

2019



Voronezh
State University



**RESEARCH
INFRASTRUCTURE**



Dear friends,

This edition is dedicated to the laboratories of Voronezh State University which are equipped with rare and expensive scientific instruments. They can be used to conduct research complying with the latest research and innovation requirements.

For VSU, as well as for any other successful institution of higher education, research is the guarantee of its competitive edge and success. We actively promote the idea of the collective use of scientific equipment and collaboration with industrial partners, other universities, and institutes of the Russian Academy of Science to conduct joint research, including those which are carried out in our laboratories.

The information presented in the Atlas of Laboratories of Voronezh State University describes the university's infrastructure which can be used for the benefit of our industrial partners. The atlas is expected to advance the search of areas for beneficial partnerships.

This university laboratory guide is an important instrument for the development of the regional centre for research and education which is being created within the framework of decrees by the President of the Russian Federation, Vladimir Putin.

The alphabetical subject index at the end of the atlas facilitates the fast searching and evaluation of the university's research and technological potential.

*VSU Rector, DSc in Economics,
Professor Dmitry Endovitsky*

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Laboratory of Telecommunication Systems and Electronic Warfare



Industrial partners

- AO Concern Sozvezdiye
- Institute of Radio-engineering and Electronics of the Russian Academy of Sciences

Research area

Development of modern communication systems and solving the problems of electromagnetic compatibility

Laboratory equipment

Vectorscopes, spectrum analysers, super high frequency oscillographs, 3D printers, etc.

Available research methods

Software systems for modelling of radio-engineering systems. PXI NI-based computer-aided measurement methods

Challenges

To train highly qualified specialists for radioelectronic companies

Major projects

- Shield building digital communication systems
- Development of ultra-wideband antenna systems
- Fractal antennas
- Development of subnanosecond impulse generators

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E.N. Ivanova Laboratory of Optical Spectroscopy

Research area

Atomic emission and molecular spectroscopy

Laboratory equipment

- IVS-29 activated AC arc and high voltage spark generator with high-frequency discharge ignition and voltage of approximately 30,000 V
- PGS-2 spectrometer with a plane diffraction grating and a ToshibaTCD1304AP series CCD
- Step attenuator
- Spectral atlases
- Vertex 37 series FT-IR spectrometer

Available research methods

Qualitative, quantitative, and semiquantitative spectrum analysis FT-IR spectroscopy



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Laboratory of Luminescence Spectroscopy

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Research area

Luminescence and non-radiating processes in colloid quantum dots and their hybrid associates of molecules and aggregates of organic dyes

Laboratory equipment

- Computer-aided spectrometric system based on a MDR 4 and MDR 41 monochromator with a xenon 150 Watt light source used to study photoluminescence excitation spectra
- Vacuum optical cryostat based on a TMN 200 turbomolecular pump
- OceanOptics fibre-optic spectrum system based on USB2000 spectrometer with a USB-DT light source used to study the adsorption and luminescence properties of colloid quantum dots
- Fully-automatic spectrofluorimeter based on a MDR 23 monochromator and a R955P photomultiplier tube (Hamamatsu) in photon counting mode
- KLM 650/80, KLM-H- 660-40-5, and KLM-G 635-6-5 laser units
- Standa optical table Honeycomb Table Tops 1HT
- Highly sensitive IR luminescence detection system based on a PDF10C/M low-noise photodiodes (ThorlabsInc., USA)

Available research methods

Luminescence spectroscopy methods:

- Photoluminescence spectra in a temperature range of 77–350 K
- Luminescence excitation spectra
- Photostimulation spectra of the burst of luminescence
- Thermally-stimulated luminescence spectra
- Spectra of optical absorption and mirror reflection

Challenges

Spectral and luminescence properties of nanostructures, crystalline phosphorus, and organic molecules

Major projects

- Russian Foundation for Basic Research project No. 17-02-00748 a “Photophysical processes in rare-earth-ion-doped CdS and ZnS colloid quantum dots conjugated with organic molecules and J aggregates”
- Russian Foundation for Basic Research project No. 7-72-10225 “Nonlinear media for low limiting optical threshold based on associates of Ag₂S colloid quantum dots and dye molecules with controlled luminescence properties”
- Russian Foundation for Basic Research project No. 19-12-00266 “Managing photostability and quantum efficiency of IR luminescence of Ag₂S colloid quantum dots for applications of quantum sensory studies”

Training Astronomical Observatory

Industrial partners

- Sternberg Astronomical Institute
- Institute of Astronomy of the Russian Academy of Sciences

Research area

Solar system: observing events in the satellite system of Jupiter and Saturn

Laboratory equipment

- Meade lx200 - ACF telescope with a 35 cm diameter mirror, Cassegrain, with a corrected coma
- Three AT 1 astronomical tubes
- School refractor telescope
- School Mitsar reflector

Available research methods

- Visual
- Photographic
- Television observation methods

Challenges

- Organisation and conducting astronomical and astrophysical practice training for students
- Conducting educational lectures providing opportunities to visually observe astronomical objects

Major projects

The observatory is among the participants of the programme aimed at observing mutual occultations and eclipses in the satellite system of Jupiter and Saturn.

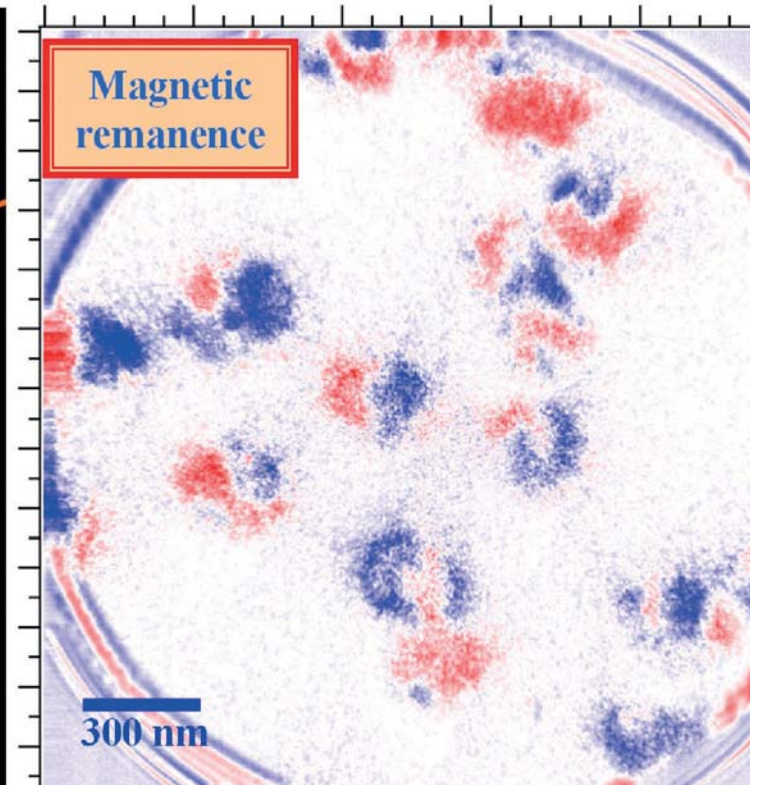
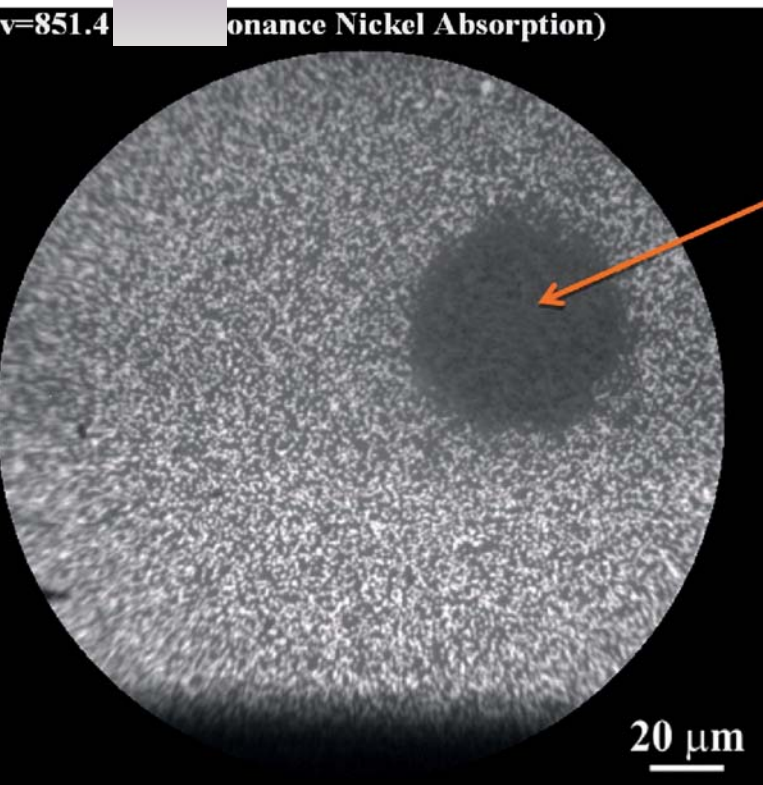
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Joint Laboratory of Electron Structure of Condensed Matter of Voronezh State University and Kurnakov Institute of General and Inorganic Chemistry of the Russian Academy of Sciences

Laboratory equipment

- Exhaust carts, thermal, magnetron, and reactive sputtering units used to control formation of thin-film coatings
- Test benches for electrical parameters of materials and structures
- UV and visible region spectrometers
- Gas sensor test and measurement benches
- Electrophysical research and impedansometry units
- The laboratory uses PCM-500 at the Department of Solid-State Physics and Nanostructures.
- The laboratory uses the output channel infrastructure of the sources of synchrotron radiation at the National Research Centre “Kurchatov Institute” (Moscow), BESSY II (Helmholtz Zentrum Berlin, Germany), SPring8 (Synchrotron Radiation Research Institute, Osaka, Japan), etc., including:
 1. High resolution photoelectron spectrometers
 2. Fluorescence detectors of the absorption spectroscopy of synchrotron radiation

3. Systems for the detection of the quantum yield of absorption spectroscopy of synchrotron radiation
4. Photoemission electron microscopes
5. Glove box, ultra-high vacuum chambers for ex-situ and in-situ extra sample preparation and modification

