22ND INTERNATIONAL CONFERENCE LASER OPTICS ICLO 2026

TECHNICAL PROGRAM

Saint Petersburg
2026

MONDAY, 22 JUNE	
11:00-13:30	**ICLO 2026 - PLENARY SESSION** *CONGRESS HALL "MOSKOVSKY" - FLOOR 1, P.1*
14:15-16:45	**9TH INTERNATIONAL A.M. PROKHOROV SYMPOSIUM ON BIOPHOTONICS - PLENARY SESSION** *CONGRESS HALL "MOSKOVSKY" - FLOOR 1, P.72*
18:00-20:00	**WELCOME RECEPTION** *TOSKANA RESTAURANT - FLOOR 3*

TUESDAY, 23 JUNE					
9:00-11:00		***SYB*** FLUORESCENCE AND FLIM 1 ***PETROV-VODKIN 1*** *P. 75*	***SYC*** PHOTONICS AND NANO-BIOTECHNOLOGY 1 ***PETROV-VODKIN 2*** *P. 77*	***SYA*** ADVANCED LASER MEDICAL SYSTEMS & TECHNOLOGIES 1 ***PETROV-VODKIN 3*** *P. 73*	***R10*** NONLINEAR QUANTUM PHOTONICS 1 ***DEYNEKA*** *P. 12*
11:00-11:30	COFFEE BREAK				
11:30-13:30		**SYB** BLOOD+ LDF+ PHOTOPLETISMOGRAPHY OPTICS ***PETROV-VODKIN 1*** *P. 76*	***SYC*** PHOTONICS AND NANOBIOTECHNOLOGY 2 ***PETROV-VODKIN 2*** *P. 77*	***SYA*** ADVANCED LASER MEDICAL SYSTEMS & TECHNOLOGIES 2 ***PETROV-VODKIN 3*** *P. 73*	***R10*** NONLINEAR QUANTUM PHOTONICS 2 ***DEYNEKA*** *P. 13*
13:30-15:00	LUNCH BREAK				
15:00-17:00	**POSTER SESSION** **R8, SYB** ***CONGRESS HALL MOSKOVSKY*** *P. 18, 79*	**SYB** TISSUE MODIFICATION AND TUMOR TREATMENT ***PETROV-VODKIN 1*** *P. 76*	***SYC*** PHOTONICS AND NANOBIOTECHNOLOGY 3 ***PETROV-VODKIN 2*** *P. 78*	***SYA*** ADVANCED LASER MEDICAL SYSTEMS & TECHNOLOGIES 3 ***PETROV-VODKIN 3*** *P. 74*	***R1*** SOLID STATE LASERS 1 ***DEYNEKA*** *P. 2*
17:00-17:30	COFFEE BREAK				
17:30-19:30	**POSTER SESSION** **R8, SYB** ***CONGRESS HALL MOSKOVSKY*** *P. 18, 79*	MEMORIAL SESSION PROF. REM V. KHOKHLOV ***PETROV-VODKIN 1*** *17:30-19:00*			***R1*** SOLID STATE LASERS 2 ***DEYNEKA*** *P. 2*

WEDNESDAY, 24 JUNE					
9:00-11:00	**POSTER SESSION** **R3, R4, C02** ***CONGRESS HALL MOSKOVSKY*** *P. 35, 38, 112*	**SYB** FLUORESCENCE AND FLIM 2 ***PETROV-VODKIN 1*** *P. 81*	***SYC*** PHOTONICS AND NANOBIOTECHNOLOGY 4 ***PETROV-VODKIN 2*** *P. 84*	***SYD*** PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE 1 ***PETROV-VODKIN 3*** *P. 87*	***SYA*** ADVANCED LASER MEDICAL SYSTEMS & TECHNOLOGIES 4 ***DEYNEKA*** *P. 81*
11:00-11:30	COFFEE BREAK				
11:30-13:30	**POSTER SESSION** **R3, R4, C02** ***CONGRESS HALL MOSKOVSKY*** *P. 35, 38, 112*	**SYB** FLUORESCENCE AND FLIM 3, OCT AND TERAHERTZ 1 ***PETROV-VODKIN 1*** *P. 82*	***SYC*** PHOTONICS AND NANOBIOTECHNOLOGY 5 ***PETROV-VODKIN 2*** *P. 85*	***SYD*** PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE 2 ***PETROV-VODKIN 3*** *P. 88*	***R2*** HIGH POWER LASERS: FIBER, SOLID STATE, GAS, AND HYBRID 1 ***DEYNEKA*** *P. 27*
13:30-15:00	LUNCH BREAK				
15:00-17:00	**POSTER SESSION** **R5, R6, R11, SYA, SYC** ***CONGRESS HALL MOSKOVSKY*** *P. 41, 44, 45, 90, 91*	**SYB** OCT AND TERAHERTZ 2 ***PETROV-VODKIN 1*** *P. 83*	***SYC*** PHOTONICS AND NANOBIOTECHNOLOGY 6 ***PETROV-VODKIN 2*** *P. 86*	***SYD*** PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE 3 ***PETROV-VODKIN 3*** *P. 88*	***R2*** HIGH POWER LASERS: FIBER, SOLID STATE, GAS, AND HYBRID 2 ***DEYNEKA*** *P. 28*
17:00-17:30	COFFEE BREAK				
17:30-19:30	**POSTER SESSION** **R5, R6, R11, SYA, SYC** ***CONGRESS HALL MOSKOVSKY*** *P. 41, 44, 45, 90, 91*	**SYB** EMERGING TECHNIQUES ***PETROV-VODKIN 1*** *P. 84*		MEMORIAL SESSION PROF. INNA M. BELOUSOVA ***PETROV-VODKIN 3*** *17:30-19:00*	***R2*** HIGH POWER LASERS: FIBER, SOLID STATE, GAS, AND HYBRID 3 ***DEYNEKA*** *P. 28*

MONDAY, 22 JUNE

ICLO 2026 - PLENARY SESSION
CONGRESS HALL "MOSKOVSKY" - FLOOR 1, P.1

9TH INTERNATIONAL A.M. PROKHOROV SYMPOSIUM ON BIOPHOTONICS - PLENARY SESSION
CONGRESS HALL "MOSKOVSKY" - FLOOR 1, P.72

WELCOME RECEPTION
TOSKANA RESTAURANT - FLOOR 3

TUESDAY, 23 JUNE

R3 SEMICONDUCTOR LASERS, MATERIALS AND APPLICATIONS 1 ***STENBERG I*** *P. 3*	***R8*** NONLINEAR PHOTONICS: FUNDAMENTALS AND ... 1 ***STENBERG 2*** *P. 8*	***R11*** LASERS FOR SPACE COMMUNICATION AND NAVIGATION 1 ***RICHTER*** *P. 15*		
COFFEE BREAK				
R12 LASER ADDITIVE MANUFACTURING: PROCESSES, MATERIALS AND APPLICATION 1 ***STENBERG I*** *P. 16*	***R8*** NONLINEAR PHOTONICS: FUNDAMENTALS AND ... 2 ***STENBERG 2*** *P. 9*	***R11*** LASERS FOR SPACE COMMUNICATION AND NAVIGATION 2 ***RICHTER*** *P. 15*	***R9*** OPTICAL NANOMATERIALS 1 ***PUDOVKIN*** *P. 10*	
LUNCH BREAK				
R3 SEMICONDUCTOR LASERS, MATERIALS AND APPLICATIONS 2 ***STENBERG I*** *P. 4*	***R4*** LASER BEAM CONTROL 1 ***STENBERG 2*** *P. 6*	***R6*** LASERS AND SYSTEMS FOR IMAGING, ... 1 ***RICHTER*** *P. 7*	***R9*** OPTICAL NANOMATERIALS 2 ***PUDOVKIN*** *P. 11*	
COFFEE BREAK				
R3 SEMICONDUCTOR LASERS, MATERIALS AND APPLICATIONS 3 ***STENBERG I*** *P. 5*	***R4*** LASER BEAM CONTROL 2 ***STENBERG 2*** *P. 7*	***R10*** NONLINEAR QUANTUM PHOTONICS 3 ***RICHTER*** *P. 14*	***R9*** OPTICAL NANOMATERIALS 3 ***PUDOVKIN*** *P. 12*	

WEDNESDAY, 24 JUNE

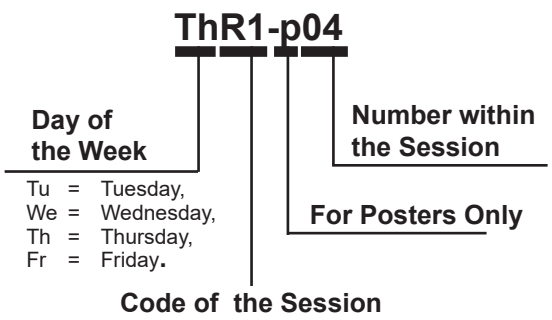
R1 SOLID STATE LASERS 3 ***STENBERG I*** *P. 25*	***R8*** NONLINEAR PHOTONICS: FUNDAMENTALS AND ... 3 ***STENBERG 2*** *P. 32*	***R5*** SUPER-INTENSE LIGHT FIELDS AND ULTRA-FAST PROCESSES 1 ***RICHTER*** *P. 29*	***C01*** CONFERENCE ON OPTICS OF DIELECTRIC, METAL, AND SEMICONDUCTOR NANOSTRUCTURES 1 ***PUDOVKIN*** *P. 102*	***C02*** CHINESE-RUSSIAN INTERNATIONAL SYMPOSIUM ON PHOTONICS 1 ***PIEDMONTE*** *P. 110*
COFFEE BREAK				
R1 SOLID STATE LASERS 4 ***STENBERG I*** *P. 25*	***R8*** NONLINEAR PHOTONICS: FUNDAMENTALS AND ... 4 ***STENBERG 2*** *P. 33*	***R5*** SUPER-INTENSE LIGHT FIELDS AND ULTRA-FAST PROCESSES 2 ***RICHTER*** *P. 30*	***C01*** CONFERENCE ON OPTICS OF DIELECTRIC, METAL, AND SEMICONDUCTOR NANOSTRUCTURES 2 ***PUDOVKIN*** *P. 102*	***A1*** EXHIBITORS WORKSHOP ***PIEDMONTE*** *P. 119*
LUNCH BREAK				
R1 SOLID STATE LASERS 5 ***STENBERG I*** *P. 26*	***R8*** NONLINEAR PHOTONICS: FUNDAMENTALS AND ... 5 ***STENBERG 2*** *P. 34*	***R7*** FREE ELECTRON LASERS 1 ***RICHTER*** *P. 31*	***C01*** CONFERENCE ON OPTICS OF DIELECTRIC, METAL, AND SEMICONDUCTOR NANOSTRUCTURES 3 ***PUDOVKIN*** *P. 103*	***C02*** CHINESE-RUSSIAN INTERNATIONAL SYMPOSIUM ON PHOTONICS 2 ***PIEDMONTE*** *P. 110*
COFFEE BREAK				
R1 SOLID STATE LASERS 6 ***STENBERG I*** *P. 27*		***R7*** FREE ELECTRON LASERS 2 ***RICHTER*** *P. 31*		***C02*** CHINESE-RUSSIAN INTERNATIONAL SYMPOSIUM ON PHOTONICS 3 ***PIEDMONTE*** *P. 111*

THURSDAY, 25 JUNE					
9:00-11:00	**POSTER SESSION** **R1, R10, SYD** ***CONGRESS HALL MOSKOVSKY*** *P. 58, 68, 100*	**SYB** OPTICAL IMAGING MODALITIES + OPTICAL CLEARING 1 ***PETROV-VODKIN 1*** *P. 93*	***SYC*** PHOTONICS AND NANOBIOTECHNOLOGY 7 ***PETROV-VODKIN 2*** *P. 95*	***SYD*** PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE 4 ***PETROV-VODKIN 3*** *P. 97*	***R2*** HIGH POWER LASERS: FIBER, SOLID STATE, GAS, AND HYBRID 4 ***DEYNEKA*** *P. 47*
11:00-11:30	COFFEE BREAK				
11:30-13:30	**POSTER SESSION** **R1, R10, SYD** ***CONGRESS HALL MOSKOVSKY*** *P. 58, 68, 100*	**SYB** OPTICAL IMAGING MODALITIES + OPTICAL CLEARING 2 ***PETROV-VODKIN 1*** *P. 94*	***SYC*** PHOTONICS AND NANOBIOTECHNOLOGY 8 ***PETROV-VODKIN 2*** *P. 96*	***SYD*** PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE 5 ***PETROV-VODKIN 3*** *P. 98*	***R2*** HIGH POWER LASERS: FIBER, SOLID STATE, GAS, AND HYBRID 5 ***DEYNEKA*** *P. 47*
13:30-15:00	LUNCH BREAK				
15:00-17:00	**POSTER SESSION** **R2, R9, C01** ***CONGRESS HALL MOSKOVSKY*** *P. 62, 65, 107*	**SYB** RAMAN SPECTROSCOPY ***PETROV-VODKIN 1*** *P. 94*	***SYC*** PHOTONICS AND NANOBIOTECHNOLOGY 9 ***PETROV-VODKIN 2*** *P. 97*	***SYD*** PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE 6 ***PETROV-VODKIN 3*** *P. 99*	***R10*** NONLINEAR QUANTUM PHOTONICS 4 ***DEYNEKA*** *P. 56*
17:00-17:30	COFFEE BREAK				
17:30-19:30	**POSTER SESSION** **R2, R9, C01** ***CONGRESS HALL MOSKOVSKY*** *P. 62, 65, 107*				***R10*** NONLINEAR QUANTUM PHOTONICS 5 ***DEYNEKA*** *P. 56*

FRIDAY, 26 JUNE					
9:00-11:00					
11:00-11:30	COFFEE BREAK				
11:30-13:30					

EXHIBITION "LASERS AND PHOTONICS"

Congress Hall "Moskovsky" - Floor 1
Tuesday-Thursday, June 23-25 10:00-18:30
Exhibitors: see p. 120



1. The first two letters of the code indicate the day of the week:
   Tu = Tuesday, **We** = Wednesday,
   Th = Thursday, **Fr** = Friday.
2. The next characters indicate code of the session.
   R = regular session, **W** = workshop, **SY** = Symposium, **C** = accompanying Conference
3. The number at the end of the code gives the position of the paper within the session (first, second, third, etc.).
4. Index «**p**» before the number indicates the poster session.
   For example, a session numbered **ThR1-p04** would indicate that this paper is to be presented at Thursday, at session R1, it is a poster paper and is the fourth paper presented during the session.

THURSDAY, 25 JUNE				
R5 SUPER-INTENSE LIGHT FIELDS AND ULTRA-FAST PROCESSES 3 ***STENBERG I*** *P. 50*	***R8*** NONLINEAR PHOTONICS: FUNDAMENTALS AND ... 6 ***STENBERG 2*** *P. 53*	***R9*** OPTICAL NANOMATERIALS 4 ***RICHTER*** *P. 55*	***C01*** CONFERENCE ON OPTICS OF DIELECTRIC, METAL, AND SEMICONDUCTOR NANOSTRUCTURES 4 ***PUDOVKIN*** *P. 104*	***C02*** CHINESE-RUSSIAN INTERNATIONAL SYMPOSIUM ON PHOTONICS 4 ***PIEDMONTE*** *P. 115*
COFFEE BREAK				
R5 SUPER-INTENSE LIGHT FIELDS AND ULTRA-FAST PROCESSES 4 ***STENBERG I*** *P. 51*	***R8*** NONLINEAR PHOTONICS: FUNDAMENTALS AND ... 7 ***STENBERG 2*** *P. 54*	***R4*** LASER BEAM CONTROL 3 ***RICHTER*** *P. 48*	***C01*** CONFERENCE ON OPTICS OF DIELECTRIC, METAL, AND SEMICONDUCTOR NANOSTRUCTURES 5 ***PUDOVKIN*** *P. 104*	***C02*** CHINESE-RUSSIAN INTERNATIONAL SYMPOSIUM ON PHOTONICS 5 ***PIEDMONTE*** *P. 115*
LUNCH BREAK				
R5 SUPER-INTENSE LIGHT FIELDS AND ULTRA-FAST PROCESSES 5 ***STENBERG I*** *P. 51*	***R8*** NONLINEAR PHOTONICS: FUNDAMENTALS AND ... 8 ***STENBERG 2*** *P. 54*	***R4*** LASER BEAM CONTROL 4 ***RICHTER*** *P. 49*	***C01*** CONFERENCE ON OPTICS OF DIELECTRIC, METAL, AND SEMICONDUCTOR NANOSTRUCTURES 6 ***PUDOVKIN*** *P. 105*	***C02*** CHINESE-RUSSIAN INTERNATIONAL SYMPOSIUM ON PHOTONICS 6 ***PIEDMONTE*** *P. 116*
COFFEE BREAK				
R5 SUPER-INTENSE LIGHT FIELDS AND ULTRA-FAST PROCESSES 6 ***STENBERG I*** *P. 52*		***R4*** LASER BEAM CONTROL 5 ***RICHTER*** *P. 49*		***C02*** CHINESE-RUSSIAN INTERNATIONAL SYMPOSIUM ON PHOTONICS 7 ***PIEDMONTE*** *P. 117*

FRIDAY, 26 JUNE				
	R8 NONLINEAR PHOTONICS: FUNDAMENTALS AND ... 9 ***STENBERG 2*** *P. 70*		***C02*** CHINESE-RUSSIAN INTERNATIONAL SYMPOSIUM ON PHOTONICS 8 ***PUDOVKIN*** *P. 118*	
COFFEE BREAK				
			C02 CHINESE-RUSSIAN INTERNATIONAL SYMPOSIUM ON PHOTONICS 9 ***PUDOVKIN*** *P. 118*	

SIDE-EVENTS & WORKSHOPS

A1. EXHIBITORS WORKSHOP

Official Language: Russian/English
Wednesday, 24 June 11:30-13:30 - Piedmonte Room, Floor 3
see p. 119

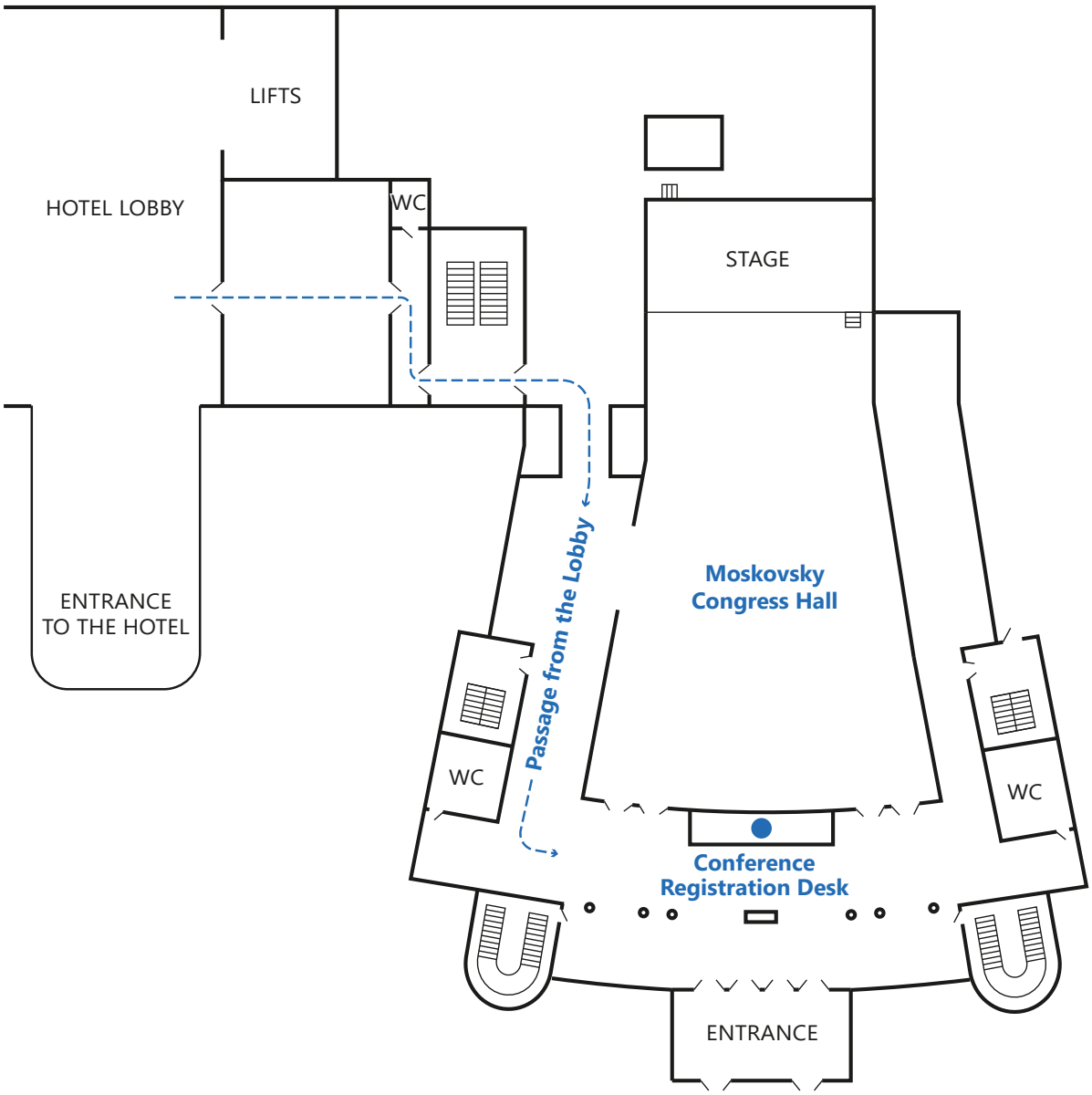
A2. SEMINAR OF SC LLS "MODERN LASER SYSTEMS: COMPONENTS, FABRICATION, METROLOGY"

