility for building engineering and building industry.

09:20-09:40

MIKRO- AND NANOSTRUCTURED USING GLASS FIBER TECHNOLOGY.

L.A. Melnikov; State Technical University, Saratov, Russia; TEGS (Technology, Equipment, Glass Structures), Saratov, Russia

The fibers with complicated controllable 2D transverse structure having the element size ranging from hundreds of microns to tens nanometers can be manufactured using the glass fiber technologies. These structures may serve as precursors for true 3D structure producing. The properties of these structures depend on the transverse structure and materials which were used for filling the holes in the glass matrix. In this presentation the details of glass fiber technologies, corresponding machinery, examples and applications of these structures are discussed.

09:40-10:00

HIGH-VELOCITY TECHNOLOGIES OF PRODUCTION NANO-SIZED AND NANOSTRUCTURED POWDER MATERIALS FOR FUNCTIONAL COATINGS AND LASER SYNTHESIS.

B.V.Farmakovskiy, T.I.Bobkova, E.Yu.Burkanova, E.A.Samodelkin, M.A.Yurkov; Federal state unitary enterprise central research institute of structural materials "PROMETEY", St.Petersburg, Russia

The priority technologies of controlled plasma – chemical synthesis and supersonic disintegrator – activation treatment of producing nano-sized and nanostructued composite powders from "metal – metal" and "metal – nonmetal" systems are described. Actual results of producing unique constructive – functional elements, based on the developed powders, using the methods of high-velocity heterophase transfer and laser prototyping are shown.

09:00-9:20

НАНОСТРУКТУРНЫЕ КОМПОЗИЦИИ НА ОСНОВЕ ПОЛИМЕРНЫХ СВЯЗУЮЩИХ И МИНЕРАЛЬНЫХ ВЯЖУЩИХ И СИНЕРГИЗМ ИХ СОВМЕСТНОГО ПРИМЕНЕНИЯ В СТРОИТЕЛЬНОЙ ОТРАСЛИ

А.Н.Пономарев; ЗАО «НТЦ Прикладных Нанотехнологий», С-Петербург, Россия

Гигантское усиление электрического поля вблизи поверхности тороподобных углеродных наночастиц - Астраленов® позволяет управлять межфазным взаимодействием на уровне различных мезаструктур вещества. В докладе обсуждаются результаты использования этих возможностей в новых легких конструкционных бетонах, армированных, в том числе, нанокомпозитной арматурой и в технологии композиционных защитных покрытий. Полученные результаты позволяют сделать выводы о том, что использование явления гигантского резонансного усиления в дисперсионном взаимодействии в бетонных растворах и в технологии полимерных композитов является мощным инструментом в создании новых высококачественных строительных материалов.

09:20-09:40

МИКРО- И НАНОСТРУКТУРЫ, ИЗГОТОВЛЕННЫЕ С ПОМОЩЬЮ СТЕКЛОВОЛОКОННЫХ ТЕХНОЛОГИЙ.

Л.А. Мельников; Саратовский государственный технический университет, Саратов, Россия; ТОСС (Технология, Оборудование, стеклянные структуры), ООО, Саратов Россия

С помощью стекловолоконных технологий можно производить волокна, имеющие заданную сложную двумерную структуру в поперечном сечении с размерами элементов от сотен микрон до десятков нанометров. Эти волокна могут являться основой для производства трехмерных структур. Свойства таких материалов зависят от поперечной структуры и веществ, которыми заполняются каналы в стеклянной матрице. В докладе представлены основные особенности стекловолоконной технологии, соответствующего технологического оборудования, примеры производимых структур и их применения.

09:40-10:00

ВЫСОКОСКОРОСТНЫЕ ТЕХНОЛОГИИ ПОЛУЧЕНИЯ НАНОРАЗМЕРНЫХ И НАНОСТРУКТУРИРОВАННЫХ ПОРОШКОВЫХ МАТЕРИАЛОВ ДЛЯ ФУНКЦИОНАЛЬНЫХ ПОКРЫТИЙ И ЛАЗЕРНОГО СИНТЕЗА.