Industrial partners

- AO Voronezh Semiconductor Plant (Voronezh)
- AO VZPP-Mikron (Voronezh)
- National Research Centre “Kurchatov Institute” (Moscow)
- Lomonosov Moscow State Pedagogical University (Moscow)
- Udmurt Federal Research Centre of the Ural Division of the Russian Academy of Sciences (Izhevsk)
- Institute of Cell Biophysics of the Russian Academy of Sciences (Pushchino)
- Immanuel Kant Baltic Federal University (Kaliningrad)
- Helmholtz Zentrum Berlin (Berlin, Germany)

- Leibniz Institute of Photonic Technology (Jena, Germany)
- International Physics Centre (Donostia, Spain)

Research area

- Atomic and electron structure of condensed matter and nanostructures
- Electron spectroscopy and X-ray photoelectron spectroscopy and microscopy of functional nano-materials
- Research using unique world-class megascience facilities
- Sorption and photoelectron processes in oxide semiconductors, gas sensors, resistance switching-memristor properties in oxide semiconductors

Available research methods

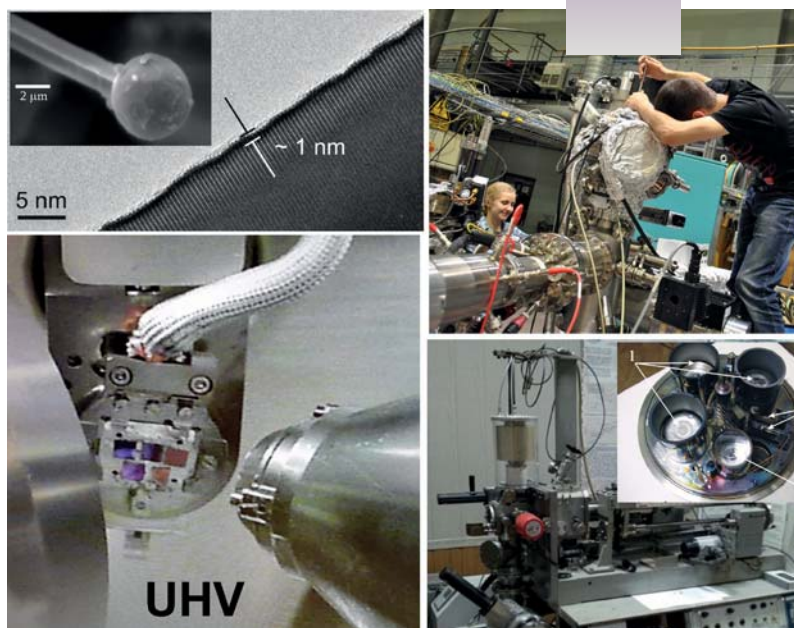
- X-ray electron methods for the research of solid-state physics and nanostructures
- Spectroscopy of X ray absorption near edge structure, XANES
- Spectroscopy of fluorescence yield of X ray absorption near edge structure, FY XANES
- X ray photoelectron spectroscopy, XPS
- Photoemission electron microscopy, PEEM
- Ultra-soft X ray emission spectroscopy, USXES
- UV and visible region spectroscopy, volt-ampere and capacity-voltage characteristics of film materials, impedancemetry in the frequency range of 10–3–108 Hz
- Thermal and magnetron methods of formation of film samples

Challenges

- Using X-ray electron methods (XANES, XPS, PEEM, USXES, etc.), including complex research with application of unique world-class megascience facilities; optical and electrophysical research and diagnostics of a wide range of solids, nanostructures, functional and hybrid materials
- Synthesis of functional nanomaterials and formation of structures based on them, including nature-like technologies for organic and inorganic composite structures, as well as metallic, semiconductor, and dielectric systems
- Studying the structure, composition, physicochemical state of the surface and boundary lines of functional nanomaterials, structures, and elements of devices based on them

Major projects

- Russian Science Foundation project No. 19–72–20180 “Compatibility and transformation of functional inorganic nanoparticles with cell cultures in hybrid material produced in vitro according to synchrotron studies of the reconstruction of atomic and electronic structure” (2019–2022)



- German Scientific Foundation (Deutsche Forschungsgemeinschaft) project “The study of the atomic and electronic structure of the surface of silicone-based nanostructures using X-ray and electronic spectroscopy with synchrotron radiation” (Untersuchungen der atomaren und elektronischen Oberflächenstruktur von nanostrukturierten Silizium-Oberflächen mit Synchrotron-Röntgenstrahlung) (2018–2019)
- Russian Science Foundation project No. 17–72–10287 “Atomic and electron structure of new functional composite nanostructures based on wide-band tin oxides and hybrid bionanomaterials combined with filamentary silicon” (2017–2019)
- The Government Order for Educational Institutions by the Ministry of Education and Science of the Russian Federation “Synthesising functional nanostructured materials and precision diagnostics for atomic and electronic structure and the interfacial interaction by means of synchrotron radiation of megascience facilities” (2017–2019)
- Federal Target Programme “Academic and Teaching Staff for Innovative Russia”, agreement No. 14.B37.21.1272 of 21.09.2012 “Atomic and electron structure and properties of various micro- and nano-forms of functional sensing materials” (2012–2014)

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Laboratory of Power Electronics

Industrial partners

- OOO AEDON
- OOO KV-Sistemy
- OOO Special Power Supply Systems

Research area

Power electronics

Laboratory equipment

- 10 computers
- 8 development kits with K1986BE92QI microcontrollers
- Soldering equipment
- Measuring instruments
- Altium Designer CAE system
- Ansys software for the modelling of two dimensional and three dimensional electrical fields
- Laboratory on the premises of the Scientific Development and Production Centre with an access to facilities used to produce prototypes and to measure their characteristics

Challenges

- Calculation and design of transistor conversion units (voltage, power supplies, converters)
- Creating and testing prototypes
- Laboratory and small volume manufacturing

Available research methods

- Analytical calculations
- Calculation of losses
- Stabilisation and optimisation of dynamic characteristics
- Pspice computer modelling
- Selection and analysis of parameters for components base
- Studying prototypes

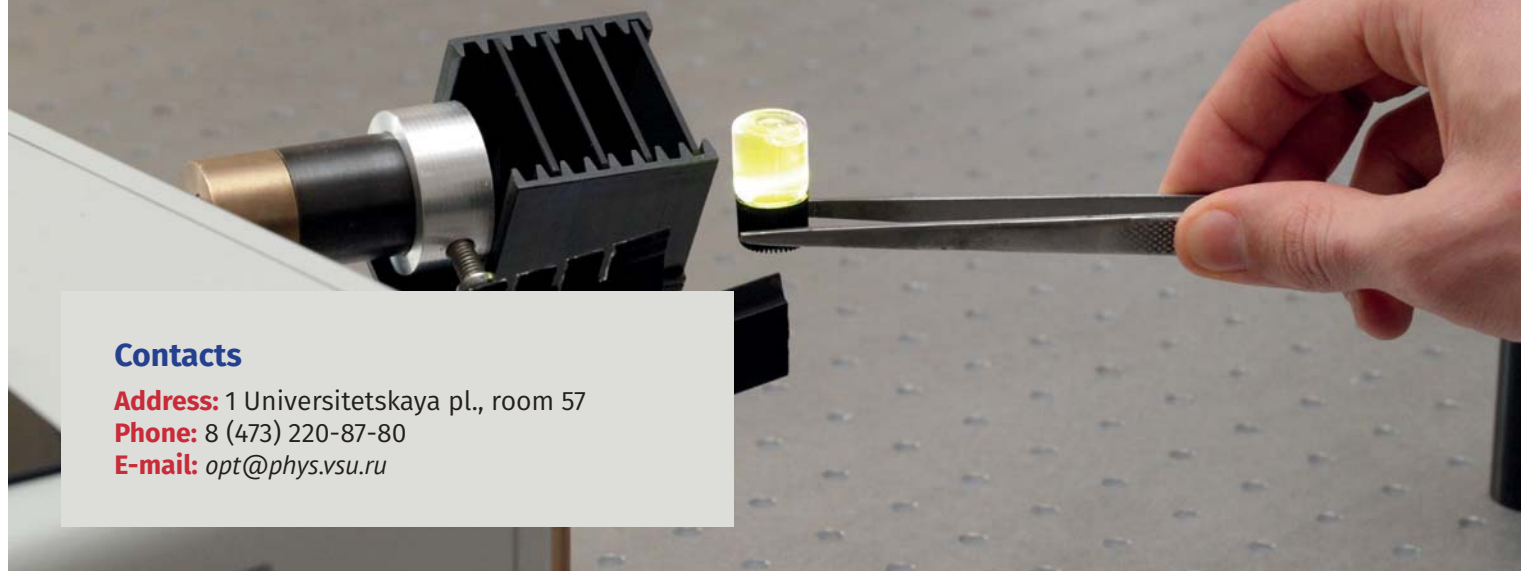
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Interdepartment Laboratory of Electronics and Photonics (section “Photonics”)



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Research area

- Nonlinear optical processes of dynamics of electronic excitation in nanomaterials
- Photoprocesses in quantum dots, including those conjugated with molecules and aggregates of organic dyes

Laboratory equipment

- Optical table
- Z-scan unit based on a motorised linear translator 8MT50- 200BS1-MEN1 (Standa, Lithuania) and Nd:YAG laser LS-2132UTF (Lotis TII, Belarus) generating radiation with wavelength of 266 nm, 355 nm, 532 nm, and 1,064 nm and duration of pulses of 5-8 ns, and a light detector FDS 10x10 (Thorlabs, USA)
- Pico Quant Time Harp 260 PicoSingle TCSPC system for time correlated photon counting to study luminescence decay dynamics within spectral range of 300-1700 nm provided by a MC-100- 20 photomultiplier tube (Becker&Hickel, Germany) and a single-photon detector InGaAs KIT-IF-25C (MicroPhotonDevices, Italy), together with semiconductor impuled lasers PICOPOWER LD375 (wavelength of 375 nm, pulse duration of 60 ps) and PICOPOWER LD660 (wavelength of 660 nm, pulse duration of 50 ps) (Alphas, Germany)

Available research methods

- Studying the nonlinear optical properties of materials by Z-scanning
- Time-resolved luminescence spectroscopy

Challenges

- Establishment of the type of nonlinearity (nonlinear absorption, absorption saturation, nonlinear refraction, nonlinear scattering) to measure the corresponding coefficients
- Analysis of nanosecond kinetics and photoluminescence lifetime in the spectral range of 300-1,700 nm