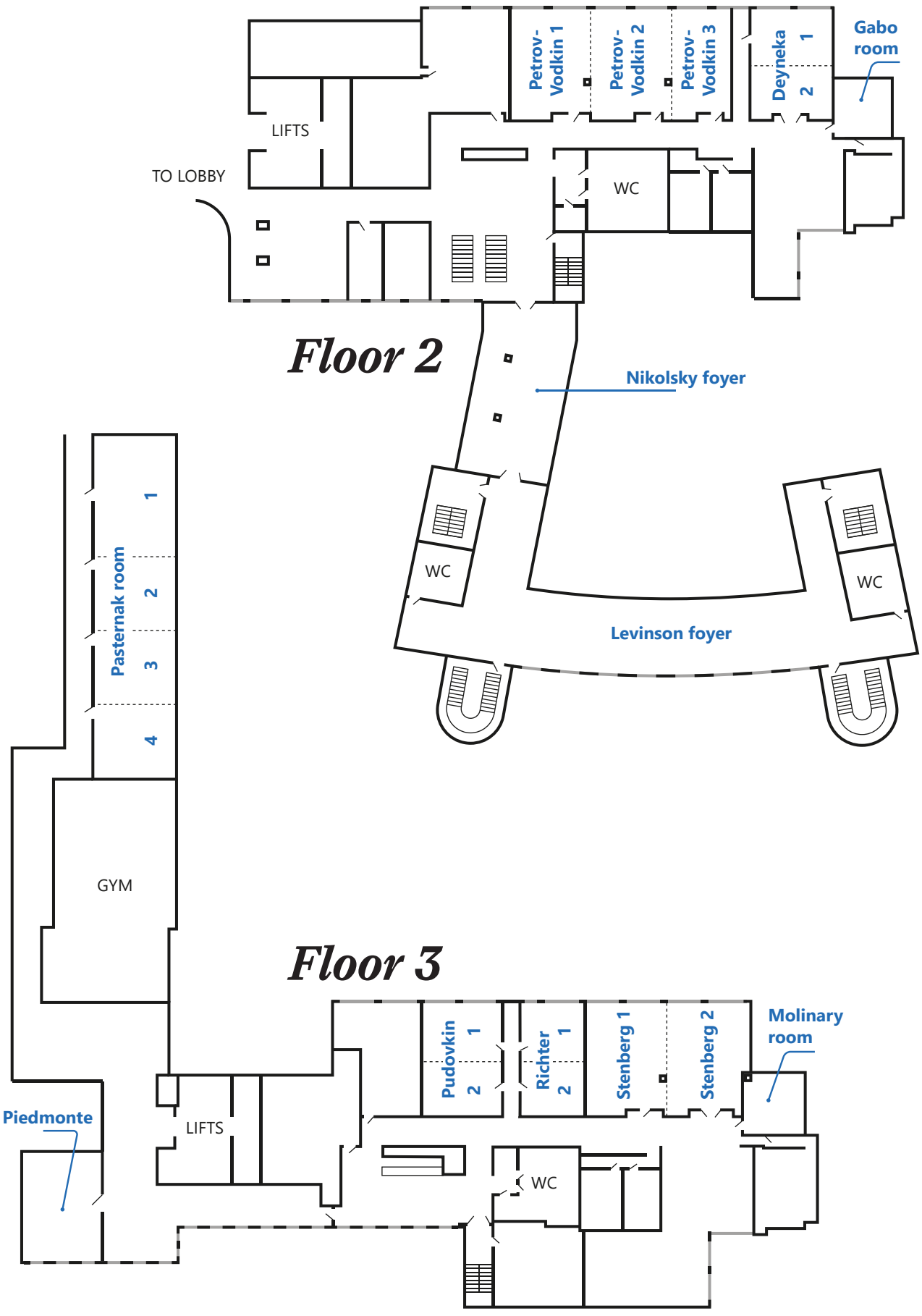
Official Language: Russian
Thursday, 25 June 11:30-13:30 - Pasternak Room, Floor 3

A3. OPEN MEETING OF THE TECHNICAL COMMITTEE FOR STANDARTIZATION 296 "OPTICS AND PHOTONICS" (TK 296)

Official Language: Russian
Thursday, 25 June 16:00-18:00 - Pasternak Room, Floor 3

Floor 1


LIFTS
HOTEL LOBBY
WC
STAGE
ENTRANCE
TO THE HOTEL
Passage from the Lobby
Moskovsky
Congress Hall
WC
WC
Conference
Registration Desk
ENTRANCE


Floor 2
Petrov-Vodkin 1
Petrov-Vodkin 2
Petrov-Vodkin 3
Deyneka 1
Deyneka 2
Gabo room
LIFTS
TO LOBBY
WC
Nikolsky foyer
WC
WC
Levinson foyer
Pasternak room 1
Pasternak room 2
Pasternak room 3
Pasternak room 4
GYM
Floor 3
Pudovkin 1
Pudovkin 2
Richter 1
Richter 2
Stenberg 1
Stenberg 2
Molinary room
Piedmonte
LIFTS
WC

9TH INTERNATIONAL A. M. PROKHOROV SYMPOSIUM ON BIOPHOTONICS

PLENARY SESSION

Location: Moskovsky Congress Hall, floor 1

14:15–14:30 **Opening and welcome remarks**
Ivan A. Shcherbakov,
Prokhorov General Physics Institute of RAS, Russia

14:30–15:15 **Quantum sensorics for biology and medicine**
Alexander Sergeev,
National Center for Physics and Mathematics, Russia

15:15–16:00 **Phototheranostics in the treatment of high-energy exposure wounds**
Igor Reshetov,
Institute of Cluster Oncology named after Professor L.L. Levshin Sechenov University, Russia

16:00–16:45 **Optical imaging in regenerative medicine**
Elena V. Zagainova
Lopukhin Federal Research and Clinical Center of Physical-Chemical Medicine, Russia

Quantum sensorics for biology and medicine

ALEXANDER SERGEEV
National Center for Physics and Mathematics, Russia

Short bio

Scientist in the field of laser physics, femtosecond optics, theory of nonlinear wave phenomena, plasma physics and biophotonics.

Born on August 2, 1955 in the village of Buturlino, Nizhny Novgorod Region.

In 1977, he graduated from the Department of Radio Physics at Gorky State University named after N. I. Lobachevsky (now the National Research Lobachevsky State University of Nizhny Novgorod, NNSU) with a degree in radio physics. He started his carrier as a research intern at the Institute of Applied Physics of the USSR Academy of Sciences.

In 2003 he was elected a corresponding member, and in 2016, he was elected an academician of the Russian Academy of Sciences. From 2017 to 2022, he was the President of the Russian Academy of Sciences.

Since October 2022 he has been appointed Scientific Director of the National Center for Physics and Mathematics.

Awards and Recognition:

State Prize of the Russian Federation in Science and Technology (1999)

Order of Honour (2006)

Government Prize of the Russian Federation in Science and Technology (2012)

Gruber Prize in Cosmology (as part of the LIGO collaboration) (2016)

Officer of the Order of the Academic Palms, France (2018)

Laureate of the International Medal “For Contribution to the Development of Nanoscience and Nanotechnology” awarded by UNESCO (2018)

Order of Merit for the Fatherland, 4th Class (September 10, 2020) – for significant contribution to the development of science and many years of fruitful work

Medal “In Commemoration of the 800th Anniversary of Nizhny Novgorod” (2021)

Honorary Citizen of the Nizhny Novgorod Region (2021)

The A. M. Prokhorov Gold Medal (September 19, 2023)

Order of Alexander Nevsky (February 5, 2024)

Abstract

Quantum sensing (Q-Sens) utilizes quantum phenomena—such as quantized energy levels in microscopic objects, the quantum states of light and fields, superposition, and entanglement—to create ultra-sensitive and precise sensors. This field can be broadly divided into two complementary approaches: (1) The use of single quantum objects (photons, atoms, molecules, nanoparticles, quantum dots, color centers, Josephson junctions) as sensitive, often optical, probes; and (2) The development of macroscopic devices for detecting quantum processes (e.g., single-photon detectors, spectrometers, microscopes). These methods and devices measure physical quantities like temperature, magnetic fields, time, or gravity with unmatched sensitivity and accuracy, surpassing classical limits. They are enabling breakthroughs in quantum computing, telecommunications, metrology, navigation, medical imaging.

Here, we examine the state of the art in the fields of single-photon detection, optics, lasers, chemistry, and nanofabrication, focusing on their applications in quantum sensing. Subsequently, we will concentrate on the adoption of Q-Sens in the life sciences. Specifically, we will discuss:

• Label-based fluorescence nanoscopy, including applications in living cells, three-dimensional imaging (with adaptive optics), fluorescence lifetime imaging, and quantum ghost imaging with correlated photons;

• Theranostics with nanoparticles and targeted drug delivery;

• Surface-enhanced Raman scattering and photoluminescence for ultra-sensitive medical analytics (e.g., in flow cytometry);

• Diamonds with color centers for intracellular thermometry and magnetometry, applicable to encephalography and cardiography;

• Physical chemistry and innovative fabrication techniques for new types of labels and structures, such as biomimetic molecules, nanolithography, genetic encoding, and DNA origami.

Special attention will be given to optical tomography of scattering biological tissues and multispectral fluorescence in vivo bioimaging for preclinical studies, which utilize modern single-photon detectors.

Phototheranostics in the treatment of high-energy exposure wounds

IGOR RESHETOV

Institute of Cluster Oncology named after Professor L. L. Levshin Sechenov University, Russia

Abstract

Purulent wounds treatment of soft tissues is associated with certain difficulties, which are caused by multiple factors, including occurrence, formation and wound nature specificities. Purulent complications significantly increase a treatment time and a process cost. We propose the problem solution of antibiotic-resistant microflora decontamination using technology based on fluorescent diagnostics and photodynamic inactivation (PDI). As nanocarriers, the photosensitizer ethosomes were used. Due to its neutral charge and spherical shape, the nanoparticles were able to penetrate through skin barrier and destroy pathogenic microorganisms.

150 patients were received PDI technology treatment of purulent wounds. Before and after irradiation, microflora composition and quantity were analyzed. The obtained data evidenced that local application of Photoran E6 and PDI technology inactivate both Gram-positive and Gram-negative bacteria. The use of photosensitizer nanocarriers led to obtain a quantitative decrease of bacterial growth in the wound of all patients and reduce the healing time of wounds.

PDI technology using application of photosensitizer nanocarriers showed high antimicrobial activity against antibiotic-resistant microflora of infected wounds in most clinical instances. The decontamination of microflora enabled to perform delayed reconstructive plastic surgery to close soft tissue defects and reduce hospitalization time of patients.

Short bio

Dr. Igor V. Reshetov graduated from the N.I.Pirogov Moscow Medical University University in 1987 and obtained PhD in 1992. Then he continued work in P.A.Herzen Cancer Research Institute. He defended doctoral dissertation about oncology microsurgical reconstruction organs and tissues in 1998. Afterwards he relocated in Sechenov University in 2014. Nowadays he has the position of Director Institute cluster oncology from 2019. As a recognized leader of oncology treatment and rehabilitation, he joined the Russian Academy of Science in 2004 and became the RAS fellow in 2016. He has published more than 100 investigation articles in SCI(E) journals. Index Hi 26.

Optical imaging in regenerative medicine

ELENA V. ZAGAINOVA

Lopukhin Federal Research and Clinical Center of Physical-Chemical Medicine, Russia

Short bio

Elena Zagaynova is a Vice director of Lopuchin Federal Research and Clinical Center of physical-chemical medicine (FMBA).

Prof. Elena Zagaynova's research focus is on the methods of the latest optical bioimaging from the subcellular level to the patient for the problems of regenerative medicine and oncology and the clinical applications in endoscopy for optical coherence tomography.

She received her Ph.D. in 2000 and the Dr. Sciences in Medicine in 2007 from the Nizhny Novgorod Medical Academy, Russia. She is a corresponding member of the Russian Academy of Science.

Prof. Zagaynova is a Senior Member of SPIE society. The results obtained by Elena Zagaynova have been published in more than 280 scientific papers in peer-reviewed journals.

Abstract

Regenerative medicine includes the creation of tissue-engineered constructs, stimulation of organ regeneration, the development of cellular products from iPSCs, and CRISPR technologies. In our studies, optical imaging enabled intravital sorting of properly differentiated cells into adipogenic, chondrogenic, and osteogenic lines from mesenchymal stem cells—laying the foundation for future label-free cell sorting. We were able to track skin formation in recipients from transplanted equivalents—controlling the structure and quality of transplanted tissue-engineered constructs. We analyzed the metabolic and oxygen status of 3D neurospheres from iPSCs, energy metabolism, and intracellular pH changes in neural spheroids carrying Down syndrome—a 3D organ model for drug testing. We determined metabolic changes in living Langerhans islets, which allowed us to select the highest-quality ones for patient transplantation. We also formulated new FLIM and OCT criteria for intraoperative verification of the effectiveness of resected liver regeneration—prognosis and determination of the critical volume of organ resection.

9TH INTERNATIONAL A. M. PROKHOROV SYMPOSIUM ON BIOPHOTONICS

SYP. SYMPOSIUM ON BIOPHOTONICS - PLENARY

Location: Congress Hall, Floor 1; Monday, June 22, 2026

SYP. SYMPOSIUM ON BIOPHOTONICS - PLENARY

MoSYP-01 14:30-15:15

Quantum sensorics for biology and medicine *(Plenary)*

A. Sergeev[1], A. Naumov[2]; [1]National Center for Physics and Mathematics (NCPM), [2]Lebedev Physical Institute RAS, Russia

The talk provides an overview of the basic principles, advantages, and future prospects of quantum sensing in biomedicine. It covers key techniques for single-photon detection and spectroscopy (absorption, photoluminescence, Raman) of single quantum emitters, as well as associated microscopy and nanoscopy methods. Furthermore, it discusses the instruments and methodologies derived from these techniques for the detection, imaging, and characterization of biological objects and tissues.

MoSYP-02 15:15-16:00

Phototheranostics in the treatment of high-energy exposure wounds *(Plenary)*

I.V. Reshetov[1], T.N. Pisareva[1], M.P. Ivankov[2], N.A. Kalyagina[3,4], K.T. Efendiev[3,4], A.M. Udineev[4], D.V. Yakovlev[3,5], A.V. Meshkov[2], V.B. Loshenov[3,4], A.A Shiryaev[1]; [1]Sechenov First Moscow State Medical University, Department of Oncology, Radiotherapy and Reconstructive Surgery, University Clinical Hospital No.[1], [2]Federal State Budgetary Institution 'A.A. Vishnevsky National Medical Research Centre for Military Medicine', Ministry of Defence of Russia, [3]Prokhorov General Physics Institute of RAS, [4]National Research Nuclear University "MEPhI", [5]Shemyakin-Ovchinnikov Institute of Bioorganic Chemistry, RAS, Russia

We propose a method to address the problem of inactivating antibiotic-resistant microflora using a technology based on fluorescence diagnostics and photodynamic therapy (PDT). This study investigated the influence of irradiation parameters and the method of photosensitizer application on the photodynamic inactivation (PDI) of the microflora on the wound surface.

MoSYP-03 16:00-16:45

Optical imaging in regenerative medicine *(Plenary)*

E.V. Zagaynova[1,2], A.V. Meleshina[2], D.S. Kuznetsova[2], S.A. Rodimova[2], A.S.Kashirina[2], P.S. Ermakova[2] , V.I. Shceslavskiy[2,4], G. Gelikonov[5]; [1]Lopukhin Federal Research and Clinical Center of Physical-Chemical Medicine, [2]Institute of Biomedical Technologies, Privolzhskiy Medical Research University, [3]Nizhny Novgorod Regional Clinical Oncological Dispanceyr, Russia; [4]Becker and Hickl GmbH, Germany; [5]A.V. Gaponov-Grekhov Institute of Applied Physics of RAS, Russia

Regenerative medicine includes the creation of tissue-engineered constructs, stimulation of organ regeneration, the production of cellular products from iPSCs, and CRISPR technologies. Using optical imaging, we sorted differentiated cells from MSCs, verified the structure of the transplanted tissue equivalent, identified Langerhans islets suitable for transplantation, and formulated optical criteria for effective liver regeneration for intraoperative assessment.

SYA. SECTION A. ADVANCED LASER MEDICAL SYSTEMS AND TECHNOLOGIES

Location: Petrov-Vodkin 3 Room, Floor 2; Tuesday, June 23, 2026

SYA. SECTION A. ADVANCED LASER MEDICAL SYSTEMS AND TECHNOLOGIES 1

Session Chair: Vladimir A. Duvanskiy, Peoples' Friendship University of Russia, Russia

TuSYA-01 09:00-09:30

Optimization of methods for processing venous bed images obtained using visible and infrared radiation sources *(Invited paper)*

K.V. Prosvirin, P.A. Ryabochkina, M.V. Gerasimov; Department of Photonics, National Research Ogarev Mordovia State University, Russia

We propose a dual-spectral pipeline for venous bed visualization combining visible (VIS) and near-infrared (NIR) images captured by two cameras with a shared lens and dichroic beam splitter, providing pixel-level alignment. Processing has two stages: dual-spectral combination with local contrast enhancement, then vessel segmentation using multi-scale Frangi filtering. Experiments on manually annotated images show improved segmentation quality over a single-channel NIR baseline.

TuSYA-02 09:30-10:00

Laser-activated irrigation of infected acute and chronic wounds *(Invited paper)*

I.A. Abushkin[1], V.M. Chudnovsky[2], M.A. Guzev[3], A.E. Anchugova[4], A.M. Plantus[5]; [1]Center for Medical Laser Technologies, [2]Pacific Oceanological Institute in V.I. Ilyichev, [3]Institute of Applied Mathematics, [4]Chelyabinsk State University, [5]North-West District Scientific Clinical Center in L.G. Sokolov, Russia

It is shown that during laser cavitation at the end of the optical fiber located in the tube, when the end of the fiber and the tube are near the bottom of the cuvette with water, a suction effect occurs. The use of the identified effect in medicine helps to effectively treat acute and chronic infected wounds.

TuSYA-03 10:00-10:30

The effect of LED liver therapy on the clinical and biochemical characteristics of drug induced toxic hepatitis in tuberculosis patients *(Invited paper)*

S. D. Nikonov[1,2,4], A. P. Mayorov[3], L. G. Daudova[1], N. F. Davidovich [2], D. A. Bredikhin[1], T. S. Geleskul[2], N. V Miller[2]; [1]Novosibirsk State University, [2]Novosibirsk Regional Clinical Tuberculosis Hospital, [3]Institute of Laser Physics, SB RAS, [4]Novosibirsk TB Research Institute of the Ministry of Health of the Russian Federation, Russia

With a reported efficacy of only 54 % in TB chemotherapy (WHO, 2018), treatment outcomes are significantly limited by toxicityof anti-tuberculosis drugs. The development of toxic hepatitis (TH) as a consequence ofmedication necessitates chemotherapy (CT) cessation and transition to hepatotropic therapy, consequently increasing hospital length of stay and reducing overall treatment success. LED therapies for TH currently lack pathogenetic validation.

TuSYA-04 10:30-10:45

Temperature control during laser lithotripsy: thermochromic fiber for thulium fiber laser

D.E. Lesnykh[1], O.I. Baytsaeva[1], V.V. Zefirov[2], M.G. Mukhin[1], E.A. Shirshin[2], V.A. Andreeva[1]; [1]VPG Laserone, [2]Lomonosov Moscow State University, Russia

High-power laser lithotripsy carries a risk of overheating the irrigation fluid and surrounding tissue. A thermochromic fiber has been developed for the thulium fiber laser (TFL) to provide real-time visual temperature feedback. This in vitro study characterized its response, demonstrating a distinct color transition at a specific irrigation fluid temperature.

TuSYA-05 10:45-11:00

Comprehensive evaluation of a 3050-nm fiber laser for ablative fractional resurfacing in dermatology

V. Arkhipova[1], A. Mimov[2], V. Smolyannikova[3], I. Konstantinova[4], I. Larionov[1], V. Andreeva[1]; [1]VPG LaserONE, [2]TORI Clinic, [3]Sechenov University, [4]RUDN University, Russia

In presented study, we evaluated a novel laser emitting at a wavelength of 3050 nm. We analysed its effect on skin ablation and regeneration. Our data show that this system has a strong tissue regenerative effect and a great potential for use in dermatology.

- Coffee Break -

Location: Petrov-Vodkin 3 Room, Floor 2; Tuesday, June 23, 2026

SYA. SECTION A. ADVANCED LASER MEDICAL SYSTEMS AND TECHNOLOGIES 2

Session Chair: Vladimir P. Minaev, IRE-Polus Ltd., Russia

TuSYA-06 11:30-12:00

The automatic optical tissue recognition function in a super-pulsed thulium fiber laser: clinical application *(Invited paper)*

O.I. Baytsaeva[1], P.A. Ibragimova[1], D.E. Lesnykh[1], A.G. Martov[2,3], V.A. Andreeva[1]; [1]Department of Laser Technologies in Medicine, VPG LaserONE, [2]Urological Center, the Central Clinical Hospital of Civil Aviation, [3]Department of Urology and Andrology, IPPE of A.I. Burnazyan SSC FMBC, FMBA of Russia, Russia

This study evaluated the Tissue Sensor (TS), an automatic optical tissue recognition system in a super-pulsed thulium fiber laser (SP TFL), during lithotripsy in 60 patients. The TS actively prevented off-target radiation, significantly reducing thermal mucosal injuries without high-grade complications. Most procedures reported no significant impact on operative duration, demonstrating improved safety without compromising efficiency.

TuSYA-07 12:00-12:30

Laser beam characteristics for optimization of stereotactic interstitial hyperthermia of cerebral gliomas *(Invited paper)*

O.V. Ostreiko; Pavlov University, Russia

The characteristics of laser radiation optimal for minimally invasive laser hyperthermia of cerebral gliomas (LITT) are presented. The results are based on scientific research conducted at Pavlov University. An original LITT technique based on zonal coagulation of intracerebral tumors has been developed. The technique has been clinically tested by the Ministry of Health. It is used at Pavlov University. The experience of more than 70 operations demonstrates the good effectiveness and safety of the developed LITT method.

TuSYA-08 12:30-12:45

A fluorescent dye -based temperature sensor for intraoperative liquid temperature monitoring

H. Afraa[1], N.V. Korneva[1], I.R. Andrievskiy[1], S.O. Shiriaev[2], D.A. Davydov[1], G.S. Budylin[2], E.A. Shirshin[1]; [1]Department of Quantum Electronics, Faculty of Physics, Lomonosov Moscow State University, [2]Biomedical Science and Technology Park, Laboratory of Clinical Biophotonics, First Moscow State Medical University, Russia

Real-time temperature monitoring is crucial during endoscopic laser lithotripsy to prevent urothelial damage. We present an all-optical Methylene Blue-based thermal sensor enabling fiber-optic measurements in saline solution. Temperature-dependent dye optical properties allow simple, biocompatible, and real-time monitoring, providing a practical solution for intraoperative control in minimally invasive urinary tract procedures.

TuSYA-09 12:45-13:00

ML -based prediction model of laser ablation morphology in biological tissues

G.A. Filokhin[1,2], N.V. Kovalenko[1,2]; [1]MIPT, [2]Fryazino branch of the Kotelnikov IRE of RAS, Russia

A predictive model for the morphology of laser ablation columns in biological tissues has been built using machine learning methods. A laboratory setup was developed to collect data in phantoms (40 g/l gelatin gel) using a thulium laser (wavelength 1942 nm) for various pulse powers (2.5--5.0 W) and durations (0.1--0.3 ms). The model demonstrated prediction errors of 14\% for depth and 8\% for diameter.

TuSYA-10 13:00-13:15

Development of a spectral optical coherence tomography system enhanced with AI algorithms

A.M. Tarasov, E.A. Chudakov, L.V. Chernov, I.I. Gogin, M.P. Kalinin, L.U. Sheremeto, D.A. Tinyakov, A.S. Matveenko, M.A. Klychnikov, D.S. Ponomarenko; [1]Russian Federal Nuclear Center All-Russian Research Institute of Experimental Physics, Russia

A model of a spectral OCT device for ophthalmology is presented. The model includes an optical layout and a digital processing unit with AI algorithms for real-time retinal analysis. The development aims at creating a compact device with improved diagnostic accuracy and automated data interpretation.

TuSYA-11 13:15-13:30

New approaches to optical temperature measurement in endovenous laser coagulation

O.V. Pykhtina[1], V.A. Arkhipova[1], N.R. Rovnyagina[2], G.S. Budylin[2], V.V. Zefirov[3], E.A. Shirshin[3], V.A. Andreeva[1]; [1]VPG LaserOne, [2]Sechenov First Moscow State Medical University, [3]Lomonosov Moscow State University, Russia

This study presents a fiber-optic instrument with a temperature-sensitive coating designed to monitor the temperature in the area of laser exposure during endovenous laser coagulation. We demonstrated localized heating measurement in the fiber area and temperature extrapolation to the vein wall, a capability which will enable adjustment of radiation parameters for controlled thermal exposure during clinical application.