Б. В. Фармаковский, Т. И. Бобкова, Е. Ю. Бурканова, Е. А. Самоделкин, М. А. Юрков; ФГУП «ЦНИИ КМ «Прометей», С-Петербург, Россия

Описываются приоритетные технологии управляемого плазмохимического синтеза и сверхзвуковой дезинтеграторно - активаторной обработки получения композиционных наноразмерных и наноструктурированных порошков системы «металл - металл» и «металл - неметалл». Показаны реальные результаты создания на основе разработанных порошков уникальных конструкционно-функциональных элементов с использованием методов высокоскоростного гетерофазного переноса и лазерного прототипирования.

A3. Наноструктурированные материалы в промышленности и медицине

РУКОВОДИТЕЛИ СЕМИНАРА:

ПОНОМАРЕВ А.Н. *ЗАО «НТЦ ПРИКЛАДНЫХ НАНОТЕХНОЛОГИЙ», РОССИЯ*

БЕЛОУСОВА И.М. *ФГУП "НПК "ГОИ ИМ. С.И. ВАВИЛОВА", РОССИЯ*

29 июня 2012 в 09:00 в зале Петров-Водкин 3

10:00-10:20

NANOSTRUCTURED MATERIALS FOR OPTOELECTRONIC DEVICES

I.M. Belousova, D.A. Videnichev, O.P. Vinogradova, I.M. Kislyakov, T.D. Murav`eva, A.I. Sidorov; Vavilov SOI Corp., NRU ITMO, St.Petersburg, Russia

Results of development of nonlinear and optical limiters on the basis of nanostructured materials for protection against laser radiation of organs of vision and photodetectors of optoelectronic devices are presented. It is shown that due to various physical principles and applied nanostructural materials a limiting of intensive laser radiation in a wide spectral range can be obtained.

10:20-10:40

APPLICATION OF CARBON NANOMODIFIERS AT A DEVELOPMENT OF NEW COMPOSITES FOR ELECTRIC TRANSPORT.

Abinov A.G., Voynov K.N., Kalinin Y.G., Krautman Y.G., Parsegov S.V., Ponomarev A.N.; Plant Composit, Government Railway University, STC of Applied Nanotechnologies Inc., Russia

In report the results of development the new composite wearing pares, in which the composite material have been modified by carbon nanoparticles – Astralenes. It was received a new composite SPL(N) able to provide a good wear and tear resistance for the details of electrotransports.

10:40-11:00

NANOSTRUCTURES INFLUENCE ON BALK AND SURFACE PROPERTIES OF OPTICAL MATERIALS

N.V.Kamanina; Vavilov SOI Corp., NRU ITMO, Russia

The influence of new nanosensitizers (such as: fullerenes, nanotubes, quantum dots, shungites and graphenes) on photorefractive, photoconductive and dynamic features of organic conjugated structures has been analyzed. Under the Raman-Nath diffraction conditions the questions of nonlinear optical characteristics improvement have been studied via varying both the spatial frequency and the energy density as well as the nanoobjects content.

In the framework of the model based on covalent bonding of carbon nanoobjects on inorganic materials surface, the orientation of nanoobjects, mechanical and polarizing properties have been discussed. Dramatic change of hardness and slight variation of the spectra in the UV an IR range have been established.

- COFFEE BREAK -

10:00-10:20

НАНОСТРУКТУРИРОВАННЫЕ МАТЕРИАЛЫ ДЛЯ ОПТИКО-ЭЛЕКТРОННЫХ ПРИБОРОВ.

И.М. Белоусова, Д.А. Виденичев, О.П. Виноградова, И.М. Кисляков, Т.Д. Муравьева, А.И. Сидоров; ФГУП "НПК "ГОИ им. С.И. Вавилова", ФГБОУ ВПО НИУ "ИТМО", С-Петербург, Россия

Представлены результаты разработки нелинейно-оптических ограничителей на основе наноструктурных материалов для защиты от лазерного излучения органов зрения и фотоприемников оптико-электронных приборов. Показано, что благодаря различным физическим принципам и наноструктурным материалам может быть получено ограничение интенсивного лазерного излучения в широком спектральном диапазоне.