Major projects

- Russian Foundation for Basic Research project No. 17-52-12034 NNIO_a “Generation of the high harmonics using quantum dots” (Russia and Germany)
- Russian Science Foundation grant No. 17-72-10225 “Nonlinear media for low limiting optical threshold based on associates of Ag₂S colloid quantum dots and dye molecules with controlled luminescence properties”
- Russian Foundation for Basic Research project No. 19-12-00266 “Managing photostability and quantum efficiency of IR luminescence of Ag₂S colloid quantum dots for applications of quantum sensory studies”



Research and Training Laboratory of IC Design

Industrial partners

AO PKK Milandr

Research area

Development of schematic-based designs in IC design, testing, and application

Laboratory equipment

- A hardware-software system NI Elvis II with LabView and Multisim software
- Microcontroller development kits K1986BE92QI
- Programmable logic device development kits Cyclone IV
- Digital oscilloscope
- Functional generators
- High-end server

Available research methods

- SPICE and Verilog computer modelling
- Automated and electrophysical measurements

Challenges

- Development of circuit designs of analogue units for microelectronic circuits
- Development of Verilog descriptions for analogue and digital units for microelectronic circuits
- Development of LabView-based measurement systems
- Development of ARM Cortex-M3 microcontroller-based embedded systems

- Development of test boards and conducting functional measurement of microelectronic circuits
- Development of human-computer interfaces (in cooperation with the Laboratory of Medical Cybernetics at the Faculty of Computer Sciences)

Major projects

- Grant of the Russian Foundation for Basic Research No. 16-29-08342 ofi_m “Comparative analysis of cognitive stimulation based on human-computer interfaces (including brain-computer interfaces) and its effects on healthy users and users with neurologic pathologies” (in cooperation with the Laboratory of Medical Cybernetics)”
- Grant of the Russian Foundation for Basic Research No. 17-29-02505 ofi_m “Molecular genetic features determining the effectiveness of eye tracking systems and brain-machine interfaces (in cooperation with the Laboratory of Medical Cybernetics)”

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Laboratory of Functional Nanomaterials



Industrial partners

- AO Voronezh Semiconductor Plant
- AO Research Institute of Electronic Technology
- NPO Energeticheskaya elektronika

Research area

Technology and study of functional properties of self-organising nanomaterials for electronics

Laboratory equipment

- Photocor Mini particle-size analyser
- Sonicator
- Bresser Advanse ID optical microscope with digital recording
- System for differential thermal analysis of microprocesses
- High precision laboratory balance

Available research methods

- Differential thermal analysis of processes in a drip reactor
- Particle size analysis by dynamic light scattering
- Surface morphological study in optical wavelengths
- Study of adsorption properties of materials
- Quantum-mechanical modelling of structure formation processes
- Computer modelling of processes of structure formation of functional nanomaterials

Challenges

- Synthesis and diagnostics of functional nanomaterials in a drip reactor
- System research of functional nanocomposites
- Experimental data processing and interpretation
- Preparing obtained results for publication
- Conducting research and development of projects within the laboratory specialisation
- Modelling structure formation processes

Major projects

Russian Science Foundation grant No. 16-43-360281 "Physical and chemical foundations of the low-temperature synthesis of silicon-carbide nanostructures for extreme electronic component base"

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Laboratory of Electrochemical Material Studies and Anticorrosion Protection

Industrial partners

- OOO VMP Voronezh
- GK PROTEK
- Innovation Centre Biruch (GK EFKO)
- OOO Elnano

Research area

Thermodynamics and kinetics of heterogeneous multi-stage electrochemical processes as a scientific foundation for preparing new highly active electrode materials, the creation of new principles of electrocatalytic reaction control, and the suppression of corrosion in metals and alloys

Laboratory equipment

- Computer-aided electrochemical systems IPC-Compact, IPC-Pro-L, IPC-Pro
- Frequency response electrochemical analysers FRA 1
- Unico 2800 spectrophotometer
- Digital metallographic microscope Altami MET 1T (up to 2,000x magnification)
- Rotating disk electrode with a device for in situ cut of a thin (μm) surface layer
- Rotating disk electrode with a ring
- Unit for in situ photoelectrochemical

measurements

- Photocolorimeters
- Conductometers
- Ionomers
- Digital voltmeters
- Power supplies
- Software for quantum chemical calculations GAUSSIAN 2003 GAUSSIAN 2009, and WIENN 2K
- Software for multiphysical calculations COMSOL Multiphysics 5.0
- Software Mathematica 11

Available research methods

- Ambulatory electrochemical study method (voltammetry, chronoamperometry, chronopotentiometry)
- Impedance spectroscopy
- Photocurrent and photopotential spectroscopy
- Spectrophotometry
- Optical microscopy
- Quantum-chemical, mathematical, and multiphysical modelling

Challenges

- Creating electro-catalytic active materials for the chemical sources of currents, electrochemical

- energy storage devices, and sensors
- Deposition of electroplated coatings with functional micro-, nanoelectronics, and anticorrosion protection properties
- Synthesis of semiconductor metal-oxide films for micro- and optoelectronics, photo (electro) catalysis, energy production, and chemical and biological sensory studies
- Establishing the kinetics and mechanism of electrocatalysis processes and hydrogenation of metals and alloys to solve problems of corrosion, electrochemical, and hydrogen energetics

Major projects

- Grant of the Ministry of Education and Science of the Russian Federation in the framework of the state order to higher education institutions for years 2014–2016, project No. 675 “Study of heterogeneous and homogeneous processes in ion exchangers, metal-polymer composites, and alloys”
- Grant of the Russian Foundation for Basic Research No. 09–03–00554-a “Synthesized oxides Cu(I) and Ag(I) in form of a nanofilm and a nanocomposite with a polymer: production and reduction kinetics, chemical inertness, stoichiometry and semiconductor properties”
- Grant of the Russian Foundation for Basic Research

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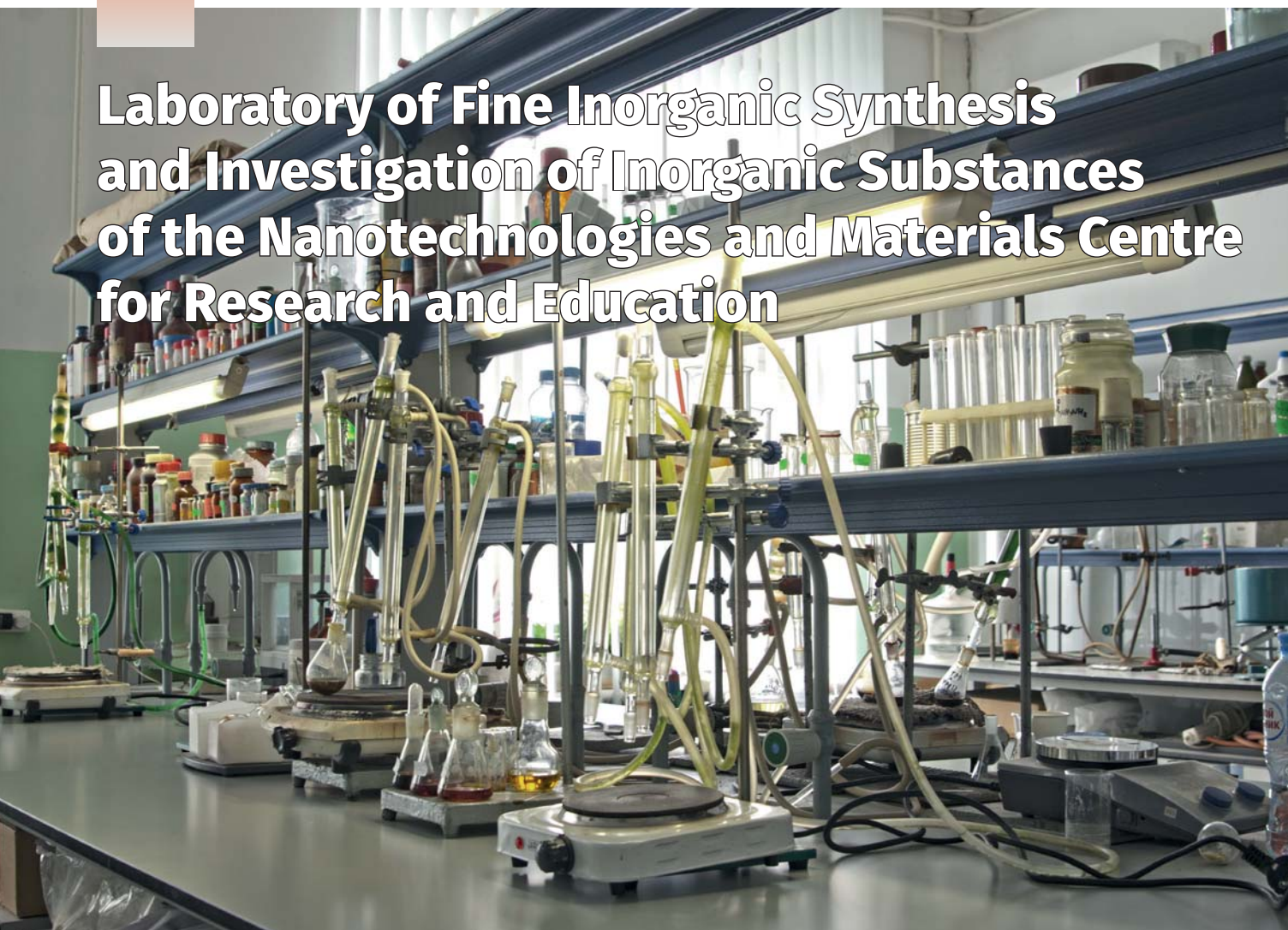
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No. 08–03–00194-a “Heterogeneous processes in metallic systems with electrochemical, chemical, adsorption, and transport stages: kinetics and thermodynamics”

- Grant of the Russian Foundation for Basic Research No. 06–03–32274-a “Selective anodic dissolution of homogeneous alloys under conditions of oxide and salt formation”
- Grant of the Russian Foundation for Basic Research No. 01–03–33190-a “The role of chemical composition and structural and vacancy defectiveness of homogeneous gold and palladium-containing alloys in the formation of their electrocatalytic activity: kinetics, double layer, and electronic structure”