- Lunch Break -

Location: Petrov-Vodkin 3 Room, Floor 2; Tuesday, June 23, 2026

SYA. SECTION A. ADVANCED LASER MEDICAL SYSTEMS AND TECHNOLOGIES 3

Session Chair: David G. Kochiev, Prokhorov General Physics Institute RAS, Russia

TuSYA-12 15:00-15:30

Laser photodestruction for the treatment of pyogenic granuloma in children *(Invited paper)*

E.N. Gasanova, A.V. Bryantsev, A. G. Dorofeev, O.O. Sarukhanyan; Clinical and Research Institute of Emergency Pediatric Surgery and Trauma - Dr. Roshal's Clinic (CRIEPST), Russia

Novel method of combined laser photodestruction using 0.97 μm wavelength radiation for the radical treatment of pyogenic granuloma in pediatric patients.

TuSYA-13 15:30-16:00

All-optical detection of temperature and distance to fiber in laser surgery *(Invited paper)*

G. Budylin[1], S. Shiriaev[1], D. Fain[2], V. Andreeva[2], V. Panov[2], E. Shirshin[2]; [1]Laboratory of Clinical Biophotonics, Sechenov First Moscow State Medical University, [2]Faculty of Physics, M.V. Lomonosov Moscow State University, Russia

We report first experiments on a compact single-fiber near-infrared diffuse reflectance approach for intraoperative feedback in laser lithotripsy. Water absorption features in the irrigated field are leveraged to provide qualitative estimates of fiber-to-target proximity and local temperature trends using the same fiber for delivery and collection. Preliminary tests support feasibility for real-time guidance and safety monitoring.

TuSYA-14 16:00-16:30

Real-time stone composition detection with an AI-based laser-integrated lithotripsy vision system *(Invited paper)*

P. Ibragimova[1], O. Baytsaeva[1], I. Golubev[1], D. Lesnykh[1], T. Khramov[1], A. Martov[2,3,4], V. Andreeva[1]; [1]VPG LaserONE, [2]Urological Center of the Central Clinical Hospital of Civil Aviation, [3]Department of Urology and Andrology, IPPE of A.I. Burnazyan SSC FMBC, FMBA of Russia, [4]Medical Research and Education Institute, M.V. Lomonosov Moscow State University, Russia

In this study we developed a deep-learning computer-vision model embedded in the Urolase Vision System to detect and classify urinary stones from intraoperative endoscopic video in real time, supporting thulium fiber laser (TFL) parameter selection. Trained and tested on clinically sourced videos with lab-confirmed fragments, the model achieved mAP50 ≈ 87.5% across urate, COM, COD, and phosphate stones.

TuSYA-15 16:30-16:45

Are visible femtosecond laser pulses safe for trophectoderm biopsy of mammalian embryo?

D.S. Sitnikov[1], M.A. Filatov[2], V.S. Agentova[1], M.V. Kubekina[2], Y.Y. Silaeva[3]; [1]Joint Institute for High Temperatures of RAS, [2]Center for Precision Genome Editing and Genetic Technologies for Biomedicine, IGB RAS, [3]Core Facility Centre, IGB RAS, Russia

Femtosecond laser pulses (514 nm, 280 fs, 16 TW/cm2) are used for trophectoderm biopsy of mouse embryos at a blastocyst stage for the first time. Expression of heat shock proteins (HSPs) and reactive oxygen species (ROS) are used as markers for induced biological effects. Biopsy procedure did not increase ROS level. However, some increase in HSP caused by laser exposure is observed.

TuSYA-16 16:45-17:00

Differentiation of biliary tract tissue and stones based on DRS spectroscopy in laser lithotripsy

E.S. Ermilova[1,2], O.I. Baytsaeva[2], M.V. Murashkina[3], N.R. Rovnyagina[4], E.A. Shirshin[5], V.A. Andreeva[2]; [1]National Research Nuclear University MEPhI, [2]Department of Laser Technologies in Medicine, VPG LaserONE, [3]City Clinical Hospital No.[31] named after Academician G.M. Savelyeva, [4]Sechenov First Moscow State Medical University, [5]M.V. Lomonosov Moscow State University, Russia

Study adapted Tissue Sensor algorithm from urology TFL lithotripsy for safe bile duct procedures to prevent wall perforation. DRS spectra from 25 clinical cases analyzed: tissue shows hemoglobin absorption peaks, stones exhibit smooth monotonic decay. Achieved 100% differentiation accuracy via spectral ratio analysis. System automatically terminates laser emission upon soft tissue detection ahead of fiber.

TuSYA-17 17:00-17:15

Exploring ring gas laser for biomedical research

I.A. Smetanin, A.O. Sinelnikov, E.A. Smetanin, A.A. Kuznetsova; RUDN University, Russia

Ring laser gyroscopes (RLG) with vibration suspension show promise for cardioseismic diagnostics. This study assessed their feasibility for detecting cardiac mechanical activity. An experimental setup evaluated RLG sensitivity to external disturbances with cardiographic spectra. Results confirm the RLG effectively registers cardiac signals, supporting its practicality for non-invasive cardiovascular monitoring.

SYB. SECTION B. LASER INTERACTION WITH CELLS AND TISSUES: CLINICAL IMAGING AND SPECTROSCOPY

Location: Petrov-Vodkin 1 Room, Floor 2; Tuesday, June 23, 2026

SYB. SECTION B. FLUORESCENCE AND FLIM 1

Session Chair: Alexander V. Priezzhev, Lomonosov Moscow State University, Russia

TuSYB-01 09:00-09:30

Autofluorescence of intrinsic chromophores in various environments: towards monitoring of redox reactions in living cells *(Invited paper)*

O.S. Vasyutinskii[1], A.V. Belashov[1], A.A. Zhikhoreva[1], F. Lin[2], Z. Huang[2], I.V. Semenova[1], J. Qu[2], E.A. Glazkova[1]; [1]Ioffe Institute, Russia; [2]Shenzhen University, China

The talk presents the analysis of FLIM images of intrinsic chromophores in living cells. As is known, in general, short and long decay times relate to unbound and bound chromophores, respectively. However, as shown in the talk the determination of relative concentrations of free and bound chromophores in cell compartments is not straightforward and needs additional experiments and significant theoretical analysis.

TuSYB-02 09:30-10:00

Optical express-biopsy using macro-FLIM: a feasibility study in glioma and breast cancer surgery *(Invited paper)*

M.V. Shirmanova[1], D.A. Sachkova[1], A.A. Plekhanov[1], E.B. Kiseleva[1], D.V. Yuzhakova[1], I.D. Shchechkin[1], K.S. Yashin[1], A.Yu. Vorontsov[2], E.A. Shirshin[3], V.I. Shcheslavskiy[1]; [1]PRMU, [2]Nizhny Novgorod Region Oncology Hospital, Russia, [3]Moscow State University, Russia

Macro-FLIM (Macroscopic Fluorescence Lifetime Imaging) offers a unique opportunity to quickly obtain large field-of-view images of tissue samples based on autofluorescence. Macro-FLIM is sensitive to the biochemical differences between tumors and normal tissues, which makes it a potential tool for differentiating normal and pathological states. We demonstrate the feasibility of using macro-FLIM for the intraoperative assessment of glioma surgical margins and the identification of breast cancer metastases in sentinel lymph nodes (RSF, 25-14-00313).

TuSYB-03 10:00-10:30

Fluorescent probes based on proton phototransfer for protein surface analysis *(Invited paper)*

E.A. Slyusareva, E. Nemtseva, D. Surzhikova; Siberian Federal University, Russia

Properties of the proteins surface differ from those of the solvent. Fluorescent probes based on intra- and intermolecular proton phototransfer exist as an equilibrium of ionic/tautomeric forms, disturbed in the near-surface regions. Difference in the spectral characteristics of these forms allows extracting useful ratiometric signals and associating them with the characteristics of the protein surface.

TuSYB-04 10:30-10:45

Fluorescence-based tumor tracking and photosensitizer depth mapping for real-time dual-wavelength photodynamic therapy monitoring

A.S. Savelyev, M.Y. Kirillin, E.A. Sergeeva, A.B. Kostyuk, P.D. Agrba, I.V. Turchin; A.V. Gaponov-Grekhov Inst. of Applied Physics RAS, Russia

Noninvasive photosensitizer (PS) distribution assessment and tumor tracking improve photodynamic therapy (PDT). This study presents a software solution for real-time dual-wavelength fluorescence imaging that enables both tasks. Software validation, which included clinical post-processing and real-time phantom tests for the CSRT-based tracker and agar phantom tests for the depth estimation algorithm, demonstrated its capability for automated PS distribution and photobleaching assessment.

TuSYB-05 10:45-11:00

Quantifying the sensitivity limit of ICG imaging in the presence of tissue autofluorescence

Y. Belozerov, I. Turchin; Inst. of Applied Physics RAS, Russia

This work investigates the fundamental sensitivity limit of indocyanine green fluorescence imaging in the NIR-I range. We demonstrate that tissue autofluorescence is the dominant factor constraining detection sensitivity, establishing a performance threshold for imaging systems. The study defines critical equipment requirements to optimizing contrast agent dosage and enabling autofluorescence registration in clinical applications.

- Coffee Break -

Location: Petrov-Vodkin 1 Room, Floor 2; Tuesday, June 23, 2026

SYB. SECTION B. BLOOD + LDF + PHOTOPLETISMOGRAPHY OPTICS

Session Chair: Mikhail Kirillin, A.V. Gaponov-Grekhov Institute of Applied Physics of RAS, Russia

TuSYB-06 11:30-12:00

Multimodal optical diagnostics of microcirculatory-tissue systems: from stationary to wearable devices *(Invited paper)*

A.V. Dunaev[1], E.V. Zharkikh[1], Y.I. Loktionova[1], V.V. Sidorov[2], V.V. Dremin[1], E.V. Potapova[1]; [1]Research and Development Center of Biomedical Photonics, Orel State University, [2]SPE "LAZMA" Ltd, Russia

The work shows that a multimodal optical approach to the diagnosis of microcirculatory-tissue systems of the body makes it possible to identify pathological changes in the early stages of their development, classify neoplasms and predict the outcome of treatment. It is noted that such diagnostic technologies can be implemented in both stationary and wearable formats and are applicable in clinical and rehabilitation practice, as well as in space missions.

TuSYB-07 12:00-12:30

Wearable laser Doppler flowmetry analyzers in monitoring microvascular responses to diverse physiological stimuli *(Invited paper)*

E.V. Zharkikh, Y.I. Loktionova, V.S. Yanushin, A.V. Dunaev; Research and Development Center of Biomedical Photonics, Orel State University, Russia

The paper presents the results of the study of the effect of individual physiological and environmental factors on the parameters recorded using wearable multimodal laser analyzers.

TuSYB-08 12:30-13:00

Light interaction with blood vessels in biological tissue in vivo *(Invited paper)*

A.A. Kamshilin; Institute of Automation and Control Processes FEB RAS, Russia

This work examines the reasons why the intensity of light, after its interaction with a tissue, becomes modulated at heart rate. The question of how the observed modulation of light is related to the perfusion of biological tissue will be discussed.

TuSYB-09 13:00-13:15

Imaging photoplethysmography reveals specific manifestations of systemic lupus erythematosus

N.P. Podolyan[1], M.A. Volynsky[2], O.V. Mamontov[3,4], R.V. Romashko[1], A.A. Kamshilin[1]; [1]Institute of Automation and Control Processes, FEB RAS, [2]ITMO University, [3]Almazov National Medical Research Centre, [4]Pavlov First St. Petersburg State Medical University, Russia

Imaging photoplethysmography synchronized with electrocardiography was used to diagnose systemic lupus erythematosus. It was found that patients had significant changes in the microcirculatory blood flow of the facial skin in the cheek area compared with the control. Therefore, the proposed technique can claim to be an objective instrumental criterion of the disease.

TuSYB-10 13:15-13:30

Systemic lupus erythematosus diagnostics based on surface-enhanced Raman scattering

L.A. Bratchenko[1,2], Y.A. Khristoforova[2], A.V. Ulyanova[3], P.A. Lebedev[3], I.A. Bratchenko[1,2]; [1]Immanuel Kant Baltic Federal Univ., [2]Samara Univ., [3]Samara State Medical Univ., Russia

An approach based on the integration of surface-enhanced Raman scattering of blood serum and multivariate analysis is presented for monitoring patients with systemic lupus erythematosus (SLE). Surface-enhanced spectra are implemented using a substrate of spherical silver particle agglomerates. The proposed approach enables spectral profiling of SLE and the identification of SLE patients with an accuracy exceeding 95%.

- Lunch Break -

Location: Petrov-Vodkin 1 Room, Floor 2; Tuesday, June 23, 2026

SYB. SECTION B. TISSUE MODIFICATION AND TUMOR TREATMENT

Session Chair: Andrey Belikov, ITMO University, Russia

TuSYB-11 15:00-15:30

Optical diagnostics in skin photoaging assessment and development of novel PDT protocols *(Invited paper)*

M. Kirillin[1], M. Shakhova[1,2], V. Fokeev[1,2], A. Saveliev[1,3], D. Kurakina[1], V. Prokopenko[1], D. Solovieva[3], K. Bylinskaya[1], V. Perekatova[1], A. Serebryakova[1,3], A. Mironycheva[1,2], I. Turchin[1], E. Sergeeva[1]; [1]A.V. Gaponov-Grekhov Institute of Applied Physics RAS, [2]Privolzhsky Research Medical University, [3]Lobachevsky State University of Nizhny Novgorod, Russia

Optical coherence tomography (OCT) and diffuse optical spectroscopy are used to detect structural features and chromophore content of skin with different photodamage level. OCT is used to evaluate clinical outcome of novel photodynamic therapy protocol for ENT diseases.

TuSYB-12 15:30-16:00

Optical and thermal modeling of benign retinal tumors laser treatment *(Invited paper)*

A.V. Belikov[1], A.A. Shamovaa[1], S.N. Smirnov[1], D.S. Polyakov[1], Yu.V. Fyodorova[1], G.D. Shandybina[1], T.G. Zakaraiya[2], E.V. Boiko[2]; [1]ITMO University, [2]S. Fyodorov Eye Microsurgery Federal State Institution, Russia

An optical-thermophysical model of the human eye with a benign retinal vascular tumor is proposed. The results of model verification and numerical optimization of laser transpupillary thermotherapy for human retinal capillary hemangioblastoma are presented and discussed.

TuSYB-13 16:00-16:30

Sapphire fiber tips for laser interstitial therapy of soft tissues and natural canals *(Invited paper)*

I.N. Dolganova[1,2], I.A. Shikunova[1], P.V. Aleksandrova[2], A.A. Platonova[2], A.K. Zotov[2], V.N. Kurlov[1]; [1]Osipyan Institute of Solid State Physics of RAS, [2]Prokhorov General Physics Institute of RAS, Russia

In this talk, we describe and discuss various designs of sapphire fiber tips for laser medicine. Special attention is paid to thin capillary sapphire tips, manufactured by Stepanov (EFG) crystal growth concept, for interstitial laser coagulation of soft tissues and natural canals.

TuSYB-14 16:30-16:45

Wearable devices in monitoring microcirculatory-tissue systems under the influence of G-loads and postural test

Y.I. Loktionova[1], E.V. Zharkikh[1], V.S. Yanushin[1], D.N. Lutsevich[2], N.V. Vlasova[2], V.V. Sidorov[3], K.S. Kireev[2], A.V. Dunaev[1]; [1]Research and Development Center of Biomedical Photonics, Orel State University, [2]State Organization "Gagarin Research and Test Cosmonaut Training Center", [3]SPE "LAZMA" Ltd, Russia

This study focuses on monitoring blood microcirculation and oxidative metabolism parameters of skin under the influence of simulated spaceflight factors on professional cosmonauts using a distributed system of portable multimodal analyzers.

TuSYB-15 16:45-17:00

Breath-holding effect on cerebral blood supply and systemic arterial pressure in rats

P.M. Dolotovskaya[1], A.Y. Sokolov[2], I.A. Mizeva[3], A.A. Kamshilin[4]; [1]N.P. Bechtereva Institute of the Human Brain of the RAS, [2]Pavlov Institute of Physiology of RAS, [3]Institute of Continuous Media Mechanics, UB RAS, [4]Institute of Automation and Control Processes, FEB RAS, Russia

In the present study, we measured the dynamics of cerebral perfusion and systemic arterial pressure in rats during a breath-holding test using a contactless imaging photoplethysmography synchronized with an electrocardiogram. It was found that this technique allows us to qualitatively assess processes of cerebral blood supply regulation caused by temporary cessation of respiration.

SYC. SECTION C. PHOTONICS AND NANOBIOTECHNOLOGY

Location: Petrov-Vodkin 2 Room, Floor 2; Tuesday, June 23, 2026

SYC. SECTION C. PHOTONICS AND NANOBIOTECHNOLOGY 1

TuSYC-01 09:00-09:45

Functional nanoprobes for in vivo Imaging *(Keynote presentation)*

Mingyuan Gao; School of Life Sciences, Soochow University, China

The in vivo applications of functional nanoparticles for the diagnosis of major diseases will be reported. Moreover, the clinical translation of functional nanoparticles will also be discussed.

TuSYC-02 09:45-10:15

Multifunctional and multimodal contrast agents: preparation, properties control, biomedical applications *(Invited paper)*

D.A. Gorin; Skolkovo Institute of Science and Technology, Russia

One of the trends in modern biophotonics is the use of multimodal diagnostic systems. This requires the development of multimodal contrast agents. A technology for synthesizing multimodal contrast agents has been developed. It has been established that the concentration of inorganic nanoparticles and/or organic dyes in composite particles allows for altering the contrast of OA, ultrasound, and MRI images.

TuSYC-03 10:15-10:45

Functionalized gold nanobipyramids and luminescent Au^- atomic nanoclusters for biomedical applications *(Invited paper)*

N.G. Khlebtsov[1,2], A.M. Burov[1], D.S. Chumakov[1], S.S. Evstigneeva[1,2]; [1]Institute of Biochemistry and Physiology of Plants and Microorganisms, Saratov Scientific Centre of RAS, [2]Saratov State University, Saratov, Russia

Pentagonal gold bipyramids and nanorods with LPR from 640 to 940 nm were synthesized, functionalized with nitrobenzenethiol, and characterized by UV-vis spectroscopy, transmission electron microscopy (TEM), surface enhanced Raman scattering (SERS), and phtotothermal (PT) studies. We also show that fluorescent glutathione-stabilized gold nanoclusters are capable of selectively binding to bacterial biofilms, but do not stain planktonic bacteria.

TuSYC-04 10:45-11:00

Optimising 825 nm photobiomodulation in adipose-derived stem cells: a comparative analysis of two- and three-dimensional culture systems

A. Crous, P. Mulaudzi, H. Abrahamse; Laser Research Centre, Faculty of Health Science, University of Johannesburg, South Africa

This study compared the effects of 825 nm photobiomodulation on adipose-derived stem cells cultured in 2D monolayers and 3D spheroids. PBM at 5 J/cm^2 optimally enhanced viability and proliferation in 2D, while 10 J/cm^2 produced the most stable, physiologically relevant responses in 3D spheroids, underscoring the importance of 3D models for translational PBM optimisation.

- Coffee Break -

Location: Petrov-Vodkin 2 Room, Floor 2; Tuesday, June 23, 2026

SYC. SECTION C. PHOTONICS AND NANOBIOTECHNOLOGY 2

TuSYC-05 11:30-12:00

Magnetic particle imaging: from physics to biomedical applications *(Invited paper)*

Jing Zhong; Beihang University, China

Magnetic Particle Imaging (MPI) is new imaging modality that enables the direct and quantitative detection and imaging of magnetic nanoparticles (MNPs). MPI directly detects the dynamic magnetization of MNPs for radiation-free and tissue-background-free imaging. This study introduces the fundamental physics of MPI for in vitro biomolecule detection and in vivo imaging for cancer diagnostics.

TuSYC-06 12:00-12:30

Optical characterization of advanced biosensing architectures for express sensitive detection of clinical biomarkers and food contaminants *(Invited paper)*

A.V. Orlov; Prokhorov General Physics Institute of RAS, Russia

Label-free optical biosensing platforms based on interferometry enable real-time characterization of biomolecular interactions with sub-nanometer axial resolution. This work presents advanced sensing architectures combining stimulus-responsive materials, reconfigurable molecular interfaces, and novel surface functionalization strategies. Systematic evaluation of interferometric and magnetometric detection reveals synergistic advantages for achieving sub-picogram sensitivity across extended dynamic ranges in clinical and food safety applications.

TuSYC-07 12:30-12:45

Next generation optical biosensing with hybrid AI-Photonics architecture

I. Saetchnikov, E. Tcherniavskaia, A. Saetchnikov; Belarusian State University, Belarus

We present a scalable optical biosensing platform combining thousands of high-Q whispering-gallery-mode microresonators with a hybrid deep-learning engine. By integrating CNNs, biLSTMs, transformer encoders, and cross-channel attention, the system enables real-time analysis of complex biochemical mixtures. In multiplexed immunosensing, it achieves >98% classification accuracy and parts-per-billion (ppb) concentration resolution, addressing scalability and data-heterogeneity challenges in photonic biosensing.

TuSYC-08 12:45-13:00

Novel highly sensitive readout for an enzyme-linked immunosorbent assay based on surface-enhanced Raman scattering

E.G. Evtushenko[1,2], A.D. Vasilyeva[1], L.V. Yurina[1], E.S. Gavrilina[1], V.B. Krylov[3], N.E. Nifantiev[3], D.V. Basmanov[4], I.N. Kurochkin[1,2]; [1]N.M. Emanuel Inst. of Biochemical Physics RAS, [2]Lomonosov Moscow State Univ., Faculty of Chemistry, [3]N.D. Zelinsky Inst. of Organic Chemistry RAS, [4]Lopukhin Federal Research and Clinical Center of Physical-Chemical Medicine, Russia

An enzyme-linked immunosorbent assay (ELISA) is a widely used and universal method in laboratory diagnostics. We report on the development of a protocol for the measurement of horseradish peroxidase label in ELISA based on surface-enhanced Raman scattering (SERS) of 2,3-diaminophenazine using a silver nanoparticles colloid. We will demostrate its application for the analysis of galactomannan, a marker of invasive aspergillosis.

TuSYC-09 13:00-13:15

Light-responsive multilayer carriers for controlled STING agonist release

L.V. Mikhailova[1], O.A. Gusliakova[2], N.A. Shushunova[3], M.V. Zyuzin[1,4], G.B. Sukhorukov[2,5]; [1]Bridge Center, Faculty of Physics, ITMO University, [2]Center for Bio- and Medical Technologies, Skoltech, [3]Core Facility Center, Saratov State Medical Univ., [4]Moscow Center for Advanced Studies, [5]Life Improvement by Future Technologies (LIFT) Center, Russia

Light-responsive polymer carriers encapsulating a STING agonist were engineered to reprogram tumor-associated macrophages from an M2- to an M1-like phenotype. Macroscopic and submicron carriers loaded with gold nanorods enabled NIR-triggered heating, controlled agonist release, and efficient uptake by macrophages. In vitro and in vivo experiments demonstrated enhanced CD86 expression and M1 polarization in melanoma, highlighting a spatiotemporally controlled immunotherapeutic strategy.

TuSYC-10 13:15-13:30

Laser-induced release of neuroactive proteins from polymer capsules using one- and multiphoton excitation for directed neural cell differentiation in 2D and 3D models

I.V. Smirnov[1], V.S. Usatova[2], O.G Astakhova[2,3], A.A. Lanin[3,4], G.B. Sukhorukov[1,4]; [1]Skolkovo Inst., [2]FCBN FMBA, [3]MSU, [4]LIFT, Russia

Combining the processes of photoconversion and laser-induced release of neuroactive proteins from polyelectrolyte capsules allows for long-term tracking of the behavior of individual activated cells within a cellular population.