10:20-10:40

ПРИМЕНЕНИЕ УГЛЕРОДНЫХ НАНОМОДИФИКАТОРОВ ПРИ СОЗДАНИИ НОВЫХ КОМПОЗИТОВ ДЛЯ ЭЛЕКТРОТРАНСПОРТА.

Абинов А.Г., Войнов К.Н., Калинин Ю.Г., Краутман Ю.Г., Парсегов С.В., Пономарев А.Н.; ЗАО завод "Композит", ФГБОУ ВПО ПГУПС, ЗАО «НТЦ Прикладных Нанотехнологий», Россия

В докладе приводятся результаты разработки новых композитных пар трения с модификацией композитного материала углеродными наномодификаторами – Астраленами. Создан новый композиционный материал "СПЛсН", обладающий повышенными антифрикционными характеристиками для использования на подвижном составе электротранспорта.

10:40-11:00

О ВЛИЯНИИ НАНОСТРУКТУР НА ОБЪЁМНЫЕ И ПОВЕРХНОСТНЫЕ СВОЙСТВА ОПТИЧЕСКИХ МАТЕРИАЛОВ.

Н.В.Каманина; ФГУП "НПК "ГОИ им. С.И. Вавилова", ФГБОУ ВПО НИУ "ИТМО", Россия

Проанализировано влияние новых наносенсибилизаторов, как-то: фуллеренов, нанотрубок, квантовых точек, шунгитов, графенов – на объёмные свойства органических структур, а именно: на изменение их фоторефрактивных, фотопроводниковых и динамических характеристик. Исследуются вопросы улучшения нелинейных оптических параметров на примере изучения дифракционных откликов органических материалов в режиме дифракции Рамана-Ната на разных пространственных частотах, при варьировании концентрацией наносенсибилизатора и плотностью энергии записи.

Дискутируется влияние, в рамках модели ковалентной «привязки» углеродных нанообъектов к поверхности неорганических и органических оптических материалов, ориентации и типа наообъектов на механические и поляризационные свойства. Установлено изменение прочностных параметров и наличие изменений спектральных характеристик в УФ и ИК-областях спектра.

- КОФЕ -

11:20-11:40

THE WORKS ON LASER NANOTECHNOLOGIES AT ST.PETERSBURG NATIONAL RESEARCH UNIVERSITY OF INFORMATION TECHNOLOGIES,MECHANICS AND OPTICS (NRU ITMO).

V.P. Veiko; NRU ITMO, Russia

The main directions of R&D at NRU ITMO in the field of laser nanotechnologies are :

- micro- and nanostructuring of metal thin films and layers based on local laser oxidation,laser ablation etc,
- laser local modification of structure and properties of amorfous-crystallic materials - glass ceramics, Cr-Cr2O3, Si-SiO2 etc,
- multifunctional nanoprobs (for scanning probe microscopy) made by laser draw and its non-destructive testing,
- laser control of surface microgeometry including laser polishing.

The general characteristic of main results in every direction with practical examples will be done

11:40-12:00

NATIVE TECHNOLOGY OF PATHOGEN INACTIVATION IN PREPARATIONS FROM DONOR BLOOD PLASMA ON THE BASE OF NANOCOMPOSITE PHOTOSENSITIZERS.

T.D. Murav`eva, I.M. Belousova, A.M. Starodubtsev, I.M. Kislyakov, E.A. Selivanov, N.G. Sivakova; Vavilov SOI Corp., NRU of ITMO, Reseach Institute for transfusiology and haematology, Russia

The native technology of an inactivation of pathogens in preparations from donor blood plasma on the basis of use new solid-phase fullerene-containing nanocomposite photosensitizer is developed.