Laboratory of Fine Inorganic Synthesis and Investigation of Inorganic Substances of the Nanotechnologies and Materials Centre for Research and Education



Research area

- Development of synthesis methods and studying the properties of SAS and emulsifiers based on raw materials and wastes of oils and fats production to be used in various industries, including cosmetic, construction, oil-producing, etc.
- Development of new inhibitors of copper corrosion, copper alloys, and steels to be used in various industries, including water supply equipment and coating compositions
- Development of new growth regulators of plants to provide for the agricultural needs
- Development of directed synthesis methods for protein kinase inhibitors with potential anticancer activities
- Development of new blood thinners based on polyazaheterocyclic systems
- Development of methods of analysis for inward raw materials and methods of process monitoring

Industrial partners

- OAO EFKO (Alexeyevka, Belgorod region)
- ZAO Petrochim (Belgorod)
- OOO NaftaEKO engineering company (Voronezh)

Laboratory equipment

- Gas chromatograph – Agilent 7890B/5977A mass spectrometer
- Agilent 6230 accurate-mass time-of-flight (TOF) LC/MS system
- Milestone MicroSynth microwave synthesis system
- Carousel 6 Plus reaction station
- Unic laboratory reactor system for organic synthesis
- PC3004 Vario chemical vacuum station
- KXTB 0.15 climatic temperature and humidity chamber

Available research methods

- Parallel controlled combinatorial synthesis of organic compounds, refining the synthesis conditions
- Chromatographic separation of mixtures and mass spectrometry analysis of organic compounds and the study of organic reaction mechanisms
- Electrochemical and full-scale testing of corrosion inhibitors
- Spectral methods for studying organic compounds in UV, visible, and IR spectra
- Studying functional properties of SAS

Challenges

- Development of new SAS for chemical enterprises (SAS and co-SAS for cleaners and emulsifiers during emulsion polymerisation, for pharmaceutical enterprises (as a structure-forming component of medicinal products), for ore mining enterprises (lubricators, emulsifiers, deemulsifiers), for construction enterprises (anti-foaming agents, foam stabilisers, for example, during foam concrete production)
- Development of new anti-corrosion inhibitors for various enterprises, including coating compositions and metalware manufacturers
- Development of new growth regulators of plants with growth enhancement and growth inhibiting effects for agricultural enterprises
- Development of new drug prototypes, including those with potential anticancer activities, blood thinners for medical companies
- Development of best synthesis conditions, development of technical documentation
Development of methods of analysis for inward raw materials and end products and methods of process monitoring

Major projects

- Ministry of Education and Science of the Russian Federation, OAO EFKO (within the Decree of the Government of the Russian Federation No. 218) “Developing a hi-tech industry for plant oil and fibre processing and transformation into non-food products” (2013–2015) (agreement N02. G25.31.0007)

Contacts

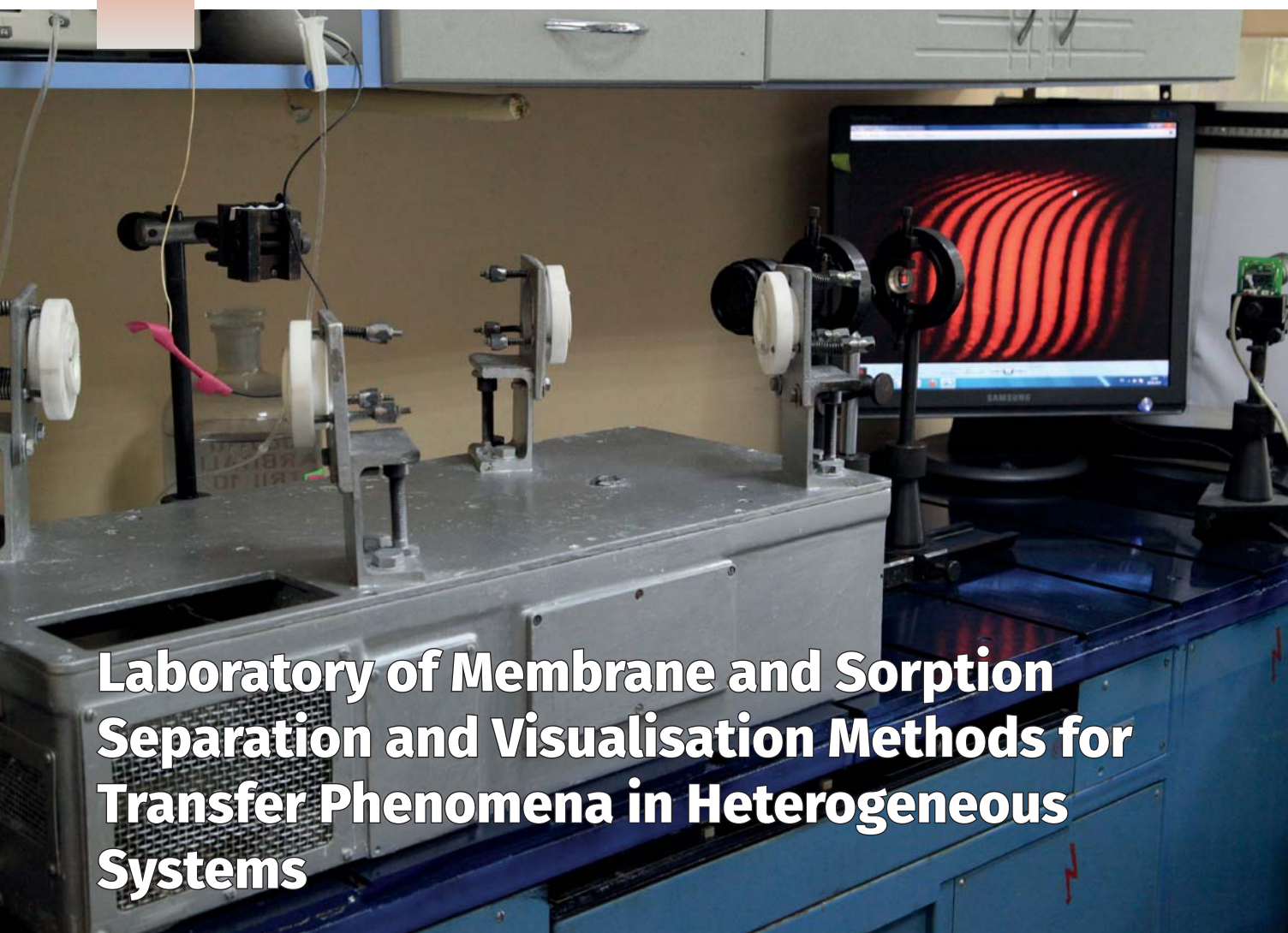
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- Government Order by the Ministry of Education and Science of the Russian Federation for higher education institutions in the area of scientific research for years 2014–2016, project No. 4.2100/2014 “New linear and condensed heterocyclic systems based on functionally substituted hydro-quinols: developing synthesising methods and studying the physiological activity”
- Federal target programme of the Ministry of Education of the Russian Federation “Research and development in top-priority areas of science and technology in Russia for 2014–2020”, agreement No. 14.577.21.0182, 2015–2017, “Development of energy-saving technologies used in the process of production of emulsifiers and emulsifying systems for food and non-food industry based on raw materials and their derivative products”
- Government Order by the Ministry of Education and Science of the Russian Federation for higher education institutions in the area of scientific research for years 2017–2019, Order No. 4.3633.2017/PCH “Development of new corrosion inhibitors for copper and its functionally-substituted triazole alloys to be used in heat-exchange equipment”
- Russian Foundation for Basic Research. Agreement No. 8-74-10097, “Development of blood thinners of new generation based on blood coagulability factor Xa and XIa inhibitors of linear and condensed functionally substituted hydro-quinols” (2018–2020)





Laboratory of Membrane and Sorption Separation and Visualisation Methods for Transfer Phenomena in Heterogeneous Systems

Industrial partners

- Food and pharmaceutical enterprises of the Voronezh region
- OOO Innovative enterprise “Membrane Technology” (Krasnodar)
- Frumkin Institute of Physical Chemistry and Electrochemistry of the Russian Academy of Sciences
- Kuban State University (Krasnodar)
- Tambov State Technical University

Available research methods

- Spectrophotometry
- Flame photometry
- Laser interferometry
- Refractometry
- IR-spectroscopy
- Ionometry
- Titrimetry
- Standardised techniques of determining the physicochemical properties of ion exchangers

Research area

- Membrane methods for water solutions cleaning of mineral and organic components
- Visualisation of transport processes in systems with ion-exchange membranes and sorbents

Challenges

- Development and enhancing membrane technologies of separation and extraction of organic substances (amino acids, sugars, spirits, etc.) from mixed solutions with mineral components, cleaning of natural and waste water
- Visualisation of transfer phenomena at the solution-membrane interphase boundary
- Development of stable ion-exchange membranes for high-temperature and high-intensity electro dialysis

Laboratory equipment

- SF-2000 spectrophotometer
- Vertex-70 spectrophotometer with a Bruker single beam circuit
- Mach-Zehnder interferometer
- Refractometer
- I-160 MI ionomer
- EXPERT-002-2-6-p conductometer
- Voltmeters
- DMM4040 multimeter
- DC sources
- LOIP Lt-112b thermostat
- Flame photometer
- LOIP LS-301 peristaltic pump
- Electrodialysis and dialysis cells
- Water distilling apparatus
- Analytical and laboratory balance

Major projects

- Grant of the Russian Foundation for Basic Research No. 18-08-01260 "Demineralisation and separation of the aqueous salt solutions of neutral amino acids and sugar by ion-exchange dialysis" (2018-2020)
- Grant of the Russian Foundation for Basic Research No. 15-08-05031 "The influence of temperature on the transport-structural parameters of

heterogeneous ion-exchange membranes and on the electrical convection during electro dialysis of high-intensity current mode" (2015-2017)

- Grant of the Russian Foundation for Basic Research No. 16-38-00572 "Electroconvective instability in stratified systems with heterogeneous ion-exchange membranes as a result of temperature modification" (2016-2017)
- Grant of the President of the Russian Federation No. MK-925.2018.3 "Studying electrical convection in systems with heterogeneous ion-exchange membranes with different surface morphologies" (2018-2019)



Contacts

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Laboratory of Express and Test Analysis Methods