- Lunch Break -

Location: Petrov-Vodkin 2 Room, Floor 2; Tuesday, June 23, 2026

SYC. SECTION C. PHOTONICS AND NANOBIOTECHNOLOGY 3

TuSYC-11 15:00-15:30

Nanostructured particles for remote neuron stimulation *(Invited paper)*

T. Pallaeva[1,2], A. Romaschenko[2], S. Lisitsyn[2], I. Smirnov[1], A. Abdurashitov[1,2], G. Sukhorukov[1,2]; [1]Skolkovo Institute of Science and Technology, [2]LIFT Center, Russia

The paper describes recent advances in fabrication of micro- and nanostructured systems enable to label, activate and track individual biological cells via alternated magnetic field and/or light.

TuSYC-12 15:30-16:00

Plasmonic porous silicon-gold nanoparticles for optical diagnostics and multimodal therapy *(Invited paper)*

L.A. Osminkina[1,2]; [1]Faculty of Physics, Lomonosov Moscow State University, [2]Institute for Biological Instrumentation of RAS, Russia

Plasmonic hybrid porous silicon–gold nanoparticles are presented as a multifunctional platform for optical diagnostics and multimodal cancer therapy. The combination of biodegradable porous silicon and plasmonic gold enables photothermal effects, radiosensitization, and surface-enhanced Raman diagnostics. These results highlight the potential of the proposed nanoplatform for future development of integrated theranostic approaches in oncology.

TuSYC-13 16:00-16:15

Microfluidic synthesis of $AgInS_2$/ZnS quantum dots with different stoichiometry for biomedicine

I.A. Reznik[1], A.A. Cherednikova[1], S. Bikmetova[1], D.V. Danilov[2], M.V. Zyuzin[1]; [1]Faculty of Physics, Bridge Center, ITMO University, [2]Interdisciplinary Research Center for Nanotechnology, St. Petersburg State University, Russia

We developed a microfluidic protocol to synthesize $AgInS_2$/ZnS quantum dots with tunable core stoichiometry (Ag:In = 0.05–0.30) and variable ZnS shell thickness. Optical properties and ROS generation were systematically linked to composition. Ag-rich QDs showed enhanced photodynamic activity against glioblastoma cells, indicating promise for biomedical imaging and photodynamic therapy applications.

TuSYC-14 16:15-16:30

Single-exosome analysis in microfluidic flow by fluorescence correlation spectroscopy and burst detection

D.D. Kozhevnikova[1], A.V. Barulin[2], A.V. Petukhov[2], S.M. Novikov[2], A.M. Yashchenok[1]; [1]Skolkovo Institute of Science and Technology, [2]Moscow Institute of Physics and Technology, Russia

Accurate characterization of small extracellular vesicles is challenging due to their nanoscale size and heterogeneity. We present a microfluidics-assisted fluorescence spectroscopy approach combining fluorescence correlation and burst analysis for single-vesicle detection. This dual-modality method enables sensitive measurement of particle concentration and provides size-related information for exosome-enriched fractions.

TuSYC-15 16:30-16:45

Multilayer sensing system with controllable density of antibody binding sites for hormone analysis

N.A. Belyakov[1,2], A.S. Rakitina[1,2], S.G. Trofimenko[1,3]; [1]Prokhorov General Physics Institute of RAS, [2]Moscow Center for Advanced Studies, [3]National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), Russia

We developed a new universal approach in biosensorics which is based on an adaptive programmable biolayers that can form a multi-layer architecture on a surface of a glass sensor chip. Under a specific microenvironment the upper layers can be desorbed what allows to change the steric structure of the biosensor and change the calibration curve directly during the measurement.

SYB. SECTION B. LASER INTERACTION WITH CELLS AND TISSUES: CLINICAL IMAGING AND SPECTROSCOPY - POSTERS

Location: Congress Hall, Floor 1; Tuesday, June 23, 2026

TuSYB-p01 15:00-18:30

The effect of laser-generated ionizing secondary radiation on the pigment-protein complex C-phycocyanin

V.V. Teplyakov[1], T.A. Semenov[1], Y.E. Sergeeva[1], P.M. Gotovtsev[2], M.M. Nazarov[1]; [1]National Research Centre "Kurchatov Institute", [2]Institute for Information Transmission Problems of RAS, Russia

We present results of experiments on the effect of two types of femtosecond pulsed radiation - an electron beam with an intensity of 3*10^18W/cm^2 and THz radiation with a pulse energy of 20 μJ - on a solution of the pigment-protein complex C-phycocyanin in deionized water as part of a study of the non-thermal effects of ionizing radiation on biological objects.

TuSYB-p02 15:00-18:30

Optical imaging for characterization of tumor-associated fibroblasts

A.I. Gavrina, V.D. Kapustina, N.I. Ignatova, V.V. Elagin, V.V. Dudenkova, I.N. Druzhkova; Privolzhskiy Research Medical Univ., Russia

Tumor-associated fibroblasts (CAFs) are a specific population of stromal cells in tumor tissue that differ from normal fibroblasts in their altered phenotype and functionality. They play a key role in the development and progression of cancer, making them potential targets for anticancer therapy. Targeting senescent CAFs may be a new approach to tumor treatment.

TuSYB-p03 15:00-18:30

Fluorescence lifetime and optical spectrum dependence during photooxidation of lipofuscin granules

P. Morozov[1,2], V. Andreev[2,3], M. Tokarev[1], M. Yakovleva[4,5], A. Kostyukov[4,5], T. Feldman[4,5], V. Kuzmin[4], M. Ostrovsky[4,5], G. Goltsman[1,3]; [1]Moscow State Pedagogical Univ., [2]LLC "Supercon Nanotech", [3]National Research University Higher School of Economics, [4]N.M. Emanuel Institute of Biochemical Physics RAS, [5]Lomonosov Moscow State University, Russia

In this paper we study the process of photooxidation in lipofuscin granules (LG) using fluorescence lifetime microscopy in combination with a superconducting single-photon detector (SSPD). The aim was to develop early diagnosis criteria for age-related macular degeneration (AMD). LG's, which accumulate in the retinal pigment epithelium (RPE), are the main source of fundus autofluorescence (FAF). Changes in their fluorescence properties during photooxidation serve as a model for studying AMD pathology.

TuSYB-p04 15:00-18:30

Principal component analysis for virus classification

E.E. Popov[1], A.T. Tabarov[1,2], V.V. Vitkin[1]; [1]Institute of Advanced Data Transfer Systems, ITMO University, [2]St. Petersburg State Pediatric Medical University, Russia

In this work we study the influence of changes in Raman spectrum of Solution of virus-containing particles on accuracy of classification using principal component analysis (PCA) as a machine learning tool for classification. Both experimental and modeling studies are presented.

TuSYB-p05 15:00-18:30

The possibility of using histological data in assessing the skin thickness by OCT

A.P. Tarasov[1,2], D.A. Rogatkin[1]; [1]Moscow Regional Research and Clinical Institute (MONIKI) named after M.F. Vladimirsky, [2]National Research Centre "Kurchatov Institute", Russia

The work presents the results of a preliminary study on the possibility of using histological data for calibrating the scale of OCT images of human skin. The study utilized thick cadaver skin, and the thickness of the stratum corneum was determined. It was established that, in general, the use of histology characterized by significant variability, which complicates the calibration of the optical tomograph's scale.

TuSYB-p06 15:00-18:30

Method and device for detecting intracranial tumor tissue in situ using fiber-optic multimodal laser spectroscopy

I.D. Romanishkin[1], A. Ospanov[2], T.A. Savelieva[1,2], K.G. Linkov[1], D.V. Yakovlev[1], A.V. Kosyrkova[3], G.V. Pavlova[3,4], I.N. Pronin[3], V.B. Loschenov[1,2]; [1]Prokhorov General Physics Institute of RAS, [2]National Research Nuclear University MEPhI, [3]N.N. Burdenko National Medical Research Center of Neurosurgery, [4]Institute of Higher Nervous Activity and Neurophysiology of RAS, Russia

This article discusses the approach to intraoperative multimodal laser spectroscopic analysis of intracranial tumors based on the simultaneous measurements of FAD and PpIX fluorescence, diffuse reflectance and Raman scattering. The data obtained this way automatically undergoes classification using a training set compiled from spectral signatures previously obtained by measuring samples of such tumors in the biobank conditions.

TuSYB-p08 15:00-18:30

Simulation of infrared radiation backscattering by curved multilayer biological tissue

R.R. Chegadaev[1], S.V. Ul'yanov[2], Yu.A. Zhavoronkov[1,2]; [1]Peter the Great St. Petersburg Polytechnic University, [2]St. Petersburg State University, Russia

We present results of Monte Carlo backscattering simulations for tissue models with different numbers of flat or curved layers, with particular emphasis on a human head model. We also studied possible causes of the loss of spatial coherence, leading to the broadening of the coherent backscattering peak. Backscattered intensity exhibited high sensitivity to blood penetration into the cerebrospinal fluid layer.

TuSYB-p09 15:00-18:30

Ce^{3+} -lasers emission interaction with skin cells investigation in the presence of antioxidants

A.S. Nizamutdinov, A.A. Varlamov, I.D. Sidorov, D.A. Makarova, N.I.Shamsutdinov, A.A. Shavelev, Y.M. Hamdan, T.A. Nevzorova, P.V. Zelenikhin, V.V. Semashko; Kazan Federal University, Russia

We report the cytotoxic effectof UVB laser radiation from LiCaAlF6:Ce3+ and LiLu0.7Y0.3F4:Ce3+-Yb3+ lasers on human skin fibroblasts. We show that only 6.2 ± 2.2% of cells reach the stage of late apoptosis, due to which they have the potential to restore the cytoplasmic membrane and subsequently divide. The effect of vitamins C and E on viability under UV irradiation is discussed.

TuSYB-p10 15:00-18:30

Development of a software package for photoacoustic tomography data analysis based on open-source Python libraries

S.A. Shevtsova[1], E.S. Prikhozhdenko[2], D.N. Bratashov[1,2]; [1]Saratov State Univ., [2]Moscow Institute of Physics and Technology, Russia

A software package for comprehensive photoacoustic tomography data processing has been introduced. It includes loading raw experimental data in HDF5 format and visualizing three-dimensional images. Based on reconstruction algorithms that convert ultrasonic sensor signals into spatial absorption maps, this tool enables both qualitative visual assessment and quantitative analysis of biological chromophore concentrations.

TuSYB-p11 15:00-18:30

Synthesis bis-diimine rhenium(I) complexes and micelles based on it for photoacoustic research

V.A. Suslova, K.S. Kisel; St.Petersburg State University, Russia

Re(I) complexes are promising candidates for synthesis contrast agents potentially applicable in photoacoustic imaging experiments. Usage of ligands with hydrophilic and hydrophobic functions allow us to obtain micelles based on this complexes. Photophysical properties of such micelles are consistent with their application as contrast agents.

TuSYB-p12 15:00-18:30

Real-time thermal mapping of biological tissue phantoms using two-dimensional FBG array

V.A. Simonov[1,2], Z.E. Munkueva[1,2], A. Kokhanovskiy[1,4], A.V. Dostovalov[1,2], A.A. Evtushenko[1,3], L.V. Boldyreva[1,3]; [1]Novosibirsk State University, [2]Institute of Automation and Electrometry SB RAS, [3]Scientific Research Institute of Neurosciences and Medicine, [4]ITMO University, Russia

The real-time thermal mapping of the biological tissue phantom under the laser treatment is demonstrated using the two-dimensional fiber Bragg grating (FBG) array with 1 mm resolution. The method can be used to develop treatment protocols of tumors under the impact of laser radiation or cold atmospheric plasma.

SYA. SECTION A. ADVANCED LASER MEDICAL SYSTEMS AND TECHNOLOGIES

Location: Deyneka 1+2 Room, Floor 2; Wednesday, June 24, 2026

SYA. SECTION A. ADVANCED LASER MEDICAL SYSTEMS AND TECHNOLOGIES 4

WeSYA-18 09:00-09:30

Improvement of advanced laser systems for monitoring diabetes mellitus complications using tissue optical clearing *(Invited paper)*

V.V. Tuchin[1,2,3], D. Li[4,5], Dan Zhu[4], E.A. Genina[1], P.A. Timoshina[1], D.K. Tuchina[1], I.Yu. Yanina[1], S. Liu[4], J. Huang[4], Yu.I. Surkov[1], I.A. Serebryakova[1], K.V. Berezin[1]; [1]Saratov State Univ., [2]Tomsk State Univ., [3]FRC "Saratov Scientific Centre of the RAS", Russia, [4]Huazhong Univ. of Science and Technology, China

The potential of using tissue optical clearing (TOC) technology for effective disease diagnostics by increasing the sensitivity and resolution of advanced laser medical systems is discussed for monitoring diabetes mellitus complications. A wide range of laser methods and devices successfully operating under TOC conditions, including optical coherence tomography (OCT), laser speckle-contrast imaging, multiphoton microscopy, Raman and fluorescence microscopies, are presented.

WeSYA-19 09:30-10:00

Laser photodestruction for the treatment of ganglion cyst in children *(Invited paper)*

M.A. Dvornikova, A.V. Bryansev, E.N. Gasanova, R.T. Nalbandyan; Scientific and Research Institute of Emergency Pediatric Surgery and Trauma - Dr. Roshal's Clinic, Russia

A ganglion cyst is the most common benign soft tissue tumor of the hand in children, most frequently located on the dorsal aspect. These lesions can cause pain, paresthesia, and limited joint function, significantly reducing the quality of life. Current conservative and surgical treatments are associated with high recurrence rates (up to 80% and 50%, respectively). Therefore, the search for new, more effective surgical approaches remains a relevant clinical task in pediatric surgery.

WeSYA-20 10:00-10:30

Solid-state nanosecond laser source for surgery with minimal collateral thermal damage *(Invited paper)*

M.K Tarabrin, D.A. Nazarov, E.A. Kozlova, D.T. Batov; Bauman Moscow State Technical University, Russia

A laser scalpel enables the bloodless and non-contact ability to create the incisions or to perform a debulking process. Unfortunately, many commercial systems create a large overheated zone around the ablation crater, which leads to the prolonged rehabilitation time. In this work the ablation of the biological tissue with minimal collateral damage by the nanosecond laser source was performed.

WeSYA-21 10:30-10:45

Method and device for hyperspectral imaging in the diagnosis of vascular hyperplasia and mesenteric blood flow disorders

V.V. Shupletsov[1], I.A. Goryunov[1], N.A. Adamenkov[1,2], A.V. Mamoshin[1,3], E.V. Potapova[1], A.V. Dunaev[1], V.V. Dremin[1,4]; [1]Orel State University, Research and Development Center of Biomedical Photonics, [2]Orel Regional Clinical Hospital, [3]The National Medical Research Center of Surgery Named After A. Vishnevsky, Russia; [4]Aston University, College of Engineering and Physical Sciences, United Kingdom

A hyperspectral imaging system for assessment of vascular hyperplasia and mesenteric blood flow disorders is developed. Diffuse reflectance–derived oxygenation maps combined with unsupervised and gradient boosting classifiers enable staging of infantile hemangiomas and identification of irreversible intestinal ischemia, demonstrating high diagnostic accuracy and intraoperative applicability.

WeSYA-22 10:45-11:00

Results of treatment of congenital melanocytic nevi in children with a wavelength of 0.45 microns and a CO_2 laser with a wavelength of 10.6 microns

S.A. Podurar[1], A.V. Bryantsev[1], G.P. Kuzmin[2], A.A. Sirotkin[2], Yu.L. Kalachev[2], G.A. Varev[3], M.A. Remennikova[4]; [1]Research Institute of Emergency Pediatric Surgery and Traumatology, [2]Prokhorov General Physics Institute of RAS, [3]Russian Engineering Club LLC, [4]Perm Scientific and Production Instrument Company (PNPPK PJSC), Russia

The optimal laser radiation parameters of 0.45 microns and 10.6 microns of pulsed periodic CO_2 laser for removal of congenital melanocytic nevi have been experimentally and clinically determined.

- Coffee Break -

SYB. SECTION B. LASER INTERACTION WITH CELLS AND TISSUES: CLINICAL IMAGING AND SPECTROSCOPY

Location: Petrov-Vodkin 1 Room, Floor 2; Wednesday, June 24, 2026

SYB. SECTION B. FLUORESCENCE AND FLIM 2

Session Chair: Boris Yakimov, Sechenov First Moscow State Medical Univ., Russia

WeSYB-16 09:00-09:30

Homogeneous luminescent bionanosensors based on fractions of carbon dots *(Invited paper)*

K.A. Laptinskiy[1,2], A.A. Korepanova[1], A.M. Vervald[1,2], T.A. Dolenko[1,2]; [1]Physics Department, Moscow State University, [2]Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Russia

Carbon nanodots (CNDs) hold promise for biomedical diagnostics and therapeutics. However their application is hampered by the poorly understood photoluminescence mechanism. This leads to empirical particle selection, which is also heterogeneous after synthesis. In this study, CND fractions isolated by horizontal gel electrophoresis were used to visualize and analyze the intracellular environment.

WeSYB-17 09:30-10:00

Oxidation-induced autofluorescence of proteins for drug storage monitoring *(Invited paper)*

A.A. Rubekina[1], B.P. Yakimov[1,2], E.A. Shirshin1; [1]M.V. Lomonosov Moscow State Univ., [2]Sechenov University, Russia

Deep blue autofluorescence (dbAF) emerges in proteins as a result of oxidative modifications and reflects their structural degradation. Here, we demonstrate that dbAF intensity increases under thermal and irradiation stress and correlates with non-optical indicators of protein instability. These results suggest that dbAF can serve as a rapid, non-invasive optical marker for monitoring the stability and quality of monoclonal antibodies during storage.

WeSYB-18 10:00-10:30

NIR autofluorescence for prostate cancer diagnostics *(Invited paper)*

B.P. Yakimov[1,2], N.V.Danilova[3], V.S. Andreev[4], P.V. Morozov[4], V.I. Scheslavsky[5], P.G. Malkov[3], I.V. Turchin[6], L.S. Urusova[7], E.A. Shirshin[1,2,3]; [1]Physics Department, Lomonosov Moscow State University, [2]Laboratory of Clinical Biophotonics, Biomedical Science and Technology Park, Sechenov University, [3]Medical Research and Educational Institute, Lomonosov Moscow State University, [4]Physics Department, Moscow Pedagogical State University, [5]Privolzhky Research Medical University, [6]Department for Radiophysical Methods in Medicine, Institute of Applied Physics of RAS, [7]Endocrinology Research Center, Russia

Near-infrared autofluorescence (NIRAF), often considered background in Raman spectroscopy, encodes diagnostic information for prostate cancer. We show NIRAF intensity and lifetime distinguish benign from malignant tissue and correlate with glandular morphology, revealing its potential as an intrinsic optical contrast mechanism.

WeSYB-19 10:30-10:45

Advanced monitoring of intracellular compartmets by label-free fluorescence lifetime imaging

I.A. Gorbunova[1], E.E. Nikonova[1], A. M. Mozerov[1], D. S. Kuznetsova1, V.I. Shcheslavskiy[3], M.V. Shirmanova[1], E.A.Shirshin[1,2], P.S.Timashev[1]; [1]Insitute for Regenerative Medicine, Sechenov First Moscow State Medical University, [2]Faculty of Physics, M.V. Lomonosov Moscow State University, [3]Institute of Experimental Oncology and Biomedical Technologies, Privolzhsky Research Medical University, Russia

In this work, we present advanced approaches for monitoring cellular metabolism in distinct intracellular compartments. We demonstrate that ultrafast FLIM detection significantly enhances molecular specificity by resolving multiple free NADH lifetimes and the short picosecond lifetime of FAD, enabling more accurate redox ratio determination. Analysis of endogenous nuclear fluorescence reveals distinct metabolic subpopulations in chemotherapy-treated cells, highlighting metabolic heterogeneity.

WeSYB-20 10:45-11:00

Pituitary near-infrared autofliorescence as the basis of optical intraoperative navigation in neurosurgery

V.M. Alibaeva[1], G.S. Budylin[2], N.V. Korneva[1,3], A. Y. Grigoriev[4], G. Y. Starkov[4], A.M. Lapshina[3], L.S. Urusova[3], E.A. Shirshin[1,3]; [1]Faculty of physics, Lomonosov Moscow State University, [2]Laboratory of Clinical Biophotonics, Sechenov First Moscow State Medical University, [3]Laboratory of Endocrine Biophotonics, Endocrinology Research Center, [4]Neurosurgical department, Endocrinology Research Center, Russia

We evaluate label-free near-infrared autofluorescence for intraoperative differentiation in endoscopic endonasal pituitary surgery. In 27 operations, a fiber probe quantified autofluorescence near 805 nm. Pituitary tissue generally showed higher signal than PitNET and surrounding tissues, with step-like transitions during continuous probe movement. Ex vivo confocal spectral imaging links the contrast to secretory granule rich microdomains with extended long-wavelength emission.

- Coffee Break -

Location: Petrov-Vodkin 1 Room, Floor 2; Wednesday, June 24, 2026

SYB. SECTION B. FLUORESCENCE AND FLIM 3, OCT AND TERAHERTZ 1

Session Chair: Marina Shirmanova, Privolzhskiy Research Medical Univ., Russia

WeSYB-21 11:30-12:00

Fluorescence guidance in endocrine surgery: beyond parathyroid detection - a multimodal biophotonics approach *(Invited paper)*

E.A. Shirshin; M.V. Lomonosov Moscow State University, Russia

We assess the origin of unique optical properties of endocrine organs and suggest multimodal techniques for optical guidance in endocrine surgery.

WeSYB-22 12:00-12:30

The role of conformational dynamics of protein globules in the photophysical properties of colored fluorescent proteins *(Invited paper)*

M. Khrenova, A. Gavshina, N. Marynich, I. Soloviev, S. Kasatkina, G. Demina, M. Shleeva, A. Savitsky; FRC Biotechnology of RAS, Russia

Fluorescence as a phenomenon is characterized by a spectrum of temporal events ranging from femtoseconds to milliseconds. Similarly, thermal motions are possible in proteins in this same range. Colored fluorescent proteins are a striking example of visualizing this entire time range as changes in the physical parameters of fluorescence, as they are complex and highly informative chromophore-protein structures.

WeSYB-23 12:30-12:45

UV-induced skin autofluorescence spectroscopy for in vivo diagnosis of metabolic and neurodegenerative diseases

S.V. Belenkaya[1,2], V.V. Salmin[2,3], N.P. Bainaev-Mangilev[4], E.O. Ivanova[1], M.V. Ershova[1], A.B. Salmina[1], S.N. Illarioshkin[1]; [1]Russian Center of Neurology and Neurosciences, [2]National Research Nuclear University MEPhI, [3]Bauman Moscow State Technical University, [4]National Research University MIPT, Russia

Characteristic patterns of skin autofluorescence were identified in persons with Parkinson's disease, diabetes mellitus, in the control and comorbid groups. The observed spectral profiles reflect alterations in endogenous fluorophores associated with affected metabolic pathways rather than isolated biochemical markers. Statistical analysis confirmed that these spectral features enable detection of pathology and provide a basis for noninvasive assessment of disease severity.

WeSYB-24 12:45-13:00

Characterization of skin morphological layers by mapping the optical scattering coefficient and speckle-contrast parameter for optical coherence tomography scans *(Invited paper)*

A.A. Sovetsky[1], K.S. Petrova[2], M.A. Brueva[1,2], M.G. Ryabkov[3], A.L. Matveyev[1], L.A. Matveev[1], V.Y. Zaitsev[1]; [1]A.V. Gaponov-Grekhov Institute of Applied Physics of RAS, [2]N.I. Lobachevsky State University of Nizhny Novgorod, [3]N.A. Semashko Clinic of Nizhny Novgorod Region, Russia

In vivo segmentation of upper skin-tissue layers is of high biomedical importance. In this regard, OCT offers exceptionally promising prospects. We demonstrate that by analyzing optical scattering and speckle-contrast parameters for OCT data, the junctions of stratum corneum, living-cell epidermis and dermis beneath can clearly be found, even when experts may hardly discern these layers in initial structural OCT scans.