The solid-phase technology of an inactivation based on principles of photodynamic impact on pathogens in preparations from donor blood plasma, will allow to guarantee their virus safety in view of a high efficiency of inactivation. Medical field of application of this technology is hematology and transfusiology. Obtaining safe preparations from donor blood plasma will reduce the risk of transfer haemo-transmitted infections to recipients at a treatment of especially serious illness, such as hemophilia, immunodeficiency, high hemorrhage with a big risk for life of the patient, and others.

The presented technology is commercially viable in view of absence of direct analogs.

12:00-12:20

EPOXY COMPOSITE COATINGS MODIFIED BY CARBON NANOPARTICLES OF TOROIDAL TOPOLOGY.

Yudovich V.M., Ponomarev A.N., Yudovich M.E.; STC of Fpplied Nanotechnologies Inc., Russia

The main characteristics of carbon nanoparticles of the fulleroid nature – Astralenes®, in particular – features of interaction of the last with a field of intermolecular forces and future of creation on the basis of such features of new materials are considered. Perceptivity of use of epoxy resins for development and production of materials of industrial function are stated. Properties of the difficult composite system having the trading name EpoxyPAN® are in detail described. The analysis of scopes of the specified multicomponent system is carried out.

11:20-11:40

РАБОТЫ ПО ЛАЗЕРНЫМ НАНОТЕХНОЛОГИЯМ В САНКТ–ПЕТЕРБУРГСКОМ НАЦИОНАЛЬНОМ ИССЛЕДОВАТЕЛЬСКОМ УНИВЕРСИТЕТЕ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ, МЕХАНИКИ И ОПТИКИ (ИТМО)

В.П. Вейко; ФГБОУ ВПО НИУ "ИТМО", Россия

Многофункциональные нанозонды. Лазерная локальная модификация структуры и свойств аморфно-кристаллических материалов - ситаллы, кремний, хром и др. Микро– и наноструктурирование поверхности тонких пленок и слоев методами абляции, термохимии и др. Лазерная управление микрогеометрией, в том числе лазерная полировка поверхности.

11:40-12:00

ОТЕЧЕСТВЕННАЯ ТЕХНОЛОГИЯ ИНАКТИВАЦИИ ПАТОГЕНОВ В ПРЕПАРАТАХ ИЗ ПЛАЗМЫ ДОНОРСКОЙ КРОВИ НА ОСНОВЕ НАНОКОМПОЗИТНЫХ ФОТОСЕНСИБИЛИЗАТОРОВ

Муравьева Т.Д., Белоусова И.М., Стародубцев А.М., Кисляков И.М., Селиванов Е.А., Сивакова Н.П.; ФГУП "НПК "ГОИ им. С.И. Вавилова", ФГУ НИИ трансфузиологии и гематологии ФМБА, Россия

Разработана отечественная технология инактивации патогенов в препаратах из плазмы донорской крови» на основе использования нового твердофазного фуллерен – содержащего нанокомпозитного фотосенсибилизатора.

Твердофазная технология инактивации, основанная на принципах фотодинамического воздействия на патогенны в препаратах из плазмы донорской крови, позволит гарантировать их вирусную безопасность ввиду высокой эффективности инактивации. Медицинская сфера применения данной технологии – гематология и трансфузиология. Получение безопасных препаратов из плазмы донорской крови снизит риск передачи гемо – трансмиссивных инфекций реципиентам при лечении особо тяжелых заболеваний, таких как гемофилия, недостаточность иммунной системы, высокие кровопотери с большим риском для жизни больного, и других.

Предложенная технология является конкурентно способной ввиду отсутствия прямых аналогов.

12:00-12:20

ЭПОКСИДНЫЕ КОМПОЗИТНЫЕ ПОКРЫТИЯ МОДИФИЦИРОВАННЫЕ УГЛЕРОДНЫМИ НАНОЧАСТИЦАМИ ТОРОИДАЛЬНОЙ ТОПОЛОГИИ.