Contacts

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zyablov@chem.vsu.ru

Research area

- Development of piezoelectric sensors used to determine substances in liquids. Sensor selectivity is achieved by modifying electrodes of piezoelectric resonators by polymer materials, particularly by molecularly imprinted polymers. For the first time, molecularly imprinted polymers based on polyamide acid and colloxylin were obtained in the laboratory.
- Studying physicochemical properties of polymer materials (selected sensor coatings) and analysed objects
- Quantum chemical modelling of substance-solvent, substance-sorbent structures to forecast the behaviour of sensors under different conditions

Laboratory equipment

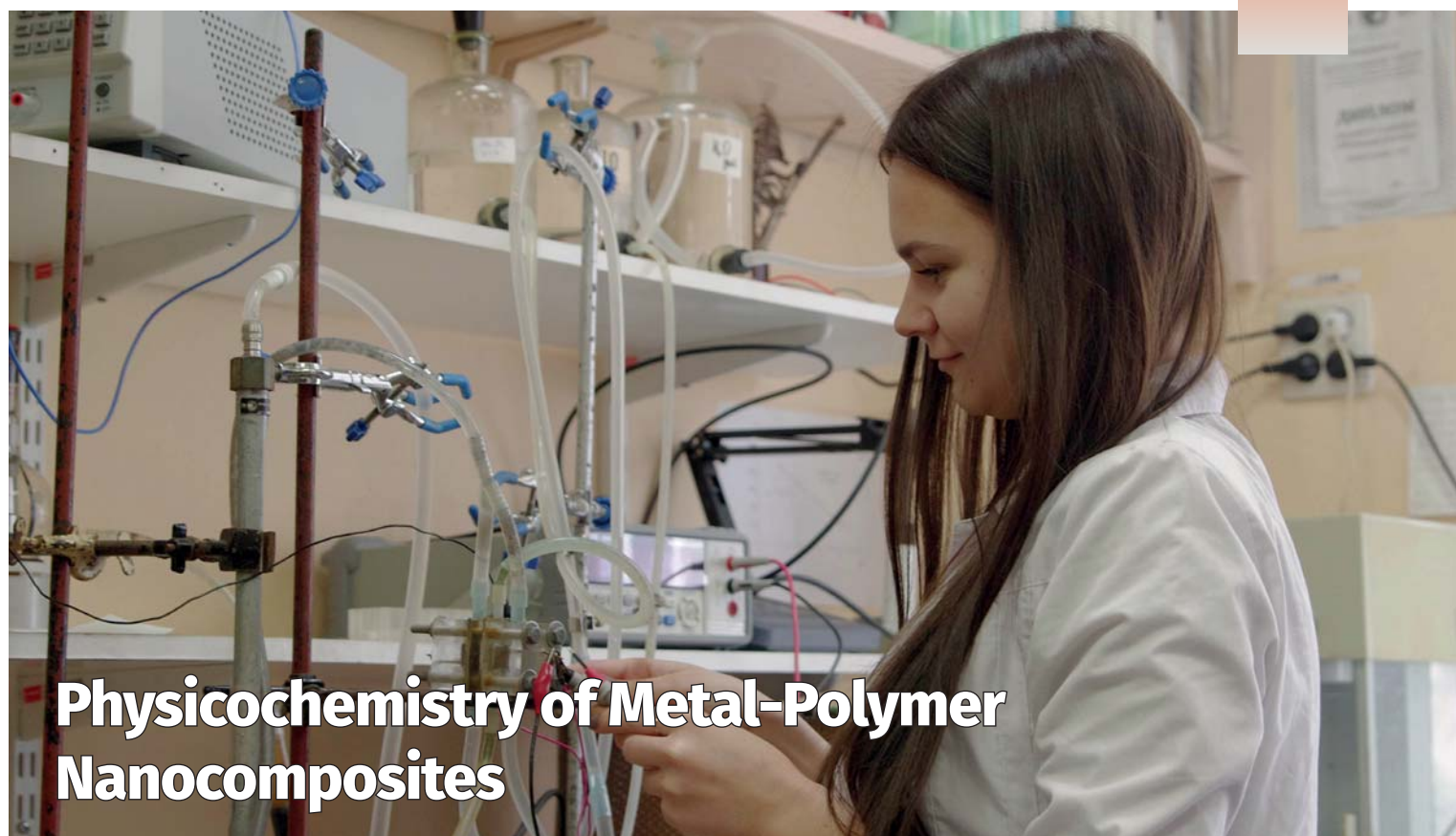
- PE 2000; spectrophotometer
- AKTAKOM-ACH 8322 frequency meter
- MP732 USB frequency meters
- CCT 3320T conductometer
- Crystal oscillator, etc.

Available research methods

- Chromatographic
- Spectral
- Electrochemical
- Sorption

Challenges

- Determination of amino acids, antibiotics, carboxylic acids, synthetic dyes, sugars in liquid medium



Physicochemistry of Metal-Polymer Nanocomposites

Research area

Physical chemistry of nanosystems

Laboratory equipment

- Potentiostats
- Current sources
- Oxygen analysers

Available research methods

- Gasometric method of studying oxygen uptake rate from water
- Dynamic method of assessing water deoxygenation rate
- Electrochemical method of assessing thin-film catalysts

Challenges

- Water deoxygenation in instant and continuous-flow systems
- Concentrating heavy metals

Major projects

- Grant of the Russian Foundation for Basic Research, project No. 11-08-00174_a “Metal-ion exchanger nanocomposites for deep deoxygenation of water: physicochemical principles and technological framework” Hear Researcher — T.A. Kravchenko
- Grant of the Russian Foundation for Basic Research:

project No. 13-08-00935_a “New functional nanostructured materials based on metals and ion-exchange polymers that can be used as catalytic agents and electrocatalysts”

- Grant of the Russian Foundation for Basic Research, project No. 13-08-07007 aimed at publishing the book “Electrochemistry of metal-ion exchanger nanocomposites” Hear Researcher — T.A. Kravchenko
- Grant of the Russian Foundation for Basic Research, project No. 14-08-00610_a “Percolation effects in metal-polymer nanocomposites as a basis for a new technology of protecting water and heating systems from oxygen-type corrosion” Hear Researcher — T.A. Kravchenko
- Grant of the Russian Foundation for Basic Research, project No. 17-08-00426_a “Electrochemical polarization of metal-ion exchanger nanocomposites for constant deoxygenation of water in open flow systems” Hear Researcher — T.A. Kravchenko

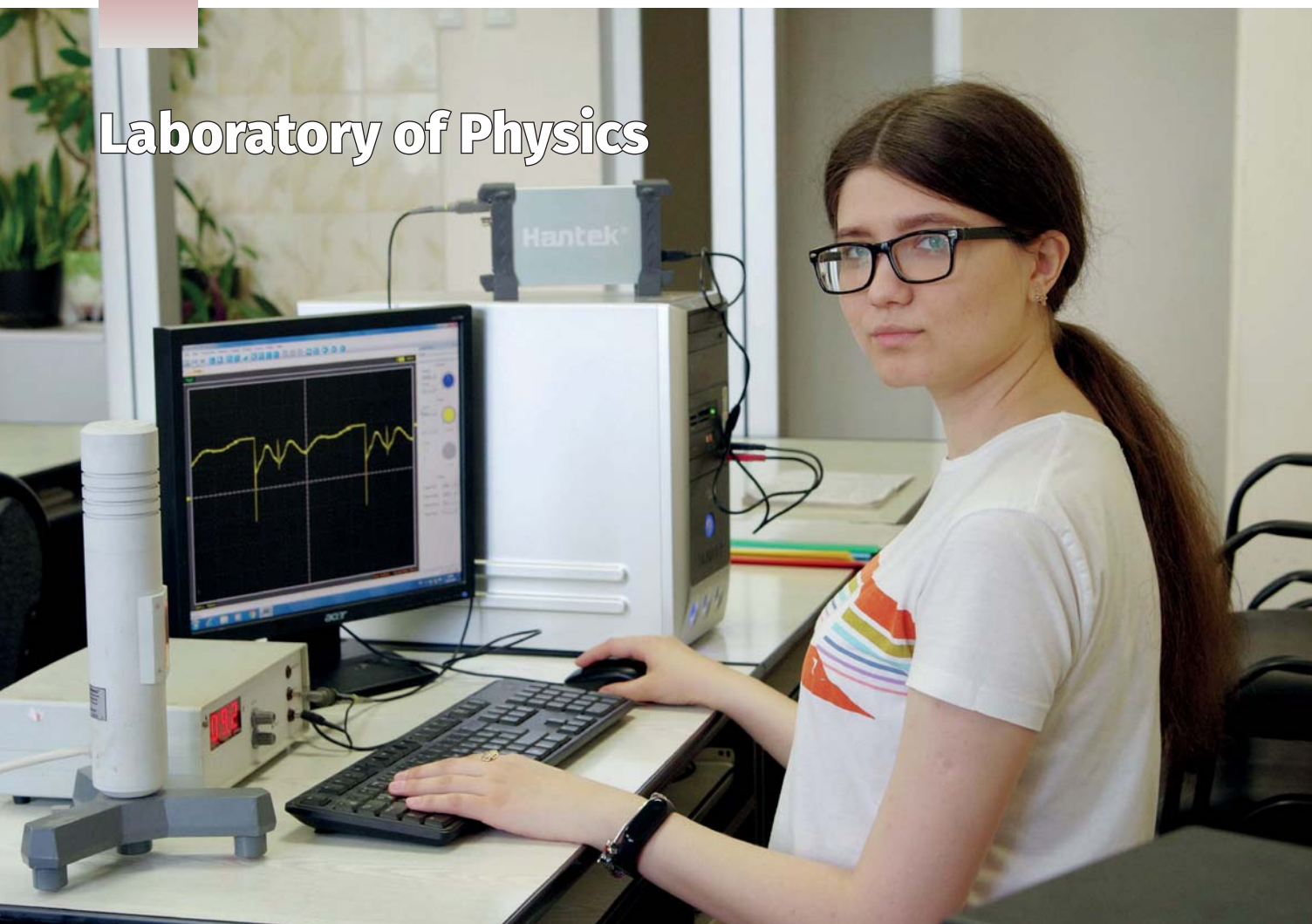
Contacts

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Laboratory of Physics



Research area

- Mathematical modelling
- Machine learning
- Computer vision

Laboratory equipment

- Set of equipment for the physics practical course "Quantum physics"
- Computers
- Projector

Challenges

- Modelling of physical processes
- Image processing and analysis by machine learning methods
- Using images to build 3D models of objects
- The laboratory is used to conduct classes within the physics practical course for students completing the programmes «Mathematics and Computer Sciences» and «Software Engineering», as well as during physics practice course for students from Basov gymnasium as part of pre-university training.