WeSYB-25 13:00-13:15

Terahertz-wave scattering in absorption medium: spherical and cylindrical scatterers

A.S. Kucheryavenko[1], I.N. Dolganova[1], N.V. Chernomyrdin[2], K.I. Zaytsev[2]; [1]Institute of Solid State Physics of RAS, [2]Prokhorov General Physics Institute of RAS, Russia

Terahertz (THz) technology finds many applications in medical diagnostics, where the effective medium theory (EMT) is commonly used to describe wave-tissue interaction. To study the limits of EMT applicability, we developed two phantom types: spherical scatterers or ordered cylindrical structure, surrounded by absorption medium. Using THz time-domain spectroscopy and Lorenz-Mie theory analysis, we demonstrate that EMT remains applicable for a broad range of scatterers' dimentions and volume fractions.

- Lunch Break -

Location: Petrov-Vodkin 1 Room, Floor 2; Wednesday, June 24, 2026

SYB. SECTION B. OCT AND TERAHERTZ 2

Session Chair: Evgeny Shirshin, Lomonosov Moscow State University, Russia

WeSYB-26 15:00-15:30

High-resolution terahertz microscopy and endoscopy of biological tissues *(Invited paper)*

V.A. Zhelnov[1], D.R. Il'enkova[1,2], D.D. Rybnikov[1,2], G.M. Katyba[1,3], V.N. Kurlov[3], K.I. Zaytsev[1], N.V. Chernomyrdin[1];[1] – Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia;[2] – Bauman Moscow State Technical University, Moscow, Russia;[3] – Osipyan Institute of Solid State Physics of the Russian Academy of Sciences, Chernogolovka, Russia

We present super-resolution terahertz (THz) solid immersion (SI) microscopy approaches including continuous-wave, pulsed and polarization-sensitive modalities. We also propose sapphire-based THz SI endoscopic system with a focal spot of 0.2λ, as well as a sapphire waveguide-assisted THz refractometry approach. Developed approaches pushing the wide application of THz technologies in biophotonics and medical diagnosis.

WeSYB-27 15:30-16:00

Terahertz sensors for biomarker detection *(Invited paper)*

O.P. Cherkasova[1,2,3], N.A. Nikolaev[1,3]; [1]Laboratory of Terahertz Photonics, Institute of Automation and Electrometry SB RAS, [2]National Research Centre "Kurchatov Institute", [3]Laboratory of Laser Biophysics, Institute of Laser Physics SB RAS, Russia

Terahertz sensors based on metamaterials exhibit unique sensitivity for detecting small amounts of molecular biomarkers. This work presents the basic principles of biosensing with terahertz metamaterials and provides examples of the sensors' designs for stress hormone and glioma biomarker detection.

WeSYB-28 16:00-16:15

Intrinsic protein luminescence as a tool for studying the structure, conformational dynamics and functioning of enzymes: case study of bacterial luciferase

EV Nemtseva[1,2]; [1]Siberian Federal University, [2]Institute of Biophysics of SB RAS, Russia

The application of various photonics techniques based on intrinsic fluorescence and phosphorescence of the protein to the analysis of conformational stability and dynamics, as well as ligand binding rates, of two bacterial luciferases is presented. The excellence and limitations of tryptophan as a universal intrinsic luminescent protein probe are discussed.

WeSYB-29 16:15-16:45

Prospects of multimodal optical coherence tomography in clinical application *(Invited paper)*

A.A. Plekhanov[1], E.B. Kiseleva[1], E.V. Gubarkova[1], A.A. Sovetsky[2], P.A. Shilyagin[2], D.A. Vorontsov[3], S.V. Panfilov[3], V.E. Zagainov[1,3], S.I. Gazhva[1], G.O. Grechkanev[1], E.V. Grigoriev[4], M.A. Sirotkina[1], S.V. Gamayunov[3], E.V. Zagaynova[1,5], G.V. Gelikonov[2], V.Y. Zaitsev[2], N.D. Gladkova[1]; [1]Privolzhsky Research Medical University, [2]A.V. Gaponov-Grekhov Institute of Applied Physics RAS, [3]Nizhny Novgorod Regional Oncological Hospital, [4]Research Institute for Complex Issues of Cardiovascular Diseases, [5]Lopukhin Federal Research and Clinical Center of Physical-Chemical Medicine, Russia

We demonstrate the successful application of multimodal OCT to address new clinical challenges. The analysis of tissue microstructural features revealed the high diagnostic potential of cross-polarization-OCT and OCT-elastography for detecting precancerous/cancerous lesions in oral mucosa, breast, colon and endometrium. Pioneering studies of sublingual microcirculation demonstrated the efficacy of OCT-angiography in monitoring patients during surgery and in postoperative intensive care phase.

Location: Petrov-Vodkin 1 Room, Floor 2; Wednesday, June 24, 2026

SYB. SECTION B. EMERGING TECHNIQUES

Session Chair: Andrei Lugovtsov, Lomonosov Moscow State University, Russia

WeSYB-30 17:30-18:00

Cardiovascular risk stratification based on Raman spectroscopy of blood serum: an alternative to MSCT of coronary arteries *(Invited paper)*

I.A. Bratchenko[1,2], I.A. Pimenova[2], P.A. Lebedev[3], M.A. Skuratova[4], L.A. Bratchenko[1,2]; [1]Scientific and Educational Center "Fundamental and Applied Photonics. Nanophotonics", Immanuel Kant Baltic Federal University, [2]Laser and Biotech Dept. Samara National Research University, [3]Therapy Dept. Samara State Medical University, [4]Samara Regional Clinical Hospital named after V.D. Seredavin, Russia

The study compared SERS data from blood serum analysis with MSCT data from human vascular studies. Using MSCT data as a standard, predictive models for the development of cardiovascular diseases were constructed based on optical biopsy data. These models demonstrated high accuracy (90% and higher) in identifying non-communicable diseases based solely on serum analysis. The proposed method demonstrates significant potential as an alternative to expensive MSCT imaging.

WeSYB-31 18:00-18:30

Discovery of a water skin layer using spontaneous Raman and stimulated Brillouin spectroscopies *(Invited paper)*

S.M. Pershin[1], D.G. Artemova[1], M.Ya. Grishin[1], P.S. Smerchansky[2], G.A. Boldin[1], I.A. Khodasevich[3]; [1]Prokhorov General Physics Institute of RAS, [2]National Research University Higher School of Economics, Russia; [3]B.I. Stepanov Institute of Physics of the NASB, Belarus

A near-surface water layer with distinct optical and interfacial properties is detected at room temperature using Raman spectroscopy, Rayleigh scattering, stimulated Brillouin scattering (SBS), and capillary meniscus measurements. Over 3–4 hours a 1–4 mm skin layer develops, accompanied by a characteristic deformation of the OH-stretch Raman band toward the ice-related component (~3200 cm-1) and by a noticeable decrease in elastic-scattering fluctuations.

WeSYB-32 18:30-19:00

Pre-breakdown Raman spectroscopy of protein solutions *(Invited paper)*

I.R. Eremin, A.Yu. Chikishev, N.N. Brandt; Lomonosov Moscow State University, Russia

We compare Raman spectra of aqueous solutions of protein excited at a wavelength of 532 nm with different energy parameters. Continuous radiation with varying powers and pulsed radiation with varying repetition rates, durations, and energies are used.

WeSYB-33 19:00-19:15

Heterogeneity and birefringence of soft tissues probed by the polarization-sensitive terahertz solid immersion microscopy

D.R. Il'enkova[1,2], D.D. Rybnikov[1,2], A.I. Alekseeva[3], A.S. Kucheryavenko[1,4], S.O. Yurchenko[2], K.I. Zaytsev[1], N.V. Chernomyrdin[1]; [1]Prokhorov General Physics Institute of RAS, [2]Bauman Moscow State Technical University, [3]Research Institute of Human Morphology, [4]Osipyan Institute of Solid State Physics of RAS, Russia

A polarization-sensitive terahertz (THz) solid immersion (SI) microscope applied to analyze freshly-excised rat tissues (muscles, tendons, aorta, brain). Refractive index was measured for orthogonal polarizations of the incident beam. Obtained THz birefringence attributed to fibrous morphology and confirmed by histology, was most pronounced in muscle tissue and Corpus callosum of the brain. These findings are crucial for developing THz biophotonics methods.

SYC. SECTION C. PHOTONICS AND NANOBIOTECHNOLOGY

Location: Petrov-Vodkin 2 Room, Floor 2; Wednesday, June 24, 2026

SYC. SECTION C. PHOTONICS AND NANOBIOTECHNOLOGY 4

WeSYC-16 09:00-09:30

Analysis of small extracellular vesicles with magnetic particles and flow cytometry *(Invited paper)*

A.M. Yashchenok; Skoltech, Russia

Immunomagnetic isolation in combination with flow cytometry is of great interest for the development of sEV-based liquid biopsy methods. This combination makes it possible to enrich sEVs free of contaminating proteins and non-vesicular particles and to detect sEV membrane proteins in situ using fluorescently labeled antigens. This, in turn, opens up great opportunities for the detection of a wide range of tumor biomarkers.

WeSYC-17 09:30-10:00

SERS probing of individual exosomes and their identification *(Invited paper)*

A.K. Sarychev[1], A. Ivanov[1], D. Korzhov[2,4], M. Shestopalova[2,4], K. Afanasev[1], I. Bykov[1], A. Smyk[5], A. Shurygin[5], K. Mochalov[2,3]; [1]Inst. for Theoretical and Applied Electromagnetics of RAS, [2]Shemyakin-Ovchinnikov Inst. of Bioorganic Chemistry, RAS, [3]RUDN Univ., [4]National Research Nuclear Univ., MEPHI, [5]James River Branch LLC, Russia

Individual exosomes are detected using surface-enhanced Raman scattering (SERS) by accumulating an electromagnetic field on a specially designed metasurface, which is a silver nanofilm deposited on a modulated plastic substrate. In the recesses of the metasurface, where the exosomes reside, the field reaches extremely high values under plasmon resonance conditions. Individual exosomes differ in their SERS spectra.

WeSYC-18 10:00-10:30

Development of approaches to the determination of biologically active substances by the method of SERS spectroscopy *(Invited paper)*

I.A. Veselova, M.V. Samodelova, N.R. Yarenkov, E.Yu. Afonyushkina, Yu.S. Vershinina, O.O. Kapitanova; Analytical Chemistry Division, Chemistry Division, Lomonosov Moscow State Univ., Russia

The report will focus on the plasmonic nanostructured polymeric materials and the creation of photocatalytic materials for SERS sensors for the detection of biological active substances. Approaches to controlling the hydrophilicity/hydrophobicity of the sensor surface will also be discussed. This will not only expand the range of analytes but also control the orientation of analyte molecules (using specific functional groups) on the plasmonic surface.

WeSYC-19 10:30-10:45

Using Raman scattering and fluorescence for non-invasive express -diagnosis of ENT-diseases (head and neck diseases)

A.B. Timurzieva[1,2], V.A. Duvansky[2], V.I. Popadyuk[2], V.I. Kukushkin[3], Yu.E. Abramov[2]; [1]N.A. Semashko National Research Institute of Public Health, [2]Peoples' Friendship University of Russia named after Patrice Lumumba, [3]Yu.A. Osipyan Institute of Solid State Physics, Russia

The aim of the study is to demonstrate the diagnostic possibility of Raman scattering and fluorescence for the early express-diagnosis of ENT-diseases. Raman scattering and fluorescence for ENT-diseases identification were useful for early, non-invasive, express-diagnostics of such pathology in clinical medicine in the future.

WeSYC-20 10:45-11:00

A novel dual reporter gene system for lung metastasis multimodal imaging

I.E. Rozhkova[1], A.N. Gabashvili[1], A.O. Sosnovtseva[2], A.A. Dresviannikova[1], A.S. Petrova[1], D.V. Goliusova[3], P.I. Nikitin[1]; [1]Prokhorov General Physics Institute of RAS, [2]Engelhardt Institute of Molecular Biology RAS, [3]Lopukhin Federal Research and Clinical Center of Physical-Chemical Medicine of FMBA, Russia

Molecular imaging aids in studying malignant diseases in vivo. This study presents two novel genetic constructs combining genes for luminescent enzymes and bacterial nanocompartments. Stable cell lines of Lewis lung carcinoma (LLC1) were generated. These cells were successfully used for modeling and multimodal visualization of lung metastases in mice.

- Coffee Break -

Location: Petrov-Vodkin 2 Room, Floor 2; Wednesday, June 24, 2026

SYC. SECTION C. PHOTONICS AND NANOBIOTECHNOLOGY 5

WeSYC-21 11:30-12:00

Application of fuorescent polarization analysis (FPA) for determination of proteins, enzyme activity and immunodiagnosis of infectious and fungal diseases *(Invited paper)*

L.I. Mukhametova[1], S.A. Eremin[1], S.V. Tillib[2], V.B. Krylov[3], N.E. Nifantiev[3]; [1]Chemical Department, Lomonosov Moscow State University, [2]Institute of Gene Biology, RAS, [3]N.D. Zelinsky Institute of Organic Chemistry, RAS, Russia

The use of fluorescent single-domain-nanobodies enables detection of the number of human proteins and their conformation by FPIA. FPIA used to measure of lysozyme activity by synthetic flu-substrates. Flu-glycoconjugates are used for Brucella-specific antibodies detection in cattle serum. Methods for invasive mycoses detection using high-specific MAb developed. This work was supported by the Ministry of Science and Higher Education of the Russian Federation № 075-00422-24-02 (agreements № 075-03-2024-401/3 from 30.05.2024).

WeSYC-22 12:00-12:30

Highly sensitive optical and magnetic biosensor methods for quantification of folic acid *(Invited paper)*

V.A. Bragina[1], D.O. Novichikhin[1], N.A. Belyakov[1,2], B.G. Gorshkov[1]; [1]Prokhorov General Physics Institute of RAS, [2]Moscow Center for Advanced Studies, Russia

Highly sensitive optical and magnetic biosensor methods based on protein-ligand interactions for folic acid (FA) quantification have been developed. The optical method, monitoring FA conjugate-antibody interactions on functionalized sensor chips, provides high analytical sensitivity with a wide dynamic range of six orders of magnitude. The point-of-care magnetic method enables rapid, simple and user-friendly FA detection in artificial saliva.

WeSYC-23 12:30-12:45

Reproducibility of albumin nanoparticle synthesis by the desolvation method

Z.R. Galaeva, P.V. Khramtsov; Institute of Ecology and Genetics of Microorganisms (IEGM), RAS, Russia

The desolvation method is a simple approach for protein nanoparticle preparation based on reduced protein solubility upon addition of an organic solvent, leading to protein aggregation. However, synthesis reproducibility strongly depends on protein purity and physicochemical properties. In this study, reproducibility of albumin nanoparticles synthesized from bovine serum albumin of different manufacturers and purification grades was evaluated.

WeSYC-24 12:45-13:00

Factors affecting the choice of IR radiation dose in nanoparticle-based photothermal therapy

A.A. Anikin, D.A. Petrukhin, V.D. Salnikov, V.K. Belyaev, V.V. Rodionova; Immanuel Kant Baltic Federal University, Russia

Anti-cancer photothermal therapy uses infrared laser heating of nanoparticles to induce cancer cell death. Compared to magnetic hyperthermia, it provides higher SAR at lower nanoparticle concentrations but involves strong temperature gradients and nanoparticle photothermal instability. These factors critically affect temperature control and optimal irradiation intensity in photothermal therapy and will be discussed in this report.

WeSYC-26 13:00-13:15

Mimicking optoelectronic synapse in a hybrid fluorescent protein/carbon nanotube transistor

I. Bobrinetskiy[1], A. Kudriavtseva[1,2]; [1]Moscow Center for Advanced Studies, [2]Prokhorov General Physics Institute of RAS, Russia

This work demonstrates an electro photoactive synaptic transistor based on individual single-walled carbon nanotube modified with green fluorescent protein (FP/SWCNT) as a light tunable charge trapping layer. The device can be electrically switched between volatile and non volatile operating modes, enabling concurrent short term and long term neuroplasticity under specific light illumination. This work was supported by the Russian Science Foundation, grant no. 26-19-00062.

- Lunch Break -

Location: Petrov-Vodkin 2 Room, Floor 2; Wednesday, June 24, 2026

SYC. SECTION C. PHOTONICS AND NANOBIOTECHNOLOGY 6

WeSYC-27 15:00-15:30

Characterization of different optical labels and their surroundings for more sensitive biosensing *(Invited paper)*

A.V. Zherdev, B. B. Dzantiev; A.N. Bach Institute of Biochemistry, Research Centre of Biotechnology of RAS, Russia

The report presents the use of different labels in immuno- and aptasensors with colorimetric and fluorimetric detection. It discusses the factors determining detection limits of homogeneous and membrane biosensors for antibiotics and other analytes, the solutions for increasing sensitivity through new labels, techniques of their functionalization and integration into intermolecular complexes. The study was supported by the RSF grant 24-16-00273.

WeSYC-28 15:30-16:00

The detection of pesticides and plasticizers by Fluorescence Polarization ImmunoAssay in different objects *(Invited paper)*

S.A. Eremin[1,2], M.A. Pashkova[1,2], Diao Zicheng[2], Xue Shixia[2], S. Filimonova[3]; [1]A.N. Bach Institute of Biochemistry, Research Centre of Biotechnology of RAS, [2]Faculty of Chemistry, Lomonosov Moscow State University, [3]Institute of Pharmacy, I.M. Sechenov First Medical University, Russia

Fluorescence Polarization Immunoassay (FPIA) is powerful tool for low-molecular-weight contaminants monitoring in a variety of matrices. This work highlights current developments of pesticides (acetochlor, butachlor) detection and plasticizers (phthalates and bisphenol A) by FPIA. Strategies for developing immunoreagents (antibodies and tracers), approaches to sample preparation for the analysis of complex matrices (water, soil, plant and animal products), and analytical characteristics are discussed. Acknowledgements: The study was supported by the Russian Science Foundation (RSF) grant # 24-43-00196 (https://rscf.ru/project/24-43-00196/).

WeSYC-29 16:00-16:15

Substrate solution optimization as a method for signal enhancement in colorimetric analysis based on Prussian blue nanoparticles.

A.D. Novokshonova[1], P.V. Khramtsov[1,2]; [1]Perm Federal Research Center UB RAS, Russia, [2]Perm State Univ., Russia

Prussian blue nanoparticles are actively studied as a label in colorimetric analysis, such as in ELISA. However, the experimental conditions during the assay optimization phase are often not systematically studied. Our work is dedicated to optimizing the conditions of nanoparticle-based colorimetric assays. We demonstrate that the colorimetric signal can be significantly enhanced by optimizing the composition of the substrate solution.

WeSYC-30 16:15-16:30

Visible light induced encapsulation of living cells into iron alginate hydrogel

A.S. Sokolov[1], S.G. Poroshin[1,2], G.B. Sukhorukov[1,2]; [1]Skolkovo Institute of Science and Technology, [2]Life Improvement by Future Technologies (LIFT) Center, Russia

The trump card of iron ions as alginate crosslinkers lies in the different behavior of iron ions with different charges. Fe^{3+} ions are strong and form a stiff, highly crosslinked hydrogel, whereas Fe^{2+} ions are weaker and crosslink alginate chains poorly. Using two visible-light-activated redox reactions, reversible hydrogel formation and dissolution were achieved. We present results on the cytocompatibility of this system.

WeSYC-31 16:30-16:45

Anisotropic magnetic nanolabels for competitive lateral flow immunoassay

A.M. Skirda[1,2], A.V. Orlov[1], J.A. Malkerov[1,3], V.V. Volkov[1,3], U.D. Rezepova[1,3], P.I. Nikitin[1,3]; [1]Prokhorov General Physics Institute of RAS, [2]Moscow Center for Advanced Studies, [3]National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), Russia

Due to unique properties of magnetic nanochains (MNCs), they are highly promising for diverse applications, including chemical synthesis, biosensing, and nanomedicine. Here, we present the MNCs application for the development of immunoassay for detection of chloramphenicol in milk. The proposed approach offers the detection limit of 5 pg/mL at the assay time of only 25 minutes.

WeSYC-32 16:45-17:00

Modeling and numerical investigation of SPR biosensor for the detection of lung cancer cells

Jay Kumar Yadav, S.K. Tripathy; Department of Electronics and Communication Engineering, National Institute of Technology Silchar, India

We have demonstrated for the first time, a new class of light-based nanogeneration of plasmon using silver/Perovskite (CsGeI3)/ZnSe for the detection of lung cancer using the refractive index of the sample. The maximum possible nanogeneration of plasmons due to light-matter interaction occurs after optimizing various layers of the proposed surface plasmon resonance (SPR) biosensors, results in better sensor performance parameters.

SYD. SECTION D. PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE

Location: Petrov-Vodkin 3 Room, Floor 2; Wednesday, June 24, 2026

SYD. SECTION D. PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE 1

WeSYD-01 09:00-09:30

Photoluminescence of molecular oxygen in systems of biological importance. Fifty years after the discovery. History, measurement technologies, application fields *(Keynote presentation)*

A.A. Krasnovsky Jr; Federal Research Center of Biotechnology RAS, Russia

Singlet oxygen molecules (SO) are known to promote photodynamic stress. In 1976, 50 years ago this author discovered that SO deactivation in natural systems is accompanied by IR phosphorescence at 1270 nm. Currently, this phosphorescence has been using worldwide as the best tool for SO investigation. This paper provides a survey of the progress for the half of century of phosphorescence research.

WeSYD-02 09:30-10:00

Multimodal QPI- and FLIM-based platform for analysis of localized photodynamic treatment of cells in vitro *(Invited paper)*

I.V. Semenova, A.V. Belashov, A.A. Zhikhoreva; Ioffe Institute, Russia

This report presents a multimodal approach combining the fluorescence lifetime imaging microscopy (FLIM) and spatial light interference microscopy (SLIM) into a single complex allowing for a concurrent analysis of fluorescence and morphological parameters of cells in vitro. The developed approach was validated on investigation of cell response to photodynamic treatment applied both onto the entire sample and on individual cells.

WeSYD-03 10:00-10:30

Singlet oxygen generation in protein-containing solutions: towards understanding the mechanisms of photodynamic therapy *(Keynote presentation)*

O.S. Vasyutinskii[1], D.M. Beltukova[1], V.P. Belik[1], K.A. Chudakov[2], O.V. Smirnov[1], I.V. Semenova[1]; [1]Ioffe Institute, [2]Peter the Great St. Petersburg Polytechnic University, Russia

As demonstrated, the photosensitizer Ce6 bound with human serum albumin practically does not produce singlet oxygen. The result obtained challenges the established mechanisms of photodynamic therapy through singlet oxygen production. Moreover, the we suggest a novel method for characterization of photosensibilizer triplet states at room temperature that was not possible before.

WeSYD-04 10:30-10:45

Sensitive singlet oxygen detection system based on a superconducting single photon detector

V.S. Andreev[1,2,3], P.V. Morozov[2,3], G.N. Goltsman[1,2,3]; [1]HSE University, [2]Moscow Pedagogical State University, [3]LLC "Scontel", Russia

In this paper we present sensitive system for detecting photons of singlet oxygen phosphorescence combined with the superconducting nanowire single photon detector. Detector coupled with multimode fiber and efficiency above 80 % with working area 50x50 um2 and DCR at working point of 1000, optimized for measurements around 1270 nm.