Юдович В.М., Пономарев А.Н., Юдович М.Е.; ЗАО «НТЦ Прикладных Нанотехнологий», Россия

Рассмотрены основные характеристики углеродных наночастиц фуллероидной природы – Астраленовтм, в частности – особенности взаимодействия последних с полем межмолекулярных сил и перспективность создания на основе таких особенностей новых материалов. Изложена перспективность использования эпоксидных смол для разработки и производства материалов промышленного назначения. Подробно описаны свойства сложной композитной системы, имеющей торговое название ЭпоксиПАНтм. Проведен анализ областей применения указанной многокомпонентной системы.

IOPscience

A4. Trends in scientific publishing

17:30 June 27th, Petrov-Vodkin 2+3 Hall

Nina Couzin,
IOP Publishing, UK

The talk will address issues related to the changing landscape of scientific publishing including new publishing models (ie open access) and what they mean for authors and readers, as well as illustrating new ways in which publishers help researchers to find information they need as well as help them to maximise the impact of their own published work.

Avesta Project Ltd

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Laser-compact group specializes in research, development and manufacturing of diode-pumped solid-state (DPSS) lasers.

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Laser-compact group is the exporter of DPSS lasers to 40 countries worldwide. The main part of the production volume is distributed in Germany, USA and France.

At present time Laser-export Co. (manufacturing company of Laser-compact group) offers Q-switched and CW infrared, green and ultraviolet lasers for use in mass spectrometry (MALDI TOF), laser microdissection, laser microscopy, Raman spectroscopy, interferometry, holography, micro materials processing, LIDAR, industrial & medical alignment/positioning, quality control of crystals etc.

In November 2009 the Quality Management System of Laser-export Co. was certified as compliant with the requirements of ISO 9001:2008.

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Cutting Edge Optronics is the leading provider of high power laser diodes, high power pump modules, and DPSS lasers. It is a vertically integrated manufacturer capable of supplying unmounted diode bars, packaged laser diodes, DPSS modules, laser diode drivers, and complete DPSS laser systems. NG CEO diode laser based products have become industry standards and are used in a wide variety of commercial and military applications.

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РОССИЙСКАЯ АКАДЕМИЯ НАУК

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Prokhorov General Physics Institute (GPI RAS) has experimental facilities making it possible to perform fundamental and applied investigations in different fields of physics. The results of these investigations led in many cases to the development and practical realization of various devices for industry, medicine, and ecology, which have no analogs in the Russian and foreign instrument making.

The institute cooperates with research organizations of 15 countries within the bilateral and interacademic conventions. Joint laboratories with scientific institutions of Canada, Italy, and France have been organized. Up to 300 foreign researchers and experts visit the institute every year.

SOI

Federal State Unitary Enterprise «Research and Development Corporation «Vavilov State Optical Institute» (RDC SOI)

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Federal State Unitary Enterprise «Research and Development Corporation «Vavilov State Optical Institute» (RDC SOI) carries out the research and development new generations of electro-optical systems, optical instruments, materials and technologies in the following basic areas:

- cosmic instrument-making;
- electro-optical systems functioning in diverse spectral ranges and aimed at solving the tasks of the medical, general industrial, and special instrument-making;
- material science and development of new technologies.

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The main activities of Company «Scientific Instruments» are development and manufacturing of laser-optical instruments, equipment for production of next-generation identification documents (e-passports, ID cards, social cards, and other), of analytical X-ray systems, of equipment in forensic science and technological equipment in industry.

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More than 20 years we have been developing and producing custom-made laser systems for industry, medicine and defense applications combined with opto-mechanics, opto-electronics systems for imaging and illuminating. We have comprehensive expertise in fiber instrument production, optical design and simulation of light and matter interaction as a solid basis to develop and produce complex custom solutions combined innovative approach to laser source and beam delivery system. Our recent achievements are laser diode modules 5-150 W, laser systems for precise glass thermal cracking and chamfering, solar simulator, head-up display. We are inventing new ways to use light as an instrument!

Author Index

Name - Initials - Paper Code