Contacts

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Laboratory of Network Technologies

Industrial partners

- AO NPO “Infobezопасnost”
- OOO Kod Bezопасnosti
- OAO InfoTeKS
- OOO Siemens
- ATOS

Research area

- IT systems administration, development of network equipment (UTM/FPGA)

Laboratory equipment

- Intel server hardware
- CISCO Systems, D-Link, and HP network equipment
- Xilinx FPGA EB

Available research methods

Real time network traffic capture and analysis

Challenges

- Development of UTM network equipment
- Administration of IT resources of the Faculty of Computer Sciences/Voronezh State University

Contacts

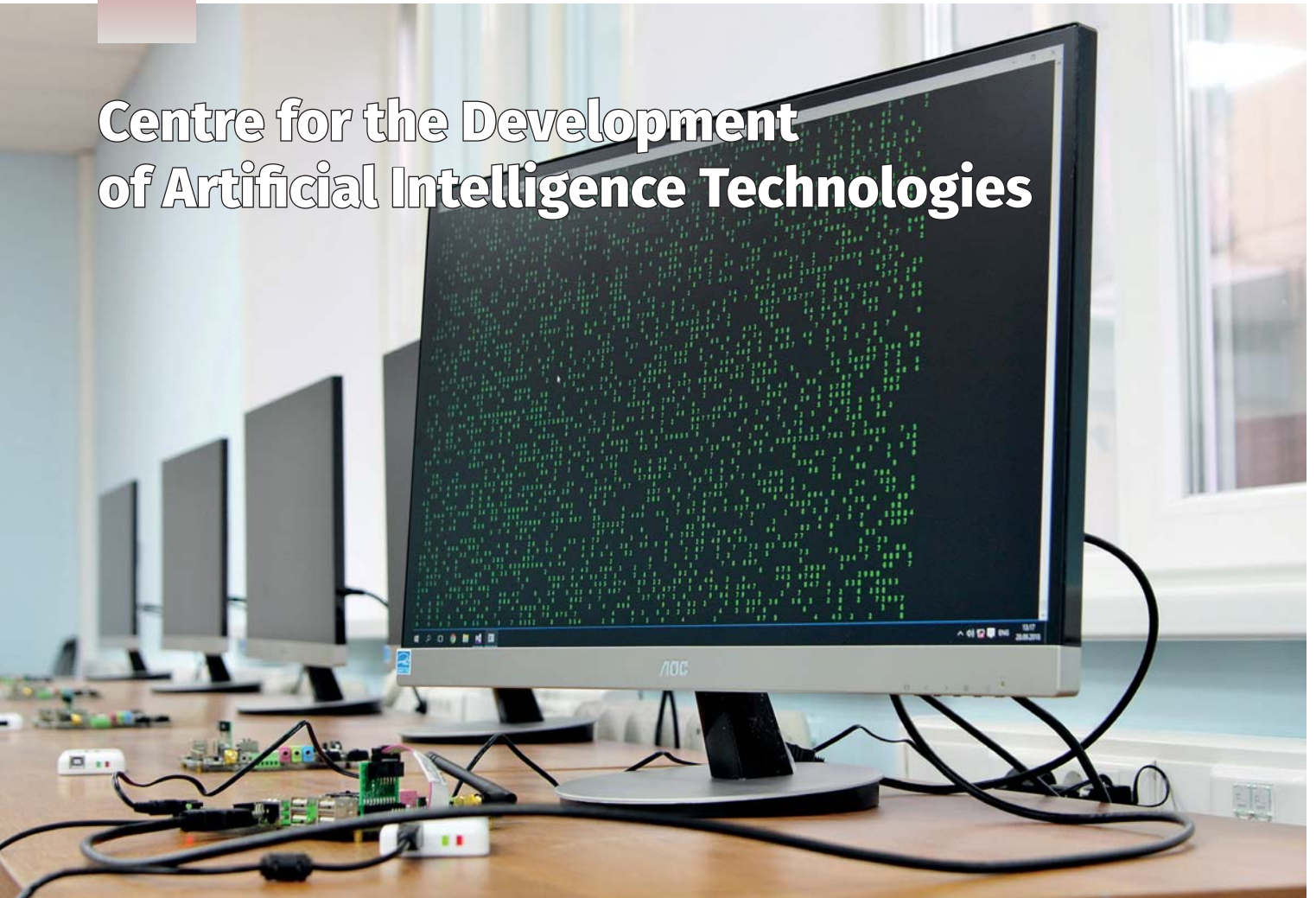
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E-mail: helpdesk@sc.vsu.ru



Centre for the Development of Artificial Intelligence Technologies



Industrial partners

AO Concern Sozvezdiye

Research area

Development of methods and technologies of machine learning and applied artificial intelligence
The centre conducts research using its equipment, both independently and jointly with other divisions of the university and interested organisations. It also conducts postgraduate degree programmes training specialists in the sphere of applied artificial intelligence and machine learning

Laboratory equipment

- High-end desktop PCs
- Hardware and software systems

Available research methods

Methods and technologies of information processing, data analysis, and machine learning

Challenges

- Conducting applied and basic research employing the laboratory's equipment, as well as scientific and intellectual resources of VSU and other interested organisations
- Development and experimental study of new methods and algorithms of information processing, as well as enhancement of existing methods and algorithms in the sphere of data analysis, machine learning, and applied artificial intelligence
- Software development for pilot research and the creation of prototypes of software systems within the specific area
- Development and introduction of software for the analysis of experimental data provided by interested organisations
- Providing research facilities required for the implementation of new education programmes, and attracting large numbers of students and postgraduates to studying modern research methods in the area of artificial intelligence and machine learning

Major projects:

- Project “Neural Network - University” “Developing the technologies for automated creation, training, and performance of artificial neural networks to be used in decision support systems for officers of technical and organizational systems”, 2018-2019
- State Task by the Ministry of Education and Science of the Russian Federation, project No. 8.3844.2017/PCh “Development of methods for express analysis and sorting of elements of grain mixture with pathologies, based on the combination of spectrum analysis and machine learning methods”, 2017-2019
- A series of R&D projects “Development of integrated information technologies and multifunctional software systems for analysis of topical images (processing, enhancement, super-resolution effect, and image recognition)”, 2011-2018
- Projects of the Foundation for Assistance to Small Innovative Enterprises in Science and Technology No. 13581 and No. 115020430017 2011-2017, and grant of the Russian Foundation for Basic Research, project No. 13-01-97507 r.centre “Development of multifunctional software for implementation of new technologies for creating digital watermarks in order to monitor the use and distribution of multi-format web content, as well as electronic and paper documents”

**Contacts**

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Laboratory of Medical Cybernetics

Research area

Health IT, human-computer interfaces

Laboratory equipment

- Electroencephalographs
- Electromyograph
- Electrocardiograph
- Holter monitor
- 24-hour blood pressure monitor
- Spirograph
- Rheograph
- Eye trackers

Challenges

Development of new human-computer interfaces and health ITs for diagnostics, rehabilitation, and operator training for technical systems

Major projects

Grants of the Russian Foundation for Basic Research

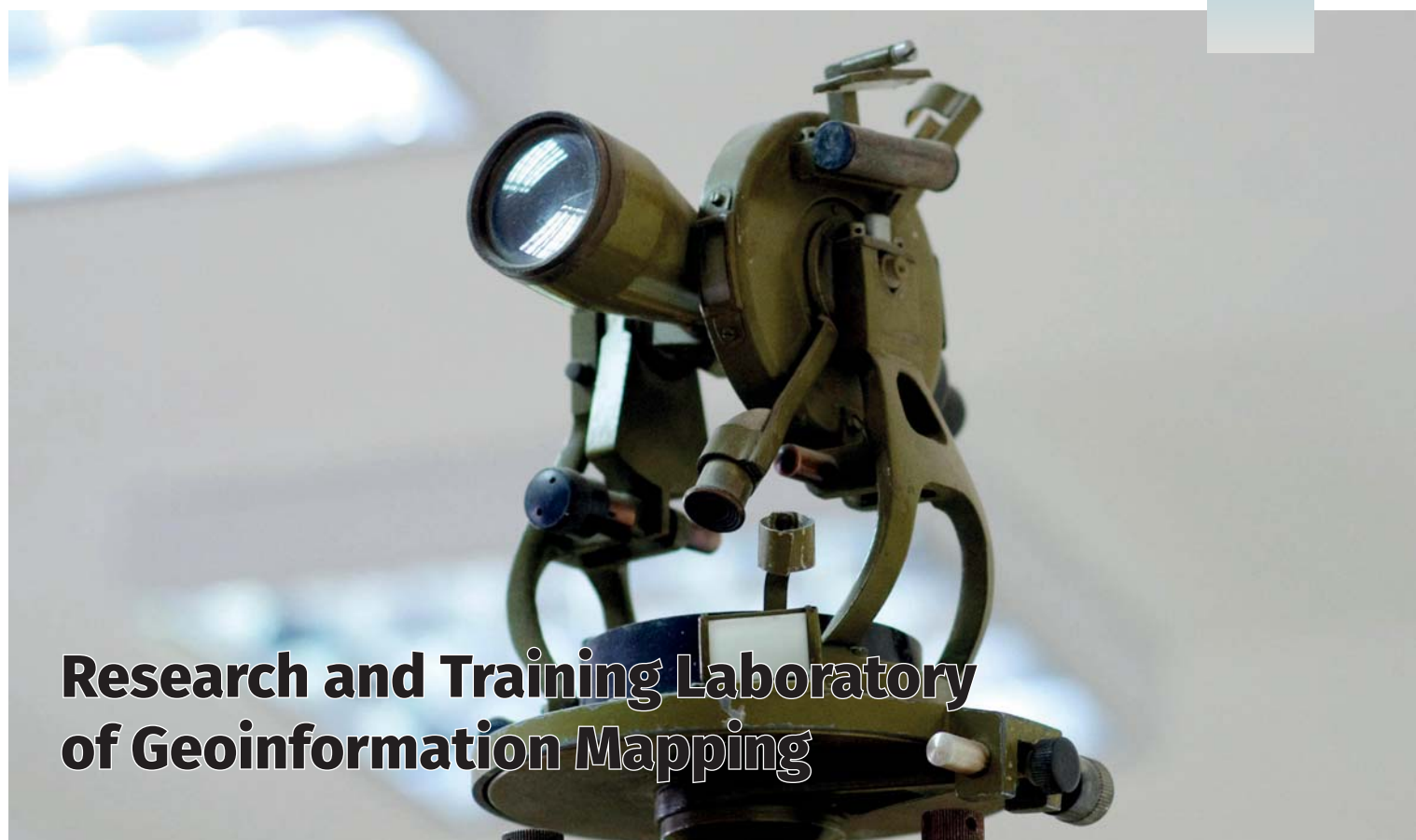
Available research methods

- EEG
- EEG/ERP
- EEG-holter
- ECG
- High-resolution ECG
- ECG-holter
- 24-hour ambulatory blood pressure monitoring
- Rheography
- Oculography
- Myography
- Spirography