WeSYD-05 10:45-11:00

Study of RPE lipofuscin photooxidation degree using VIS-NIR spectroscopy and fluorescence lifetime imaging microscopy

P. Morozov[1,2], V. Andreev[1,2,3], M. Yakovleva[4,5], A. Kostyukov[4,5], M. Tokarev[1], T. Feldman[4,5], V. Kuzmin[4], G. Goltsman[1,3], M. Ostrovsky[4,5], M. Shirmanova[1]; [1]Physics dept., Moscow Pedagogical State University, [2]LLC "Superconductor Nanotech", [3]Physics dept., National Research University Higher School of Economics, [4]N.M. Emanuel Institute of Biochemical Physics RAS, [5]Biology dept., Lomonosov Moscow State University, Russia

To study fluorescence lifetimes of lipofuscin from retinal pigment epithelium cells we used fluorescence excitation method with time correlated photon counting and fluorescence lifetimes imaging microscopy in combination with superconducting single-photon detector. An analysis of fluorescence lifetimes and VIS-NIR spectra before and after photooxidation of lipofuscin granules showed significant differences in the characteristic lifetimes, as well as a shift of the maximum of fluorescence spectrum to short-wavelength region. These methods become promising for development of early preclinical method.

- Coffee Break -

Location: Petrov-Vodkin 3 Room, Floor 2; Wednesday, June 24, 2026

SYD. SECTION D. PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE 2

WeSYD-06 11:30-12:00

Photo- and sonocatalytic activity of Fotoditazin decorated microbubbles *(Invited paper)*

A. Orlova[1,2], A. Boltenko[1,2], T. Estifeeva[2,3], M. Rider[1], M. Yaroslavova[1], K. Parutina[2], A. Surkova[1], R. Barmin[2,3], P. Rudakovskaya[2,3]; [1]International Research and Education Centre for Physics of Nanostructures, ITMO University, [2]Center for Photonic Science and Engineering, Skolkovo Institute of Science and Technology, [3]Dmitry Mendeleev University of Chemical Technology of Russia, Russia

Mixtures of protein-shelled microbubbles with the photosensitizer Fotoditazin were studied for photo- and sonodynamic applications. Circular dichroism and optical spectroscopy revealed that Fotoditazin interacts with the microbubble shell, inducing shell-dependent changes in BSA structure and sensitizer aggregation. Stabilized shells and monomeric chlorin e6 result in enhanced photo- and sonocatalytic activity of Fotoditazin.

WeSYD-07 12:00-12:30

Nano-phytoformulations of berberine and pheophorbide-a mediated photodynamic therapy on lung cancer spheroids model *(Invited paper)*

H. Abrahamse, M. Moloudi, B. George; Laser Research Centre, Faculty of Health Sciences University of Johannesburg, South Africa

Lung cancer is the second most common cancer, causing ~2 million cases and 1.76 million deaths annually due to late diagnosis. Smoking and environmental factors dominate risk. Conventional therapies face toxicity and resistance. Photodynamic therapy is a targeted, noninvasive alternative. Natural photosensitizers berberine and pheophorbide-a show promise, enhanced by nanocarriers and validated using 3D spheroid models.

WeSYD-08 12:30-12:45

Evaluation of phototoxic potential of gold nanoparticles - liposome - pheophorbide-a against breast cancer cells

B.P. George, M. Zahra, H. Abrahamse; Univ. of Johannesburg, South Africa

Breast cancer treatment is limited by poor specificity and therapy resistance. This study evaluated green-synthesised Dicoma anomala-derived gold nanoparticles encapsulated in liposomes and loaded with pheophorbide-a for photodynamic therapy against MDA MB-231 triple-negative breast cancer cells. The nanoformulation showed dose-dependent cytotoxicity and induced intrinsic apoptosis, highlighting its potential as a promising breast cancer therapeutic platform.

WeSYD-09 12:45-13:00

Synthesis of core-shell ternary quantum dots -porphyrin conjugates and itsphotodynamic therapy application

S.O. Oluwafemi; Univ. of Johannesburg, South Africa

In this presentation, a large-scale aqueous synthesis of ternary quantum dots (QDs) and their conjugation to porphyrin will be discussed as an efficient way to overcome photosensitizer shortcomings. The singlet oxygen generation of this highly aqueous-soluble novel conjugate and its cell viability against different cancer cell lines will be discussed, highlighting its potential for PDT applications.

WeSYD-10 13:00-13:15

Plasmon-oxygen luminescence method for registration of quercetin and its derivates in extract solutions

A.V. Tsibulnikova[1], E.S. Zemlyakova[1,2], V.A. Slezhkin[1,2], A.A. Kostrina[1], D.A. Artamonov[1], I.G. Samusev[1]; [1]Immanuel Kant Baltic Federal University, Russia

This paper presents a luminescent method for the qualitative determination of flavonoids – quercetin and its main derivatives in the extract of viburnum berries (Viburnum Opulus L.) using oxygen saturation process and plasmon mechanism.

- Lunch Break -

Location: Petrov-Vodkin 3 Room, Floor 2; Wednesday, June 24, 2026

SYD. SECTION D. PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE 3

WeSYD-11 15:00-15:30

A fiber photometry approach for the in vivo assessment of BBB integrity and brain tissue clearance *(Invited paper)*

A.K. Berdnikov[1], A.V. Stavrovskaya[1], I.V. Potapenko[1,2], V.I. Zhdankina[1], A.N. Lukyanchuk[1], Yu.K. Komleva[1], V.V. Salmin[2], A.B. Salmina[1,2]; [1]Russian Center of Neurology and Neuroscience, [2]Bauman Moscow State Technical University, Russia

Fiber photometry could be a potent method for assessing blood-brain barrier integrity in vivo. By monitoring sodium fluorescein decay in 5xFAD Alzheimer's mice versus wild-type controls, we observed significantly altered clearance dynamics. This approach enables longitudinal monitoring of BBB function, overcoming the limitations of standard post-mortem assessments.

WeSYD-12 15:30-16:00

Non-invasive optical assessment of skin perfusion under lower limb ischemia *(Invited paper)*

V.I. Bukova[1], A.M. Kovalchuk[2], I.V. Makarova[1], A.V. Guryleva[1], A.S. Machikhin[1], V.P. Baklaushev[2]; [1]Scientific and Technological Centre of Unique Instrumentation of RAS, [2]Federal Center of Brain Research and Neurotechnologies of FMBA of Russia, Russia

Critical lower limb ischemia impacts microcirculation and requires early, non-invasive diagnosis. This study proposes the use of photoplethysmography and videocapillaroscopy for assessing skin microcirculation to address this issue. In a rat ischemia model, reduced perfusion and vessel density were observed after embolization. The method is rapid, safe, cost-effective, and suitable for continuous studies.

WeSYD-13 16:00-16:15

Controlling radiation parameters to expandthe functional capabilities of the optical method of recording human physiologicalsignals

V.V. Davydov[1,2], M.A. Yakusheva[3], D.S. Provodin[1], E.V. Porfir'eva[1], D.V. Davydova[1], E.A. Zhestkaya[2], Y.A. Guseva[1]; [1]Peter the Great St.Petersburg Polytechnic University, [2]St.Petersburg Electrotechnical University "LETI", [3]St.Petersburg State University of Telecommunications, Russia

A new method for recording human biological signals based on an optical sensor with a CCD array and radiation parameter adjustment has been proposed. The use of the new method has made it possible to increase the signal-to-noise ratio by more than an order of magnitude and to record minor changes in the cardiovascular system that were not previously reflected in the recorded signals.

WeSYD-14 16:15-16:30

Intraoperative fluorescent verification of intracerebral bone fragments in penetrating cranial injuries

G.G. Bulyshchenko[1], N.K. Vasileva[1], B.V. Martynov[1], G.V. Papayan[2], K.A. Chemodakova[1], K.N. Babichev[1], S.D. Mirzametov[1], B.G. Adleyba[1], S.A. Goryainov[3], A.I. Gaivoronsky[1], I.A. Menkov[1], I.V. Boykov[1], D.V. Svistov[1]; [1]Department of Neurosurgery, Military Medical Academy named after S.M. Kirov, [2]Center for Laser Medicine, Almazov National Medical Research Centre, [3]Department of Bone and Soft Tissue Tumors, A. Tsyb Medical Radiological Research Center, Russia

A novel intraoperative method using ultraviolet light (390 nm) visualizes bone fragments in penetrating brain injuries via green-blue autofluorescence. In a clinical case, it enabled complete removal of fragments <5 mm, undetectable under white light. The technique is simple, portable, and cost-effective, significantly improving surgical precision and infection prevention in field and emergency neurosurgery.

WeSYD-15 16:30-16:45

LED compact illuminator -based photodynamic therapy efficacy assessment

A.Yu. Sain[1], A.S. Abdurashitov[1,2], P.I. Proshin[2], D.A. Terentyeva[1,3], G.B. Sukhorukov[1,2], O.A. Sindeeva[1]; [1]Center for Bio- and Medical Technologies, Skolkovo Institute of Science and Technology, [2]Life Improvement by Future Technologies (LIFT) Center, [3]Center for Photonic Science and Engineering, Skolkovo Institute of Science and Technology, Russia

The increasing demand for specialized equipment in photodynamic therapy necessitates innovative design approaches. This study presents the tunable LED illuminator operated at 660 nm engineered to scan-less provide uniform irradiation. The practical efficacy of the compact LED illuminator for photodynamic therapy parameters optimization was evaluated through experiments involving commonly used in vitro models for studying cancer treatments across various organs.

WeSYD-16 16:45-17:00

Hardware design for reliable photosensitizers assessment

A.S. Abdurashitov[1,2], P.I. Proshin[1,2], A.U. Sain[1], D.A. Terentyeva[1,3], A.D. Kosov,[4], G.B. Sukhorukov[1,2], O.A.Sindeeva[1]; [1]Center for Bio- and Medical Technologies Skoltech, [2]Life Improvement by Future Technologies (LIFT) Center, [3]Center for Photonic Science and Engineering, Skoltech, [4]Department of Chemistry, Lomonosov Moscow State University, Russia

This work details a compact, scanless 660 nm LED illuminator engineered for PDT. The design ensures precise, uniform, and stable light delivery (1-20 mW/cm^2) across standard 96-well plates. We validate performance through rigorous photodynamic efficacy studies on six cancer cell lines, establishing a robust platform for in vitro photosensitizer testing.

SYA. SECTION A. ADVANCED LASER MEDICAL SYSTEMS AND TECHNOLOGIES - POSTERS

Location: Congress Hall, Floor 1; Wednesday, June 24, 2026

WeSYA-p01 15:00-18:30

Speckle correlation analysis approach with acoustic probing for the diagnostic of the morphology of the multi-phase foam -like systems

E.A. Isaeva, A.A. Isaeva, D.A. Zimnyakov; Yury Gagarin State Technical University of Saratov, Russia

The methods for the analyzing the structural and functional properties of foam-like media play an important role in the development of the methods for synthesizing tissue engineered structures or monitoring the degradation processes of 3D scaffolds. This paper presents the results of a study of a laser field scattered by the model gas-liquid foam under the lowfrequency acoustically probing using speckle correlometry technique.

WeSYA-p02 15:00-18:30

The light transport modeling during the foam-like media aging

E.A. Isaeva, A.A. Isaeva, D.A. Zimnyakov; Yuri Gagarin State Technical University of Saratov, Russia

This paper presents the results of radiation transfer modeling based on the Percus–Yevick hard-sphere model, which reproduces the morphology of gas-liquid foam during the initial stages of a foam-like medium aging and statistical modeling of radiation transfer in foam-like media simulated using a system of Kelvin cells at various stages of aging. Additionally, modeling of radiation transfer processes in a foam-like medium with a polydisperse structure was performed.

WeSYA-p03 15:00-18:30

Improving human sperm motility using infrared low-level laser irradiation

D.S. Sitnikov[1], I.M. Shorina[1], N.P. Makarova[2]; [1]Joint Institute for High Temperatures of RAS, [2]"National Medical Research Center for Obstetrics, Gynecology and Perinatology" MoH, Russia

Infrared (780 nm) low-level laser radiation was used for photobiostimulation as a means of therapy for male infertility. We studied the motility of human sperm after exposure to radiation with at an intensity of 140 MW/cm2 for two minutes. An increase in sperm kinetics was detected compared to control group.

WeSYA-p04 15:00-18:30

Influence of UV laser treatment on the wettability of metallic materials for biomedical applications

M.Yu. Kandaurova, T.Yu. Sablina, I.A. Zyatikov, Yu.N. Panchenko; Institute of High Current Electronics, SB RAS, Russia

The effect of UV laser treatment (λ = 266 nm) on the wettability, phase and chemical composition of TiNi alloy and AISI 316L stainless steel was studied.

WeSYA-p05 15:00-18:30

Notched fibers as a sensing element of infrared fiber probes

I.V. Yuzhakov, P.V. Pestereva, A.A. Yuzhakova, E.N. Malyshkina, A.E. Lvov, L.V. Zhukova; Ural Federal University, Russia

The notched fiber is made of ceramic with a composition of 42 mol. % AgBr0.7I0.3 in AgCl. It transmits radiation in the range of 3.5–15.0 μm with a loss of up to 1.8 dB/m. This fiber is a promising sensor element for fiber-optic probes.

WeSYA-p06 15:00-18:30

Histophysiological study of the striated muscle tissue after exposure to 2 μm continuous-wave laser radiation

V.V. Astashov[1], M.S. Kopyeva[1,2], S.A. Filatova[2], V.A. Kamynin[2], V.I. Kozlov[1], V.A. Duvanskiy[1]; [1]Peoples' Friendship University of Russia, RUDN University, [2]Prokhorov General Physics Institute of RAS, Russia

A histophysiological study of the striated muscle tissue of experimental animals was carried out on the 3rd day after exposure to continuous-wave laser radiation of a Holmium fiber laser with different exposure times. Using histological and functional research methods, morphological changes characteristic of aseptic inflammation were identified, depending on the radiation dose.

WeSYA-p07 15:00-18:30

Surface modification of Ti-6Al-4V alloy by nanosecond ultraviolet laser irradiation

T.Yu. Sablina, M.Yu. Kandaurova, I.A. Zyatikov, I.K. Lopatkin, Yu.N. Panchenko; Institute of High Current Electronics, SB RAS, Russia

The microstructure and surface functional characteristics of Ti-6Al-4V titanium alloy were investigated following treatment with nanosecond ultraviolet (UV) laser irradiation. UV laser treatment led to the formation of titanium oxide phases (TiO2, TiO). This resulted in enhanced nanohardness (by 25–30%), increased roughness, and a significant increase in hydrophilicity – the water contact angle decreased from 80° to 9–13°.

WeSYA-p08 15:00-18:30

Laser formation of surface functional layers for use as neurointerfaces

D.T. Murashko[1], M.S. Savelyev[1], A.Yu. Gerasimenko[1,2]; [1]Institute of Biomedical Systems, National Research University of Electronic Technology, [2]Institute for Bionic Technologies and Engineering, I.M. Sechenov First Moscow State Medical University, Russia

The formation of functional layers based on carbon nanomaterials contributes to an increase in the effective surface area of neurointerfaces. This study presents the results of the formation of functional layers by laser exposure to the surface of an AISI 316L steel substrate and the introduction of a layer of single-walled carbon nanotubes.

WeSYA-p09 15:00-18:30

Comparative modeling of intramaterial inscription in hydrophilic and hydrophobic acrylics for intraocular lenses

U.S. Averkieva[1], S.G. Sazonkin[1], I.O. Orekhov[1], K.B. Pershin[2], S.I. Kudryashov[2], N.A. Smirnov[2], P.P. Pakholchuk[2], A.V. Gorevoy[2], Yu.S. Gulina[2], E.N. Rimskaya[2], P.A. Danilov[2], A.Yu. Tsygankov[2]; [1]Bauman Moscow State Technical Univ., [2]P.N. Lebedev Physical Inst. of RAS, Russia

We investigated intramaterial inscription in hydrophilic and hydrophobic acrylics for intraocular lenses at 1.56 μm. Line and ring geometries were compared for femtosecond and picosecond pulses using fluence maps, normalized ratio, depth, and thermal buildup. Femtosecond pulses yielded narrower regions above threshold and thinner walls, whereas picosecond pulses increased depth per pass but raised thermal load, especially in hydrophilic acrylic.

WeSYA-p10 15:00-18:30

The effect of fiber output end shape on the 1.54 μm laser ablation efficiency of biotisues phantoms

R. Nasser , S.N. Smirnov, A.Yu. Perepelyakov, A.V. Belikov; Institute of Laser Technologies, ITMO University, Russia

This study investigates how shaping the output end of an optical fiber (flat, V, pyramid, ball) affects laser-induced cavitation bubbles and tissue ablation. Using a 1.54 μm Yb,Er:Glass laser, we show that specially shaped fibers significantly increase bubble size and ablation efficiency in gel phantoms, with the pyramid shape yielding a 5.3-fold improvement over a standard flat end.

SYC. SECTION C. PHOTONICS AND NANOBIOTECHNOLOGY - POSTERS

Location: Congress Hall, Floor 1; Wednesday, June 24, 2026

WeSYC-p01 15:00-18:30

New asymmetric porphyrin-based dyad as a fluorescent probe for cellular imaging

A.A. Smirnov, D.A. Lukyanov, A.V. Povolotskiy, V.A. Pomogaev, E.V. Solovyeva; Institute of Chemistry, St. Petersburg State University, Russia

Porphyrin dyads are considered promising multimodal fluorescent probes due to their ratiometric spectral response and excellent biocompatibility. However, very few water-soluble compounds of this type are known. In this study, a new asymmetric dyad, ZnTPPS-TPP, was synthesized, containing both metallated and non-metallated fragments. Photophysical properties of the dyad were studied in biological environments and supported by DFT modeling.

WeSYC-p02 15:00-18:30

Wavelet analysis of cerebral versus systemic hemodynamics responses to breath-holding in rats

I.A. Mizeva[1], A.Y. Sokolov[2], A.A. Kamshilin[3]; [1]Institute of Continuous Media Mechanics, UrB RAS, [2]I.P. Pavlov Institute of Physiology of RAS, [3]Institute of Automation and Control Processes FEB RAS, Russia

The study analyzes the response of low-frequency components of simultaneously measured cerebral blood supply and systemic arterial blood pressure to breath-holding in rats. The dynamics of cerebral blood supply was assessed by imaging photoplethysmography. The dynamics of the frequency components was quantified by the wavelet analysis. Results reveal distinct, frequency-specific regulatory mechanisms of cerebral blood supply.

WeSYC-p03 15:00-18:30

Separation of linear dichroism and birefringence in Polarization-Modulation Pump-Probe method as a tool for studying ultrafast dynamics in biomolecules.

O.S. Vasyutinskii[1], D.A. Volkov[1], M.V. Belashov[1,2], A.V. Dmitrieva[1,3], M.A. Plotitsyna[1,3], M.E. Sasin[1]; [1]Ioffe Institute, [2]ITMO University, [3]Peter the Great St. Petersburg Polytechnic University, Russia

We experimentally separated linear dichroism (LD) and birefringence (BF) effects in NADH solution using polarization-modulation pump-probe spectroscopy. The BR detection gives significant increase in signal and can be used for studying long relaxation processes. The LD signal is more convenient for studying of fast relaxation processes. The approach enables the detailed study of ultrafast energy transfer processes in biomolecules in solutions and cells.

WeSYC-p04 15:00-18:30

Photoluminescence quenching of carbon dots by multi-metal ion systems in aqueous solutions

A.A.Cherednikova[1], H.Barhum[2], L.V.Mikhailova[1], M.V.Timofeeva[1], E.N. Gerasimova[1], A.E. Zhilina[3], I.I. Vazhenin[1], I.A.Reznik[1], P. Ginzburg[2], M.V.Zyuzin[1]; [1]School of Physics and Engineering, ITMO University, Russia; [2]Department of Physical Electronics, Tel Aviv University, Israel; [3]Faculty of Biotechnologies, ITMO University, Russia

Fe3+ and Co2+ are essential for oxygen transport and vitamin B12 synthesis. Monitoring metal ion concentration changes enables early-stage diagnostics. Biological environment is a multicomponent system, containing various metals. This study explores CD's photoluminescence quenching behavior and sensitivity to Fe3+, Co2+, Fe3+/Co2+ combined system, where it's detected separately and as multi-metal ion system.

WeSYC-p05 15:00-18:30

Fluorescent copper nanoclusters stabilized with small L-proline and large vancomycin: ligand effect

A.I. Demenshin, E.A. Kolobova, T.S. Sych, U.P. Zimarina, E.V. Solovyeva; St.Petersburg State University, Russia

Copper nanoclusters are promising for bioanalytics. Their intrinsic fluorescence can be combined with recognition properties of stabilizing organic ligands for improved biomolecule sensing. In this work, we present the developed procedures of the synthesis of L-proline and vancomycin-stabilized copper nanoclusters, their characterization and application in fluorescence sensing and electrophoretic separation of drugs from the family of selective serotonin reuptake inhibitors.

WeSYC-p06 15:00-18:30

Kinetic characterization of G-protein-coupled receptors using spectral-phase interferometry

A.M. Skirda[1,2], A.V. Orlov[1], S.G. Trofimenko[1,3], E.S. Vyhodtseva[1,3], P.I. Nikitin[1,3]; [1]Prokhorov General Physics Institute of RAS, [2]Moscow Institute of Physics and Technology, [3]National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), Russia

Despite their therapeutic importance, a substantial number of G-protein-coupled receptors (GPCRs) remain classified as "orphan receptors", meaning their ligands and cellular functions are unknown. Using a low-coherence interferometry-based biosensing platform, we characterize the binding kinetics between GPCR fragments and stabilizing antibodies. Developed approach provides a scalable method for the functional profiling of orphan GPCRs and the screening of potential ligands.

WeSYC-p07 15:00-18:30

Quantitative analysis of amino acid mixtures using drop-coating deposition Raman spectroscopy

E.Y. Ponkratova[1], A.S. Shtumpf[1], M.P. Sandomirskii[1], K.A. Maleeva[2], D.A. Zuev[1]; [1]Faculty of Physics, ITMO University, [2]International Research and Education Center for Physics of Nanostructures, ITMO University, Russia

Proteinogenic amino acids are vital for peptides and proteins in the human body. Current analysis methods face challenges, prompting exploration of Raman spectroscopy with drop-coating deposition (DCDR) for unique molecular vibrations. This study evaluated the DCDR method using amino acid mixtures, determining optimal parameters. Results indicated varying accuracy based on hydrophobicity, highlighting DCDR's limitations and potential for analyzing complex mixtures.

WeSYC-p08 15:00-18:30

Integration of optical genome mapping with super-enhancer annotations: a conceptual framework for structural variant analysis in regulatory regions

N.N. Orlova, G.A. Ashniev, Yu.V. Makus, A.V. Orlov; Prokhorov General Physics Institute of RAS, Russia

We propose a conceptual framework for integrating optical genome mapping (OGM) data with super-enhancer annotations to systematically identify structural variants affecting cancer-associated regulatory regions. OGM utilizes laser-induced fluorescence imaging of labeled DNA molecules, providing resolution suitable for analyzing extended regulatory elements. This approach may enable detection of enhancer hijacking events and facilitate discovery of novel mechanisms of oncogene dysregulation.

WeSYC-p09 15:00-18:30

Modeling of skin diffuse reflectance spectra

Ya.A. Razumov[1], I.A. Serebryakova[1], Y.I. Surkov[1], E.A. Genina[1,2], V.V. Tuchin[1,2,3]; [1]Optics and Biophotonics Department, Saratov State University, [2]Laboratory of Biophotonics, Tomsk State University, [3]Laboratory of Laser Diagnostics of Technical and Living Systems, IPMC RAS, FRC "Saratov Scientific Centre of the RAS", Russia

This study presents a comprehensive investigation of the optical properties of human skin with varying melanin content (1–50%) and hematocrit levels (10–50%) using the CloudMonteCarloforLightTransport platform. Simulated diffuse reflectance spectra in the 400–1000 nm range were compared with experimental in vivo data acquired using a spectrometer and a dermatoscope. The work aims to establish a foundation for developing color-correction algorithms and quantitative methods for assessing skin biochemical parameters based on accessible optical measurements

WeSYC-p10 15:00-18:30

Optical biosensors for studying the kinetics of antibody binding and regeneration of sensor chips based on gelatin - folate conjugates

D.O. Novichikhin[1], V.A. Bragina[1], G.M. Sorokin[2], A.I. Nikitin[3], N.A. Belyakov[1,4]; [1]Prokhorov General Physics Institute of RAS, [2]Chuvash State University, [3]Volga branch of MADI, [4]Moscow Center for Advanced Studies, Russia

A label-free optical biosensor based on low-coherence interferometry was developed for studying molecular binding kinetics by measuring surface biolayer thickness. Antibody binding to immobilized folic acid-gelatin conjugate (FA-gelatin) was investigated as a model system. Kinetic constants, competitive displacement, and surface regeneration were characterized for various chip modifications. Results demonstrate that FA-gelatin serves as a convenient model conjugate for assays with limited binding-site accessibility.

WeSYC-p11 15:00-18:30

Partial enzymatic hydrolysis as a promising sample preparation method for the analysis of protein amino acid side chains oxidation using surface-enhanced Raman spectroscopy

A.D. Vasilyeva[1], I.A. Boginskaya[2], R.O. Aliev[1], L.V. Yurina[1], E.G. Evtushenko[1,3], M.I. Indeykina[1], K.N. Afanas´ev[2], M.V. Sedova[2], I.A. Ryzhikov[2,4], M.A. Rosenfeld[1], I.N. Kurochkin[1,3]; [1]N.M. Emanuel Institute of Biochemical Physics, RAS, [2]Institute for Theoretical and Applied Electromagnetics, RAS, [3]Lomonosov Moscow State University, Faculty of Chemistry, [4]N.E. Bauman Moscow State Technical University, Russia

Surface-enhanced Raman spectroscopy (SERS) is a well-established basis for the development of cheap and rapid analytical protocols. For the case of hypochlorite-induced fibrinogen oxidative modification, SERS spectra of oxidized and native fibrinogen were shown to be very similar. Partial enzymatic hydrolysis of the protein significantly enhances the differences, enabling the SERS-based analysis of amino acid side chains oxidative modification.

SYB. SECTION B. LASER INTERACTION WITH CELLS AND TISSUES: CLINICAL IMAGING AND SPECTROSCOPY

Location: Petrov-Vodkin 1 Room, Floor 2; Thursday, June 25, 2026

SYB. SECTION B. OPTICAL IMAGING MODALITIES + OPTICAL CLEARING 1

Session Chair: Sergey Nikitin, Lomonosov Moscow State University, Russia

ThSYB-34 09:00-09:30

Erythrocyte-endothelium interplay investigated via optical tweezers *(Invited paper)*

M.K. Maksimov[1], P.B. Ermolinskiy[1], O.N. Scheglovitova[2], M.R. Kapkaeva[2], A.E. Lugovtsov[1], A.V. Priezzhev[1]; [1]Faculty of Physics, Lomonosov Moscow State University, [2]The Gamaleya National Center of Epidemiology and Microbiology, Russia

The interactions between pairs of erythrocytes, between single erythrocytes and endothelium monolayer are studied in vitro via optical tweezers. RBC-endothelium system is altered by the addition of nitric oxide precursor, L-Arginine. The results acquired demonstrate the dose-dependent decrease in erythrocyte aggregation and disaggregation forces, while the erythrocyte-endothelium adhesion forces seem to be not affected by nitric oxide.

ThSYB-35 09:30-10:00

Optical monitoring of intrafollicular drug delivery *(Invited paper)*

Yu.I. Svenskaya[1], Yu.I. Surkov[1,2], M.S. Saveleva[1], P.A. Demina[1], I.A. Serebryakova[2], M.E. Lobanov[1], R.A. Anisimov[1], G.S. Terentyuk[1], E.A. Genina[2], V.V. Tuchin[1,2]; [1]Science Medical Center, Saratov State University, [2]Institute of Physics, Saratov State University, Russia

We report on a novel approach towards the glucocorticosteroid encapsulation and delivery to hair follicles. Efficient intrafollicular accumulation of the GC-loaded carriers after their US-assisted topical application in vivo in rats provided the delivery of the drug molecules to targeted receptors. Gradual degradation of the vaterite matrices inside the HF granted in situ liberation of the payload. The resulting enhancement of a local drug concentration in skin provided the lowering of the dose and frequency of its application.

ThSYB-36 10:00-10:15

Comparative analysis of optical properties of subcutaneous and visceral adipose tissue in the context of diabetes mellitus modeling

I.Yu. Yanina; Saratov State University, Russia

The aim of this part of the study was to identify the optical characteristics of subcutaneous and abdominal adipose tissue in normal conditions and in a diabetic model using multiwavelength refractometry and spectroscopy in an experimental study of the absorption and reflectance spectra of biological tissues, as well as to determine their absorption and scattering.

ThSYB-37 10:00-10:15

Convolutional neural networks for differential diagnosis of maxillary sinus pathologies

E.O. Bryanskaya[1], D.V. Gerasin[1], A.V. Bakotina[2], A.Yu. Ovchinnikov[2],

Yu.O. Nikolaeva[2], V.V. Dremin[1], A.V. Dunaev[1]; [1]Research and Development Center of Biomedical Photonics, Orel State University, [2]Russian University of Medicine of the Ministry of Health of the Russian Federation, Russia

The work shows that application of convolutional neural networks in digital diaphanoscopy makes it possible to identify pathological changes in maxillary sinuses, classify the type of pathology (sinusitis, cystic change), indicating the side of the pathology. The proposed approach can be used for developing a clinical decision support system for early detection of maxillary sinus pathologies.

ThSYB-38 10:15-10:30

Hybrid nanomaterials for optical heating and temperature monitoring in biological objects

E.N. Gerasimova, L.V. Mikhailova, M.V.Zyuzin; ITMO University, Russia

Nanoscale temperature monitoring is vital in biomedicine, as thermal changes affect cellular functions.. This study introduces hybrid nanomaterials for real-time thermal sensing during laser heating. We demonstrate temperature monitoring via ODMR in nanodiamonds with nitrogen-vacancy center during photoinduced delivery of bioactive compounds and photothermal therapy. Additionally, we show plasmonic or all-dielectric nanostructures enable optical heating and monitoring through Raman scattering.

ThSYB-39 10:30-10:45

Intraoperative diagnostics of brain tumors using optical spectroscopy and machine learning algorithms

A. Ospanov[1], T.A. Savelieva[1,2], I.D. Romanishkin[2], S.V. Shugai[3], S.A. Goryajnov[3], G.V. Pavlova[3,4], I.N. Pronin[3], V.B. Loschenov[1,2]; [1]National Research Nuclear University MEPhI, [2]Prokhorov General Physics Institute of RAS, [3]N.N. Burdenko National Medical Research Center of Neurosurgery, [4]Institute of Higher Nervous Activity and Neurophysiology of RAS, Russia

The paper discusses classification algorithms for the analysis of fluorescence, diffuse reflectance, and Raman spectra obtained from biopsies of intracranial tumors.

Location: Petrov-Vodkin 1 Room, Floor 2; Thursday, June 25, 2026

SYB. SECTION B. OPTICAL IMAGING MODALITIES + OPTICAL CLEARING 2

Session Chair: Ilya Turchin, A.V. Gaponov-Grekhov Institute of Applied Physics of RAS, Russia

ThSYB-40 11:30-12:00

Application of optical methods for noninvasive mapping of skin endogenous chromophores *(Invited paper)*

S.A. Perkov[1], V.A. Vorobev[1,2], T.N. Torokhov[1,3], B.V. Sheludko[4,1,5], D.U. Musaeva[1], M.M. Kuziuk[6], M.A. Kurochkin[1], S.Yu. Gorodkov[7], D.A. Gorin[1]; [1]Skolkovo Institute of Science and Technology, Russia; [2]Ecole Polytechnique Federale de Lausanne, Switzerland , [3]Prokhorov General Physics Institute of the Russian Academy of Sciences, Russia; [4]Institute for Information Transmission Problems of the Russian Academy of Sciences, Russia; [5]Moscow Institute of Physics and Technology, Russia, [6]Central University, Russia; [7]Saratov State Medical University, Russia

An overview of optical methods for assessing skin chromophore concentrations in newborns is presented, emphasizing their diagnostic potential. As specific examples, the application of hyperspectral imaging for noninvasive diagnosis of infantile hemangioma and the use of fluorescence spectroscopy to assess bilirubin photodegradation during neonatal jaundice treatment are investigated.

ThSYB-41 12:00-12:30

Laser beam scattering on a blood smear and the diffractometric parameter of erythrocytes *(Invited paper)*

S.Yu. Nikitin, E.G. Tsybrov, M.S. Lebedeva; M.V. Lomonosov Moscow State University, Russia

This paper examines the problem of measuring the geometric parameters of red blood cells in a blood smear using laser diffractometry. An algorithm is proposed for measuring the parameter characterizing the variation in red blood cell size and shape.

ThSYB-42 12:30-13:00

Optoacoustic characterization of vascular network in health and disease *(Invited paper)*

A.G. Orlova[1], A.M. Glyavina[1,2], A.A. Kurnikov[1], D.A. Khochenkov[3], Yu.A. Khochenkova[3], K.S. Kim[1,2], A.V. Maslennikova[1,2,4], S.V. Nemirova[1,4], I.V. Turchin[1], P.V. Subochev[1]; A.V. Gaponov-Grekhov Institute of Applied Physics of RAS, Russia

The structural and functional state of human and animal tissues was investigated using optoacoustic imaging. Normal tissues and experimental tumors with different transplantation sites were compared. Therapy-induced changes in tumor vascularity were demonstrated. In patients with post-thrombotic syndrome, increased blood volume, vessel diameter, and vascular tortuosity were revealed.

ThSYB-43 13:00-13:15

Metrology and data processing for photoacoustic imaging and cytometry

D.N. Bratashov[1,2], E.S. Prikhozhdenko[1]; [1]MIPT, [2]Saratov State University, Russia

This work examines capabilities of photoacoustic (PA) imaging and in vivo flow cytometry techniques for quantitative biomedical analysis. As the PA signal is nearly proportional to chromophore concentration, these methods enable precise in vivo spectroscopy and metrology. We focus on calibration approaches that allow real-time measurement of chromophores, nanoparticles, and metabolites, with applications in pharmacokinetics, pharmacodynamics, and targeted drug delivery.

ThSYB-44 13:15-13:30

Assessment of major skin chromophores in different body sites using diffuse reflectance spectroscopy

K.A. Bylinskaya, M.Y. Kirillin, E.A. Sergeeva, I.V. Turchin, A.B. Kostyuk, V.M. Perekatova; Biophotonics Laboratory, A.V. Gaponov-Grekhov Institute of Applied Physics of RAS, Russia

Diffuse reflectance spectroscopy (DRS) is a non-invasive technique for assessing chromophore concentrations in biological tissues. This study aims to quantify variations in the content of main chromophores (melanin, hemoglobin, water etc.) in skin across different anatomical sites and age groups, using a VIS-NIR self-calibrating DRS system. Measurements were performed on healthy volunteers at the wrist, palm, web space, and temple.

- Lunch Break -

Location: Petrov-Vodkin 1 Room, Floor 2; Thursday, June 25, 2026

SYB. SECTION B. RAMAN SPECTROSCOPY

Session Chair: Ivan Bratchenko, Immanuel Kant Baltic Federal Unversity, Russia

ThSYB-45 15:00-15:30

Multidistance self-calibrating diffuse optical spectroscopy of biotissue *(Invited paper)*

I.V. Turchin[1], V.V. Perekatova[1], K.A. Bylinskaya[1], A.S. Savelyev[1], E.A. Sergeeva[1], M.Yu. Kirillin[1], S.P. Dmitriev[2], S.V. Gamayunov[2]; [1]Federal Research Center A.V. Gaponov-Grekhov Institute of Applied Physics of RAS, [2]Research Institute of Clinical Oncology "Nizhny Novgorod Regional Clinical Oncological Dispensary", Russia

This study evaluates analytical models for diffuse optical spectroscopy (DOS), comparing them to Monte Carlo simulations. A refined model shows superior accuracy for source-detector distances over 2 mm, while a semi-analytical fit performs best at small source-detector separations. A self-calibrating probe design improves measurement precision, and the developed broadband DOS system has been applied in tumor and skin graft monitoring.

ThSYB-46 15:30-16:00

Tissue optical clearing in the diagnosis of a number of pathologies *(Invited paper)*

E.A. Genina[1], Yu.I. Surkov[1], I.A. Serebryakova[1], P.A. Timoshina[1], E.N. Lazareva[1], D.K. Tuchina[1], V.V. Tuchin[1,2,3]; [1]Saratov State Univ., [2]Tomsk State Univ., [3]IPMC RAS, Russia

Tissue optical clearing was used as an assistant technology in multimodal diagnostics of skin neoplasm and modeled alloxan diabetes.

ThSYB-47 16:00-16:30

Built-in multi-spectral imaging system for in vivo biomedical applications *(Invited paper)*

A.S. Machikhin, V.I. Batshev, A.V. Guryleva; Scientific and Technological Centre of Unique Instrumentation of RAS, Russia

We present a compact single-sensor multispectral imaging system based on a split-aperture design operating in the 0.4–1.7 μm range. Spatiospectral calibration and image processing enable accurate mapping of viable parameters. Experiments on phantoms, rats, and volunteers demonstrate the efficiency of the proposed device for non-invasive assessment of blood microcirculation and hemodynamic parameters.

ThSYB-48 16:30-16:45

Direct and inverse problem of the dependence between optical properties and diffuse reflected and transmitted signal for multilayer biological tissues

A.A. Krivetskaya[1,2], T.A. Savelieva[1,2], D.M. Kustov[1], V.V. Levkin[3], S.S. Kharnas[3], I.D. Romanishkin[1], V.B. Loschenov[1,2]; [1]Prokhorov General Physics Institute of RAS, [2]Institute of Engineering Physics for Biomedicine, National Research Nuclear University MEPhI, [3]Department of Faculty Surgery No.1, I.M. Sechenov First Moscow State Medical University, Russia

The knowledge of the biological tissues' optical properties is important for the personalization of the laser-induced therapy. The investigation of the direct and inverse problems is crucial for the understanding of the laser-tissue interaction.

ThSYB-49 16:45-17:00

Impact of laser spatial and temporal coherence in laser speckle contrast imaging

V.V. Perekatova, E.A. Sergeeva, M.Yu. Kirillin, D.A. Kurakina, Y.A. Belozerov, A.S. Savelyev, I.V. Turchin; A.V. Gaponov-Grekhov Institute of Applied Physics of RAS, Russia

Laser Speckle Contrast Imaging quantifies blood flow, but source coherence critically affects accuracy. However, the critical influence of the illumination source's coherence properties on measurement accuracy is often overlooked. This study systematically investigates how temporal and spatial coherence affect speckle contrast.

SYC. SECTION C. PHOTONICS AND NANOBIOTECHNOLOGY

Location: Petrov-Vodkin 2 Room, Floor 2; Thursday, June 25, 2026

SYC. SECTION C. PHOTONICS AND NANOBIOTECHNOLOGY 7

ThSYC-33 09:00-09:30

Gold -based hybrid nanostructures with porphyrin derivatives for theranostics *(Invited paper)*

E.V. Solovyeva, A.A. Smirnov, V.O. Svinko, S.F. Aslanov, D.A. Lukyanov, A.V. Povolotskiy; St. Petersburg State University, Russia

The use of porphyrins in photomedicine is already in clinical practice. However, the search of more effective agents continues, including the development of organic-inorganic structures in which porphyrins combine with plasmonic nanoparticles. Here, we present hybrid structures based on gold nanoparticles and porphyrins, their photophysical properties, preliminary cellular tests and potential for bioimaging and photodynamic therapy.

ThSYC-34 09:30-10:00

Induction of non-apoptotic cell death in hepatocarcinoma cells via photothermal therapy using Au@Fe_3O_4 nanostars *(Invited paper)*

K. Levada[1], S. Pshenichnikov[1], A. Anikin[1], A. Motorzhina[1], M. Albino[2,3], V. Malashchenko[4], L. Litvinova[4], V. Rodionova[1], C. Sangregorio[2,3], L. Panina[1,5]; [1]REC Smart Materials and Biomedical Applications, Immanuel Kant Baltic Federal University, Russia; [2]Institute of Chemistry of Organometallic Compounds - C.N.R., Italy; [3]Department of Chemistry 'Ugo Schiff' and INSTM, University of Florence, Sesto Fiorentino (FI), Italy; [4]Center for Immunology and Cell Biotechnology, Immanuel Kant Baltic Federal University, [5]National University of Science and Technology MISiS, Russia

Hybrid Au@Fe_3O_4 nanostars, with a gold core and magnetite shell, are promising for photothermal cancer therapy. They efficiently convert near-infrared light to heat. In tests on liver cancer cells (Huh7), combining low-dose nanostars with NIR light reduced cell viability by 79% and triggered non-apoptotic cell death, confirming their potential for targeted, minimally invasive treatment.

ThSYC-35 10:00-10:30

Plasma membrane-bound heat shock proteins: mHsp70 as a target for theranostics in oncology *(Invited paper)*

M. Shevtsov[1,2]; [1]Department of Radiation Oncology, Klinikum rechts der Isar, Technical University of Munich, Germany; [2]Laboratory of Biomedical Nanotechnologies, Institute of Cytology (RAS), Russia

Heat shock protein 70 (Hsp70) is uniquely expressed on the plasma membrane of malignant cells (mHsp70) but not normal tissues, making it an attractive therapeutic target. Experimental, preclinical, and pilot clinical studies demonstrate that mHsp70 promotes tumor invasion and migration and can be selectively targeted by chaperone inhibitors, tumor-homing peptides, and antibody-functionalized nanoplatforms for theranostic applications in neuro-oncology.

ThSYC-36 10:30-10:45

Detection of Alzheimer's disease using potential SPR biosensor

Jay Kumar Yadav[1], Kedar Nath Das[2]; [1]Dept. of Electronics and Communication Engineering, National Institute of Technology Silchar, [2]Dept. of Mathematics, National Institute of Technology Silchar, India

In this paper, we have developed a perovskite (CsGeI3)-Ta2O5-based Kretschmann's configuration surface plasmon resonance (SPR) biosensor for assessing Alzheimer's disease, utilizing the refractive index (RI) of the sample to differentiate between healthy brain tissue and Alzheimer's disease. Furthermore, to enhance light-matter interaction, we have optimized the thickness of the silver and Ta2O5 material layers, along with the analyte sample.

ThSYC-37 10:45-11:00

Plasmonic Au-decorated magnetic Fe_3O_4 elongated clusters for dual-mode biosensing

V.V. Volkov[1,2], A.M. Skirda[1,3], A.V. Orlov[1], P.I. Nikitin[1,2]; [1]Prokhorov General Physics Inst. of RAS, [2]National Research Nuclear Univ. MEPhI (Moscow Engineering Physics Inst.), [3]Moscow Inst. of Physics and Technology, Russia

Plasmonic magnetic elongated clusters were developed for dual-mode biosensing. Magnetite nanoparticles, synthesized by co-precipitation, self-assembled into anisotropic clusters under magnetic field and coated with SiO_2 via Stöber process. Au satellites were deposited via borohydride reduction. The platform enables simultaneous magnetic manipulation/ detection and optical readout with possibility of simple biomolecule functionalization on Au surface through thiol groups.

- Coffee Break -

Location: Petrov-Vodkin 2 Room, Floor 2; Thursday, June 25, 2026

SYC. SECTION C. PHOTONICS AND NANOBIOTECHNOLOGY 8

ThSYC-38 11:30-12:00

Programmable DNA nanostructures for on-chip photonic architectures *(Invited paper)*

I.V. Martynenko; Skoltech, Russia

Structural DNA nanotechnology, particularly the DNA origami technique, provides a powerful bottom-up approach for fabricating photonic architectures with nanometer precision. By using programmable DNA self-assembly, complex plasmonic and photonic elements can be precisely positioned and integrated on-chip with unprecedented spatial control. This talk presents recent advances in DNA-origami–templated nanophotonics, emphasizing scalable assembly strategies and their potential for next-generation biophotonic and quantum optical devices.

ThSYC-39 12:00-12:30

Limitations and solutions for nanozyme application in immunoassays *(Invited paper)*

P.V. Khramtsov; Perm Federal Research Center, Russsia

Nanozymes—artificial enzyme mimetics—are increasingly regarded in the current literature as promising alternatives to natural enzymes in colorimetric immunoassays. In this presentation, we aim to address several challenges associated with the practical implementation of nanozymes, as well as to discuss potential solutions and future research directions in this field.

ThSYC-40 12:30-12:45

Biosensor based on reduced graphene oxide for noninvasive detection of carcinoembryonic antigen

A.S. Kudriavtseva[1,2], B.G. Gorshkov[1], I.I. Bobrinetskiy[2], P.I. Nikitin[1]; [1]Prokhorov General Physics Institute of RAS, [2]Moscow Center for Advanced Studies, Russia

A biosensor based on reduced graphene oxide functionalized with a DNA aptamer was developed for non-invasive detection of carcinoembryonic antigen in saliva. The dual-mode platform, combining field-effect transistor and electrochemical principles, achieves a zeptomolar detection limit and a dynamic range spanning eight orders of magnitude. This approach enables rapid, reliable, and highly sensitive point-of-care cancer monitoring.

ThSYC-41 12:45-13:00

Machine learning in data analysis and data augmentation for Raman spectroscopy

E.S. Prikhozhdenko; MIPT, Russia

This study uses Principal Component Analysis (PCA) to generate synthetic Raman spectra and augment training data for classifying adipose tissue before and after lipase exposure. Optimized Random Forest and Gradient Boosting models achieved high accuracy (up to 96.4%), validating the data augmentation method and aligning with expected biochemical changes from hydrolysis.

ThSYC-42 13:00-13:15

Machine learning and evolutionary optimazation in modeling the optical response of organic pigments

V.A. Kurkov[1], D.D. Chesalin[2], N.N. Reutskii[3], A.N. Samarin[1], R.Y. Pishchalnikov[1]; [1]Prokhorov General Physics Institute of RAS, [2]Faculty of Biology, Lomonosov Moscow State University, [3]Faculty of Physics, Lomonosov Moscow State University, Russia

Considering the optically allowed electronic transition of carotenoids at 400-550 nm, we classified absorption spectra of these pigments by the set of Huang-Rhys factors. The modeling of the spectra in terms of semiclassical theory was optimized by differential evolution. As the result, the data base containing pigments, their spectra, and corresponding quantum parameters was made for the optical response identification.

ThSYC-43 13:15-13:30

Ultrafast force-clamp spectroscopy reveals force-dependent friction regulation of the microtubule-binding Ndc80 complex

V.M. Demidov, I.V. Gonchar, F.I. Ataullakhanov; Center for Theoretical Problems of Physicochemical Pharmacology, RAS, Russia

This work demonstrates the use of ultrafast force-clamp spectroscopy to investigate the properties and mechanism of force-induced motion of the kinetochore protein complex Ndc80 at the single-molecule level in vitro. We show that the Ndc80 complex can glide along microtubule wall under external force, and that this motion is highly asymmetric in a direction-dependent manner. This asymmetry arises from force-dependent modulation of the Nuf2 domain's interaction with the microtubule.