Contacts:

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Research and Training Laboratory of Geoinformation Mapping

Industrial partners

- Cartography laboratory of the Institute of Geography of the Russian Academy of Sciences (head of the laboratory - A.A. Medvedev)
- Moscow State University of Geodesy and Cartography (the Department of Cartography)

Research area

Geoinformation and cartography, cartographic research methods

Laboratory equipment

- Desktop PCs S775 Intel Core 2; Pentium 3
- A4 and A3 flatbed scanners
- HP — DJ 500/800 plotter
- BQ MP 575 multimedia projector

Available research methods

- Spatial analysis and modelling by means of geoinformation systems
- Analysis of the Earth distance probing data (aerial photography)

Challenges

Determining the geographic (spatial) properties of natural and anthropogenic processes in natural and social systems of the Central Black Earth Region,

which affect the environmental conditions and natural resource management in the region

Major projects

- Annual national research conference “Geoinformation and cartography in Russian regions” (2009-2018)
- Publishing projects Medical and environmental atlas of the Voronezh Region (2010), Ecological-geographic atlas of the Voronezh Region (2013)
- Grant of the Russian Foundation for Basic Research No. 14-05-31329 mol_a “Developing a model for environmental quality indication by means of GIS technologies”, Head Researcher — S.A. Epryntsev

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Руководитель: Нестеров Юрий Анатольевич

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Resource Centre of Radioecological Security

Contacts

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Research area

Radioecology and automatic environmental design

Major projects

- Project 530644-TEMPUS 1–2012–1-ES-TEMPUS-JPCR “HUMAN Security (environment, quality of food, public health and society) on Territories Contaminated by Radioactive Agents”, coordinator — University of Cordoba (Spain); Head Researcher at VSU — S.A. Kurolap (2012–2016).
- Commercial contract research No. 08108/378DS12 of 19.10.2012: “Analysing the demographic situation at the construction site of Novovoronezh Nuclear Power Plant 2” for OAO Rosatomenergopoyect, Head Researcher — S.A. Kurolap (2012)
- Commercial contract research “Analysing the demographic situation at the supposed construction sites of Smolensk Nuclear Power Plant 2”, for OAO Rosatomenergopoyect, Head Researcher — S.A. Kurolap (2013)

Laboratory equipment

- Asus Core i5 – 3570/20
- BenQ multimedia projector
- Samsung laptop
- Tripod mounted 152x152 projection screen
- Whiteboard
- Radiometer
- Dosimeter DKG-07, MKS-01SA-1B “Drozd”
- Acer multimedia projector

Available research methods

- Computer processing of environmental geo data applying mathematical statistics methods and special software “Ecolog”
- Measurement of radiation parameters of environmental objects

Challenges

- Radioecological monitoring
- Automatic environmental design

Research and Training Laboratory of Ecology and Analytics

Research area

Ecological and analytical study of the state of the environment (analysis of air, water, soil, bottom sediments in order to identify the presence of dangerous chemicals), bioindication studies

Laboratory equipment

- Electronic analytical scales
- Electronic scales
- Programmable muffle furnace
- Laboratory oven
- Thermostat
- Heating panel
- Water biotesting laboratory
- Voltammetric analyser TA-4
- pH-meter
- Photoelectric photometer KFK-3-01
- NKV field lab
- Distillator
- Autoclave
- Centrifuge

Available research methods

- Gravimetric method
- Photometric method
- Titrimetric method
- Voltammetric method (for identifying heavy metals)
- Potentiometric method
- Water and soil biotesting
- Bioindication methods

Challenges

- Defining the chemical composition of fresh, natural, and waste water
- Defining the total content and active forms of chemical elements in soils
- Determining the level of toxicity of water and soils by means of biotesting
- Assessing the vitality of woody plants by means of bioindication methods

Major projects

- Grant of the Russian Geographical Society and the Russian Foundation for Basic Research No. 17-05-41072 “Geoinformation support of regional systems for medico-ecological monitoring of large industrial centres”, Head Researcher - S.A. Kurolap (2017-2019)
- Commercial contract research “Studying the



vegetation resources at “Reconstruction of KGMO 1 in the territory between CS Noginsk and CS Yakhroma” for DOAO Gasproyengineering, Head Researcher - S.A. Kurolap (2017)

- Grant of the Russian Foundation for Basic Research No. 17-05-00569 “Studying the functioning of ecological and geochemical background and health risks to people living in building and industrial areas of the Central Black Earth Region”, Head Researcher - S.A. Kurolap (2017-2019)

Contacts

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Research and Training Laboratory “Vascular Plant Herbarium – VORG”

Contacts

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E-mail: grigaya@mail.ru, art8266@yandex.ru

Industrial partners

- Komarov Botanical Institute of the Russian Academy of Sciences (St.Petersbutg)
- Tsytin Main Moscow Botanical Garden of Academy of Sciences (Moscow)
- Institute of Ecology of the Volga basin of the Russian Academy of Sciences (Tolyatti)
- Lomonosov Moscow State University (Moscow)
- Institute of Geography of the Russian Academy of Sciences (Moscow)
- Institute of Steppe of the Ural Division of the Russian Academy of Sciences (Orenburg)
- Societas Biologica Fennica Vanamo, Helsinki, Finland;
- Kuprevich Institute of Experimental Botany of the National Academy of Sciences of Belarus (Minsk, Belarus)

Research area

Biogeography, geoecology, floristics, biodiversity of natural and urbanised ecosystems, steppe protected areas in Northern Eurasia

Laboratory equipment

- S775 Intel Core 2 desktop PC
- Binocular
- Herbarium cabinets (7)
- Freezer-refrigerator
- 20,590 samples of herbarium materials

Available research methods

- Biogeographical analysis
- Traversing

- Floristic and geobotanical method
- Cartographic methods

Challenges

Study and research projects, PhD research, grants of the Russian Foundation for Basic Research, collaboration with the leading Russian and international research institutions

Major projects

1. Creation of Herbarium VORG, which includes 20,590 plant species
2. Grants of the Russian Foundation for Basic Research:
 - International grant No. 14-04-90403 “Assessing the diversity and structure of the adventive flora of the Eastern Europe forest-steppe in order to conserve the ideal function of the specially protected territories” FSFEI HE Voronezh State University Head Researcher - A.Ya. Grigorievskaya (2014-2015)
 - Project No. 13-05-97512 “Environmental dangers of invasive plants species of man-transformed geosystems as the reason for the creation of the Black Book of Extinct Plants of the Voronezh Region” FSFEI HE Voronezh State University Head Researcher - A.Ya. Grigorievskaya (2013-2015)
 - Project No. 13-05-00356 “Biodiversity and ecological framework of urban agglomerations as a sustainable development factor (case study of Voronezh Region). FSFEI HE Voronezh State Forest Engineering University Head Researcher - O.S. Lisova (2013-2015)

Hydrometeorological Observatory

Industrial partners

Voronezh Centre for Hydrometeorology and Environmental Monitoring, a branch of the Central Black Earth Region Department of Hydrometeorology and Environmental Monitoring

Research area

Hydrometeorological studies: studying the microclimate of the urban area, studying the thermal and radiation regime of the geological substrate of various types of subsoil characteristic of the Central Black Earth Region

Laboratory equipment

- Meteorological station
- Automatic meteorological station
- M-49 meteorological station
- Wild's anemometer
- Handheld anemometers ARI-49
- MS-13
- Aneroid barometer
- Adjustable cistern mercurial barometer SR-A
- Liquid-in-glass meteorological thermometers
- Clouds atlas
- Psychrometric tables
- Scientific, reference, information, cadastral materials concerning water bodies in Russia, their state and regime

Available research methods

- Receiving satellite hydrometeorological data
- Performing meteorological and actinometric observations
- Accumulation, storage and summary of meteorological data

Challenges

Observation of numerous meteorological objects:

- atmospheric pressure
- air temperature, temperature of soil surface, and temperature of subsoils at the depth of up to 2.4 meters
- frost line
- air humidity
- total and lower cloud cover
- state of the Sun orb
- atmospheric effects
- amount and duration of precipitation
- ground visibility and cloud base
- wind speed and direction
- sunshine duration
- snow cover depth

Major projects

Grant of the Russian Foundation for Basic Research No. 11-05-00079-a "Medical-geographical analysis of the public health rate as related to climate change in the Central Black Soil Region in the 21 century", Head Researcher - S.A. Kurolap (2011-213)

Contacts

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Complex Research Laboratories of the Research Institution of Geology

Industrial partners

- FSFI Hydrospeitsgeologia
- A.P. Karpinsky Russian Geological Research Institute (VSEGEI)
- OOO Akma-Universal
- OOO SIBELKO

Research area

Geology, hydrogeology, geo-engineering, ecology

Laboratory equipment

- Photoelectric colorimeter KFK-2-UKhL4.2
- Hanna Instruments HI 98309 pure water tester/ conductivity meter
- HTR -220CE VIBRA electronic scales
- Ionometric converter I-500
- KFK-3KM spectrophotometer
- Burette GOST 29251-91
- Densitometer (PAO Steklopribor, Chervonozavodsk)
- Combined glass electrode ESK-10601/4
- Atomic absorption spectrometer Kvant-Z.ETA-T
- Aneroid barometer BAMB-1
- Ion-selective electrode ELIS-131F
- Semi-automatic soil compactor
- Frost heave measurement device UPG-MG 4.01/H
- Laboratory ion meter I-150MI
- S8 Tiger X-ray diffractometer (Bruker AXS)
- Dial indicator ICh-10
- Glass electrode ES-10603
- Electric laboratory oven SNOL 67/350
- Muffle furnace Snol 6.7/1300
- Polarizing microscope POLAM R-312 (LOMO) (Russia)
- Binocular MBS-1 LOMO (Russia)
- Vibration analyser A 20
- Water distilling apparatus DE-4
- Titration system SM-2
- MATRIX hydraulic bottle jack
- HERZOG TP-40 pellet press
- Pycnometers

Available research methods

The methods described in standards and regulatory documents (GOST, guidelines of the Academic Council on Analytical Research methods, conversational standards PNDF, SNiP (construction rules and regulations), Sanitary Regulations and Norms, etc.)