- Lunch Break -

Location: Petrov-Vodkin 2 Room, Floor 2; Thursday, June 25, 2026

SYC. SECTION C. PHOTONICS AND NANOBIOTECHNOLOGY 9

ThSYC-44 15:00-15:30

Multi-functionalization diamond particles for biological applications *(Invited paper)*

K.V. Bogdanov[1], T.E. Didukh[1], S.A. Grudinkin[2], A.V. Baranov; [1]ITMO University, [2]Ioffe Institute, Russia

This study presents CVD diamond nano/sub-microparticles with core/shell structure for biomedical applications. The boron core heats via laser absorption, exciting SiV/GeV color centers in the shell for temperature-sensitive and visualization luminescence at 738/602 nm.

ThSYC-45 15:30-16:00

Optical properties of diatom algae: from nature to photonic structures *(Invited paper)*

J. Cvjetinovic, S. Dyakov, M. Reshetova, A. Ivleva, D. Tsiurko, D. Gorin; Skolkovo Inst. of Science and Technology, Russia

Diatom frustules are hierarchically structured silica shells enabling efficient light manipulation. Numerical modeling reveals Talbot interference and enhanced energy localization. Scaled-up biomimetic frustules fabricated by DLP 3D printing experimentally confirm Talbot focusing in the terahertz range. Modification via iron oxide nanoparticles is explored, linking optical and biological effects. The results demonstrate potential applications in bioinspired photonics, sensing, and light-harvesting technologies.

ThSYC-46 16:00-16:15

Application of lasers for amyloid fibril aggregation, disaggregation and detection

Y.A. Trutnev, T.A. Matveeva, E.A. Molkova, R.M. Sarimov; Prokhorov General Physics Institute of RAS, Russia

Amyloid fibrils, central to neurodegenerative diseases, resist conventional disaggregation and often yield toxic oligomers. We generated lysozyme-derived fibrils under varied conditions—temperature (22–65°C), denaturant concentration, and agitation—to produce structurally diverse aggregates. These were irradiated with ns/ps Nd:YAG laser pulses (1064/532 nm). This approach aims to achieve precise, non-invasive fibril disaggregation, advancing targeted therapy for protein-misfolding disorders.

ThSYC-47 16:15-16:30

Stabilization of the mesoporphyrin IX dihydrochloride with flavonoids (Tagetes patula L.) luminescent complex by ytterbium ions

E.S. Zemlyakova, A.V Tcibulnikova, V.A. Slezhkin, A.A. Kostrina, D.A. Artamonov, I.G. Samusev; Immanuel Kant Baltic Federal University, Russia

The study focuses on the photosensitizers found in plant extracts, their activation by molecular oxygen, and the formation of luminescent complexes with electromagnetic energy transfer.

ThSYC-48 16:30-16:45

Smart microchamber biomaterial scaffolds for bioactive compounds release and microenvironment modulation

A.V. Ermakov[1], E.V. Lengert[2], A.N. Ivanov[3], G.B. Sukhorukov[1, 4]; [1]Life Improvement by Future Technologies (LIFT) Center, [2]Institute of Molecular Theranostics, I.M. Sechenov First Moscow State Medical University, [3]Central Research Laboratory, Saratov State Medical University of V.I. Razumovsky, Ministry of Health of the Russian Federation, [4]Vladimir Zelman Center for Neurobiology and Brain Rehabilitation, Skolkovo Institute of Science and Technology, Russia

Addressing the rising costs of wound care, we present a novel microstructured wound dressing with integrated sensing and controlled release capabilities. Utilizing solid-powder encapsulation, this platform dynamically modulates the wound microenvironment via sustained delivery of antioxidants and hydrogen peroxide. This approach promotes angiogenesis, reduces inflammation, and facilitates scar-free healing by subtly shifting the chemical profile for optimized tissue regeneration.

ThSYC-49 16:45-17:00

Intravital cardiac dynamics imaging of zebrafish larva with a tunable two-photon light-sheet microscope

K.A. Kungurov[1,2], A.D. Sergeeva[3,4], L.L. Naumov[3], M.A. Solotenkov[1,2], A.B. Fedotov[1,2], V.V. Belousov[2,3,4], D.S. Bilan[3,4], A.A. Lanin[1,2]; [1]Physics Department, M.V. Lomonosov Moscow State University, [2]Life Improvement by Future Technologies (LIFT) Center, Skolkovo, [3]M.M. Shemyakin and Yu.A. Ovchinnikov Institute of Bioorganic Chemistry, RAS, [4]Federal Center of Brain Research and Neurotechnologies, Federal Medical Biological Agency, Russia

We have developed a femtosecond, three-stage, ytterbium-doped fiber chirped pulse amplifier for a solid-state laser. This source was used in a two-photon light-sheet microscopy scheme. As study subjects we used zebrafish larva with labeled cardiomyocytes. The developed system enabled non-invasive, high-speed, high-resolution visualization of cardiac temporal dynamics and morphology.

SYD. SECTION D. PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE

Location: Petrov-Vodkin 3 Room, Floor 2; Thursday, June 25, 2026

SYD. SECTION D. PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE 4

ThSYD-17 09:00-09:30

Aqueous dispersions of carbon nanoparticles: variability of basic structural elements and their role in the generation and accumulation of ROS *(Invited paper)*

N.N. Rozhkova[1], A.S. Stepanova[1,2], N.D. Sharpar[1,2], S.P. Rozhkov[3]; [1]Institute of Geology, Karelian Research Centre RAS, [2]Petrozavodsk State University, [3]Institute of Biology, Karelian Research Centre RAS, Russia

We analyzed the factors of structural heterogeneity of aqueous dispersions of shungite carbon nanoparticles (ShC). Water regulates intermolecular interactions and predetermines the existence of two types of ShC phases in water at physiological temperatures. ShC acts as a heterogeneous catalyst, enhancing the generation of ROS in the presence of iron ions, determining their antibacterial effect on the pathogenic microorganisms.

ThSYD-18 09:30-10:00

Colloidal $CaF_2:Eu^{2+}$ nanoparticles as nanoscintillators for X-ray-induced photodynamic therapy *(Invited paper)*

Yu.V. Orlovskii[1], A.T. Shaidulin[1,2], E.O. Orlovskaya[1], O.V. Uvarov[1], S.Kh. Batygov[1], I.G. Samusev[3], Yu.S. Romanko[4], V.B. Loschenov[1], V.N. Makhov[5]; [1]Prokhorov General Physics Institute of RASciences, [2]National Research University Higher School of Economics, [3]Immanuel Kant Baltic Federal University, [4]I.M. Sechenov First Moscow State Medical University, [5]P.N. Lebedev Physical Institute of RAS, Russia

X-ray-induced photodynamic therapy is a cancer treatment method that combines the advantages of clinically used photodynamic therapy and radiation therapy. This method's high penetration depth is achieved by X-ray radiation, while enhanced cytotoxicity is achieved by a suitable combination of a nanoscintillator emitting in the optical region and a photosensitizer that effectively absorbs this radiation. To achieve this, we synthesize non-toxic, stable aqueous colloids of CaF2 nanoparticles doped with europium ions in their inactivated state.

ThSYD-19 10:00-10:15

Macrophage-guided transport of photosensitizers for enhanced photodynamic tumor treatment

D.A. Terentyeva, Z.V. Kozyreva, D.A. Gorin, O.A. Sindeeva; Skolkovo Inst. of Science and Technology, Russia

Macrophages can function as "Trojan horses" delivering photosensitizer-loaded microcapsules into tumors to enhance photodynamic therapy. Layer-by-layer microcapsules were efficiently internalized and retained by peritoneal macrophages for up to 6 days without degradation, enabling transport into tumor spheroids and light-induced tumor regression in a CT-26 colon cancer model, addressing limited photosensitizer penetration in solid tumors.

ThSYD-20 10:15-10:30

Tissue-mimicking phantoms with tunable optical properties for laser thermotherapy

S.A. Mirzaeva[1], P.V. Aleksandrova[1], I.N. Dolganova[1,2], Yu.A. Suchkov[1], V.B. Tsvetkov[1], K.I. Zaytsev[1], D.G. Kochiev[1], A.K. Zotov[1]; [1]Prokhorov General Physics Institute of RAS, [2]Osipyan Institute of Solid State Physics of RAS, Russia

Laser ablation demands precise thermal control. Existing phantoms cannot simultaneously replicate tissue's mechanical and optical properties and thermal response. We developed liver-mimicking alginate phantoms matching 1064 nm optical and thermal dynamics, bone-mimicking tunable opal structures replicating optical properties and thermal response, hybrid phantoms modeling thermal response on bone-soft tissue interfaces. Our results enable protocol optimization, device calibration, and surgical training for cancer therapy.

ThSYD-21 10:30-10:45

Low level laser therapy in dentistry

Y.S. Kozlova; Sechenov First Moscow State Medical Univ., Russia

Low Level Laser Therapy in Dentistry (LLLT) is very wide used in different parts of dentistry for example for treatment of dentin hypersensitivity, temporomandibular joint, for quicker healing process after any surgical procedure in the oral cavity, in orthodontic treatment for accelerating tooth movement, periodontal treatment.

Location: Petrov-Vodkin 3 Room, Floor 2; Thursday, June 25, 2026

SYD. SECTION D. PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE 5

ThSYD-22 11:30-12:00

Method of planning and monitoring the absorbed dose of laser light during photodynamic therapy of multilayered tissues of hollow organs *(Invited paper)*

T.A. Savelieva[1,2], A.A. Krivetskaya[1,2], D.M. Kustov[1], V.V. Levkin[3], S.S. Kharnas[3], V.B. Loschenov[1,2]; [1]Prokhorov General Physics Institute of RAS, [2]Institute of Engineering Physics for Biomedicine, National Research Nuclear University MEPhI, [3]Department of Faculty Surgery No.1, I.M. Sechenov First Moscow State Medical University, Russia

A PDT planning algorithm has been developed based on numerical modeling and utilizing optical-spectral measurement data of diffuse transmittance and diffuse reflectance of laser radiation by the walls of hollow gastrointestinal organs and the fluorescence of the photosensitizer contained within them, which allows to calculate the absorbed laser dose and to assess the biochemical effectiveness of PDT.

ThSYD-23 12:00-12:30

Raman spectroscopy: from solving fundamental problems to practical applications *(Invited paper)*

V.S. Novikov[1], L.Yu. Kozlova[1], S.O. Liubimovskii[1], S.M. Kuznetsov[1], D.D. Vasimov[1,2], A.M. Semin[1,3], V.I. Andreev[1,3], A.N. Bortcova[1,3], M.N. Moskovsky[4], S.V. Gudkov[1], V.V. Kuzmin[1], E.A. Sagitova[1], G.Yu. Nikolaeva[1]; [1]Prokhorov General Physics Institute of RAS, [2]Moscow Institute of Physics and Technology, [3]D.I. Mendeleev Russian University of Chemical Technology, [4]Federal Scientific Agronomic and Engineering Center VIM, Russia

Raman spectroscopy remains a powerful tool for molecular analysis, with expanding applications enabled by portable instruments and advanced data processing. We develop Raman methods (including Resonance Raman and SERS) to assess polymer crystallinity and composition, analyze oils and dietary supplements, identify carotenoids, and detect plant diseases at early stages, supporting medical, food, and agricultural applications.

ThSYD-24 12:30-12:45

Photodynamic therapy effect on the mouse mammary tumors with high levels of mechanical stress

A.V. Ryabova[1,2,3], I.D. Romanishkin[1], I.V. Markova[1,2], T.A. Savelieva[1,2], A.S. Moskalev[1,2], D.A. Vasilieva[2], D.V. Pominova[1,2]; [1]Prokhorov General Physics Institute of RAS, [2]Institute of Engineering Physics for Biomedicine, National Research Nuclear University MEPhI, [3]Peoples' Friendship University of Russia named after Patrice Lumumba, Russia

The effects of photodynamic therapy (PDT) on the tumor's extracellular matrix (ECM) were studied. The used tumors were differed in stiffness, scattering, blood permeability, water and collagen content. Ce6 accumulation was slower for stiffer tumors, which correlates with hypoperfusion and hypoxia. PDT reduced tumor stiffness due to cell death and ECM damage.

ThSYD-25 12:45-13:00

Methylene blue and chlorin e6 metabolic effects on macrophages: FLIM monitoring

D.V. Pominova[1,2], I.V. Markova[1,2], I.D. Romanishkin[1], A.S. Skobeltsin[1,2], V.I. Makarov[1,2], A.V. Ryabova[1,2]; [1]Prokhorov General Physics Institute of RAS, [2]Institute of Engineering Physics for Biomedicine, National Research Nuclear University MEPhI, Russia

We studied methylene blue (MB) and chlorin e6 (Ce6) metabolic effects on tumor-associated macrophages (TAMs). At first M1 and M2 macrophages polarized from THP-1 were treated with MB or Ce6, and then, photodynamic therapy was performed. Fluorescence-lifetime imaging microscopy (FLIM) of NAD(P)H/FAD revealed MB-induced OXPHOS restoration versus Ce6 OXPHOS blockade. Changes in NADH and FAD metabolic trajectories corresponding to the M2 to M1 shift in macrophage polarization were observed.

ThSYD-26 13:00-13:15

Optical properties of tumors with varying stroma stiffness in the visible and short-wave infrared ranges

I.V. Markova[1,2], D.V. Pominova[1,2], T.A. Savelieva[1,2], I.D. Romanishkin[1], A.S. Skobeltsin[1,2], A.V. Ryabova[1,2]; [1]Prokhorov General Physics Inst. of RAS, [2]National Research Nuclear Univ. MEPhI, Russia

In this work, the tumors with varying stiffness optical properties in transplanted mouse models during photodynamic therapy (PDT) in the visible and short-wave infrared ranges were studied. Using diffuse reflectance spectroscopy, a correlation between the tumor stiffness, absorption and scattering characteristics was established, as well as scattering decrease after PDT was observed.

- Lunch Break -

Location: Petrov-Vodkin 3 Room, Floor 2; Thursday, June 25, 2026

SYD. SECTION D. PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE 6

ThSYD-27 15:00-15:30

Photodynamic therapy for cancer of external and visceral localizations in Russia *(Invited paper)*

E.Ph. Stranadko[1], T.I. Malova[2], M.V. Riabov[1]; [1]Skobelkin Centre for Laser Medicine - a branch of the Federal Clinical Center for High Medical Technologies, FMBA of Russia, [2]"VETA-GRAND" LLC, Russia

Photodynamic Therapy (PDT) for cancer at various stages and locations has been practiced in Russia for 32 years. PDT fundamentally changes the status of a significant group of inoperable patients with various cancer localizations.

ThSYD-28 15:30-15:45

Endoscopic photodynamic recanalization for inoperable obstructive esophageal cancer

E.Ph. Stranadko[1], T.I. Malova[2], M.V. Riabov[1]; [1]Skobelkin Centre for Laser Medicine - a branch of the Federal Clinical Center for High Medical Technologies, FMBA of Russia, [2]"VETA-GRAND" LLC, Russia

Esophageal cancer is one of the most aggressive and rapidly progressing malignant tumors. Photodynamic Therapy (PDT) expands the treatment options for inoperable esophageal cancer. PDT is effective in advanced obstructive esophageal cancer, improving the outcomes for this challenging group of patients and enhancing their quality and duration of life.

ThSYD-29 15:45-16:00

Ultraviolet irradiation of bacterial cellulose as an additional purification method *(Invited paper)*

P.M. Larionov[1], N.A. Maslov[2], I.A. Rozhin[2], T.M. Terekhova[1], I.A. Kirilova[1], A.A. Korytkin[1]; [1]Research department, Novosibirsk Research Institute of Traumatology and Orthopedics named after Ya.L. Tsivyan of the Ministry of Health of the Russian Federation, [2]Laser Technologies Laboratory, S.A. Khristianovich Institute of Theoretical and Applied Mechanics, SB RAS, Russia

The effectiveness of ultraviolet (UV) irradiation for the purification of bacterial cellulose was studied using laser-induced spectroscopy (LIFS) and laser scanning microscopy (LSM). A total UV dose of 12 J/cm2 resulted in the disappearance of the tryptophan peak and a marked reduction in the tyrosine peak, consistent with LSM results showing a significant reduction in the size and density of microbial inclusions.

ThSYD-30 16:00-16:15

Effective polycationic photosensitizer, their mechanisms of accumulation and effects on cancer cells in vitro

E.V. Akhlyustina[1,8], I.D. Romanishkin[2,8], I.G. Meerovich[3], S.Sh. Karshieva[4,5], A.S. Skobeltsin[1,2,8], D.A. Bunin[6,8], E.A. Makarova[7,8], V.B. Loschenov[1,2], E.A. Kogan[8], Zh.-L. Chen[9], G.A. Meerovich[2,8], Yu. G. Gorbunova[4,10], I.V. Reshetov[8]; [1]National Research Nuclear University MEPhI, [2]Prokhorov General Physics Institute of RAS, [3]A.N. Bach Institute of Biochemistry, Research Center of Biotechnology RAS, [4]National University of Science and Technology MISIS, Russia, [5]N.N. Blokhin National Medical Research Center of Oncology, [6]Frumkin Institute of Physical Chemistry and Electrochemistry, [7]Organic Intermediates and Dyes Institute, [8]I.M. Sechenov First Moscow State Medical University, Russia; [9]Huadong Hospital, Fudan University, China; [10]Kurnakov Institute of General and Inorganic Chemistry, Russia

The binding of photosensitizer molecules to cancer cells depends on the sign and charge value. A comparative in vitro study demonstrated that polycationic one exhibit higher phototoxicity. Photodynamic therapy with polycationic photosensitizer has a damaging effect on cancer cells through direct necrosis, increased apoptosis, a reduction in the number of all cancer stem cell subpopulations, and suppression of their proliferation.

ThSYD-31 16:15-16:30

Diagnosis of microbial contamination in bacterial cellulose using laser-induced fluorescence (LIF) spectroscopy

N.A. Maslov[1], P.M. Larionov[2], I.A. Rozhin[1], T.M. Terekhova[2], A.A. Korytkin[2]; [1]Khristianovich Inst. of Theoretical and Applied Mechanics SB RAS, [2]Novosibirsk Research Inst. of Traumatology and Orthopedics MH RF, Russia

This study explores the potential of laser-induced fluorescence (LIF) for real-time monitoring of bacterial cellulose (BC) purity. Our analysis reveals that current purification methods fail to completely remove residual proteins and microbial contaminants, limiting BC's applicability in medical settings. LIF spectroscopy proved highly effective in rapidly and accurately detecting amino acid residues, making it a promising tool for optimizing purification processes.

ThSYD-32 16:30-16:45

Investigation of the antibacterial effect of quartz nanoparticles of shungite rocks

N.D. Sharpar[1,2], A.S. Stepanova[1,2], N.N. Rozhkova[1]; [1]Institute of Geology of the Karelian Research Centre of RAS, [2]Petrozavodsk State University, Russia

The antibacterial activity of aqueous dispersions of quartz nanoparticles stabilized with carbon has been studied. Dispersions have been shown to have a bacteriostatic effect on pathogenic bacteria, inhibiting their growth. With respect to non-pathogenic bacteria, the effect was manifested only with prolonged exposure and the addition of ascorbic acid ions. The results confirm the potential of nanoparticles for biomedical applications.

SYD. SECTION D. PHOTODYNAMIC PROCESSES IN BIOLOGY AND MEDICINE - POSTERS

Location: Congress Hall, Floor 1; Thursday, June 25, 2026

ThSYD-p01 10:00-13:30

Hydrothermal microwave-assisted synthesis of colloidal solutions of $CaF_2:Eu^{2+}$ nanoscintillators

A.T. Shaidulin[1,2], E.O. Orlovskaya[1], O.V. Uvarov[1], S.Kh. Batygov[1], V.B. Loschenov[1], V.N. Makhov[3], Yu.V. Orlovskii[1]; [1]Prokhorov General Physics Institute of RAS, [2]National Research University Higher School of Economics, [3]P.N. Lebedev Physical Institute of RAS, Russia

This work examines the influence of the microwave-assisted hydrothermal synthesis conditions of colloidal CaF2:Eu3+ nanoparticles (NPs) on the brightness of the Eu2+ X-ray excited optical luminescence (XEOL) at the interconfigurational transition 4f65d1 → 4f7 (8S7/2) (luminescence in the range of 400-480 nm with a maximum at 425 nm, close to the Curcumin photosensitizer absorption maximum at 420-430 nm).

ThSYD-p02 10:00-13:30

Optical methods and devices for monitoring microcirculation during photodynamic therapy

A.V. Guryleva[1], A.S. Machikhin[1], T.G. Grishacheva[2], S.G. Chefu[2], N.N. Petrishchev[2]; [1]Biomedical Instrumentation Lab. STC UI RAS, [2]Laser Medicine Center, Pavlov University, Russia

Direct assessment of skin microcirculation during photoactivation is crucial for understanding and optimizing photodynamic therapy. We propose a non-invasive imaging photoplethysmography method for continuous, spatially resolved monitoring of microcirculation in tumor and healthy tissue. Validated in an animal model, it reveals distinct tumor–tissue microvascular responses during and after photoactivation.

ThSYD-p03 10:00-13:30

Direct singlet oxygen generation by a bi-chromatic Raman fiber laser and its effect on glioblastoma cells

M. Naumenko[1,2], V. Volosi[2], A. Leonteva[1,3], A. Nushtaeva[1,3], A. Ivanenko[2], S. Kulemzin[4], K. Baranov[4], A. Moskalensky[1,2]; [1]Sirius University of Science and Technology, [2]Novosibirsk State University, [3]Institute of Chemical Biology and Fundamental Medicine,

[4]Institute of Molecular and Cellular Biology, Russia

Singlet oxygen (1O2) underpins photodynamic therapy but is limited in brain tumors by photosensitizer delivery across the blood–brain barrier. We investigate photosensitizer-free 1O2 generation in glioblastoma cells using a dual-wavelength NIR pulsed fiber laser (1066 and 1241 nm), revealing wavelength-dependent differences between chemical 1O2 yield and biological metabolic suppression.

ThSYD-p04 10:00-13:30

Photophysical properties of chlorin E6 at aPDT on experimental models

A.F. Malikov[1], A.M. Udeneev[1], D.V. Yakovlev[2], N.A. Kalyagina[1,2]; [1]National Research Nuclear University MEPhI, [2]A.M. Prokhorov General Physics Institute of RAS, Russia

The aim of this study is to investigate various photophysical properties of chlorin e6 during antimicrobial photodynamic therapy (PDT) using wound surface models. The analysis of the accumulation and photobleaching of the photosensitizer in molecular and ethosomal forms on the wound surface of post mortem models was performed.

ThSYD-p05 10:00-13:30

FLIM-assisted monitoring of intracellular transportation and accumulation of Radachlorin photosensitizer

E.A. Glazkova[1], A.A. Zhikhoreva[2], A.V. Belashov[2], T.N. Belyaeva[3], A.V. Salova[3], I.K. Litvinov[3], E.S. Kornilova[3], I.V. Semenova[2], O.S.Vasyutinskii[2]; [1]Herzen State Pedagogical University, [2]Ioffe Institute, [3]Institute of Cytology of RAS, Russia

Mechanisms and kinetics of Radachlorin uptake and accumulation in HeLa cells were studied by analysis of distributions of fluorescence intensity and lifetime at different incubation times. The observed decrease of Radachlorin fluorescence lifetime during its intracellular transportation was suggested to be due to its uptake via endocytosis and gradual acidification of endosomes on the way to lysosomes.