Challenges

- Chemical analysis of water, soil, subsoils, sediment, rock formations, ores, and their by-products
- Mineralogical analysis and geotechnical investigation of subsoils

Major projects

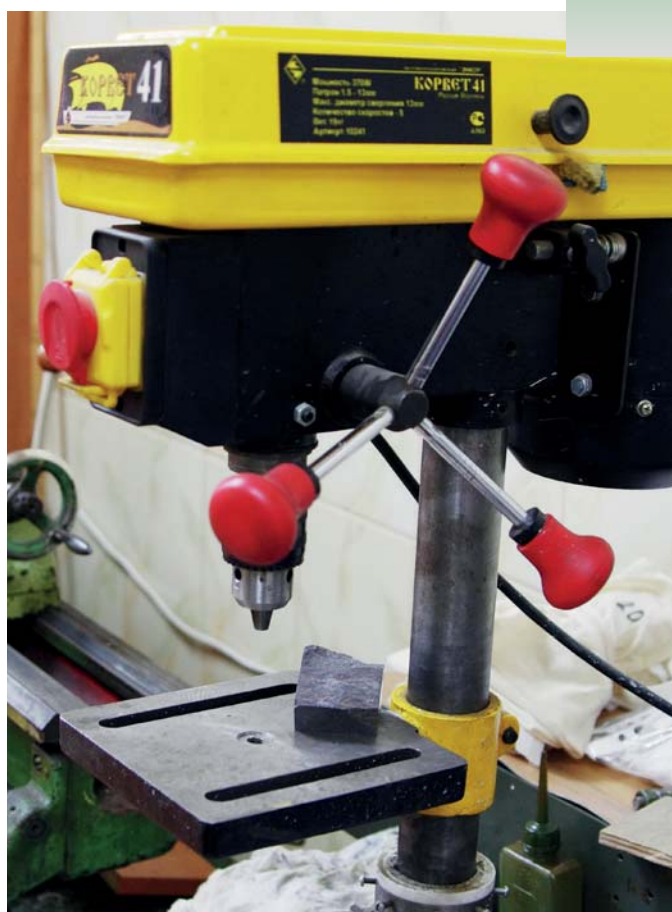
Performing geological and groundwater public survey (1:200,000 and 1:1,000,000 scale) since 1991

Contacts

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Laboratory of Biostratigraphical Research

Industrial partners

- AO Sibirskoye PGO (Chita)
- OAO Uralskaya geologo-syomochnaya ekspeditsiya (Ekaterinburg)
- Institute of the Earth's Crust Siberian Branch of the Russian Academy of Sciences (Irkutsk)
- OAO Geokarta-Perm (Perm)
- Institute of Physicochemical and Biological Issues in Soil Studies of the Russian Academy of Sciences (Moscow, Puscheno)

Research area

Biostratigraphic criteria for chronological periodisation of sedimentary rocks from Precambrian to the Holocene

Laboratory equipment

Biological microscopes MBI 3 and R 17, with a magnification ranging from 250 to 1500

Available research methods

- Spore-and-pollen analysis (identifying Palaeozoic, Mesozoic, and Cenozoic spores and pollen)
- Diatomic analysis (identifying Cenozoic diatoms)

Challenges

Performing paleontological studies in order to determine the age of the mapped rock masses, layers and sediment units

Major projects

The laboratory was opened 60 years and since then it has been working on various scale projects. The employees of the laboratory are highly qualified specialists

Contacts

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Mineragenical and Mineralogical and Petrological Laboratories

Research area

Minerageny, mineralogy, petrography

Laboratory equipment

- Geological and outline maps
- Computer hardware and software
- Paper demonstration materials
- Olympus BX51 polarized-light microscopes
- Polam P 312 ore microscopes
- Binoculars MBS 9;
- JEOL 6380 LV microprobe analyzer with INCA 250 energy dispersive analysis system
- S8 Tiger X-ray diffractometer (Bruker AXS GmbH, Germany)

Major projects

- Ministry of Education and Science of the Russian Federation, roadmap “Magmatism and ore-forming systems of non-ferrous and precious metals, their place in the theory of general evolution of the Precambrian lithosphere in Central Russia (assessing the resources and exploration prospects)”
- Ministry of Education and Science of the Russian Federation, Federal target programme “Academic and Teaching Staff...” 1.1 Federal target programme for the Centre for Research and Education 1.1 No. 14.V37.21.0585 “New criteria for blue earth localisation and the forecast for their localisation in the Russian territory of the East European Platform”
- Ministry of Education and Science of the Russian Federation, Federal target programme “Academic and Teaching Staff...” 1.2.1 Federal target programme 1.2.1 No.14.V37.21.1253 “Geology and petrology of sulphide-platinoid-nickel-copper ore-forming systems in the Voronezh region, their place in the theory of general evolution of the Precambrian lithosphere in Central Russia (assessing the resources and prospects for creating Central European base for mining strategically important metals)”
- Ministry of Education and Science of the Russian Federation, Federal target programme “Academic and Teaching Staff...” 1.3.2 Federal target programme 1.3.2 No.14.740.11.1273 “Assessing and forecasting non-ferrous and precious metals in the Lgovsky-Rakityansky greenstone belt (Central Russia, the Kursk Magnetic Anomaly)”
- Grant of the Russian Foundation for Basic Research No. 11-05-00316-a “Gold and platinum black-shale stratified Precambrian depositional sequences in



the Central Russia (types, composition, genesis, resources, forecasting and integrated development techniques)”

Available research methods

- Historical geology methods of mineragenetic analysis and mapping, including determining tectonomagmatic cycles of each orogen and/or platform, determining the paragenetic relationships of ores and structural and compositional complexes of tectonomagmatic cycles, and separation of mineragenetic provinces and belts, and mineragenetic zones within them. Mineragenetic zones are basic small-scale spatial taxons with each tectonomagmatic cycle having its own mineragenetic zone.
- Optical diagnostics of minerals under the microscope in transmitted and reflected light
- Mineralogical analysis of rocks and ores
- Radiographical analysis
- X-ray fluorescence analysis
- Electron microprobe analysis with scanning electron microscopy

Challenges

- Mineragenetic assessment of geological features
- Conducting mineralogical analysis of black sand and crushed samples
- Determining mineral composition of rocks and ores
- Petrographic description of rocks

Contacts

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Mining and Petrological Laboratory Sample Preparation and Substance Analysis Laboratory



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Research area

Mineralogy, petrography, petrology, geochemistry, minerageny

Laboratory equipment

- Computer hardware and software
- Polam P 311 polarized-light microscopes
- Polam P 312 ore microscopes
- Roll-jaw crusher
- LDI 65 grinder
- Draft chamber
- Johnson riffles
- Sochnev magnet
- Automated line for production of thin and polished rock sections (including diamond saws and buffing and grinding wheels)

Available research methods

- Optical diagnostics of minerals under the microscope in transmitted and reflected light
- Electron microprobe analysis with scanning electron microscopy
- Mineralogical analysis of rocks and ores
- Radiographical analysis
- X-ray fluorescence analysis
- Electron microprobe analysis with scanning electron microscopy

Challenges

- Determination of mineral composition of rocks and ores
- Petrographic description of rocks
- Preparation of samples for mineralogical analysis, analysis of the chemical composition of minerals, rocks, and ores, and rock age analysis
- Preparing thin and polished rock sections, preparations for X-ray microanalysis
- Conducting mineralogical analysis of black sand and crushed samples

Major projects

- Ministry of Education and Science of the Russian Federation, geodynamics roadmap “Magmatism and ore-forming systems of non-ferrous and precious metals, their place in the theory of general evolution of the Precambrian lithosphere in Central Russia (assessing the resources and exploration prospects)”
- Ministry of Education and Science of the Russian Federation, Federal target programme “Academic and Teaching Staff...” 1.1 Federal target programme for the Centre for Research and Education 1.1 No. 14.V37.21.0585 “New criteria for blue earth localisation and the forecast for their localisation in the Russian territory of the East European Platform”
- Ministry of Education and Science of the Russian Federation, Federal target programme “Academic and Teaching Staff...” 1.2.1 Federal target programme 1.2.1 No.14.V37.21.1253 “Geology and petrology of sulphide-platinoid-nickel-copper ore-forming systems in the Voronezh region, their place in the theory of general evolution of the Precambrian lithosphere in Central Russia (assessing the resources and prospects for creating Central European base for mining strategically important metals)”
- Ministry of Education and Science of the Russian Federation, Federal target programme “Academic and Teaching Staff...” 1.3.2 Federal target programme 1.3.2 No.14.740.11.1273 “Assessing and forecasting non-ferrous and precious metals in the Lgovsky-Rakitnyansky greenstone belt (Central Russia, the Kursk Magnetic Anomaly)”
- Grant of the Russian Foundation for Basic Research No. 11-05-00316-a “Gold and platinum black-shale stratified Precambrian depositional sequences in Central Russia (types, composition, genesis, resources, forecasting, and integrated development techniques)”

Training Laboratory of Soil Science and Soil Mechanics

Industrial partners

ООО АКМА-Universal

Research area

Soil science, soil mechanics, engineering structures, geocryology

Laboratory equipment

- Preconsolidation apparatus
- Box shear apparatus
- Consolidometers, stabilometer
- Compressor
- Apparatus for the determination of soil characteristics (PNG-1), apparatus for determining the free swell index of loamy soils (PNG)
- Balance
- Hydraulic press
- Metal sample containers
- Vasiliev's cone
- Areometer

- Pycnometer
- Soil shrinkage moulds

Available research methods

Laboratory study of soil properties, compression (simple and triaxial compression), shear

Challenges (перечень услуг)

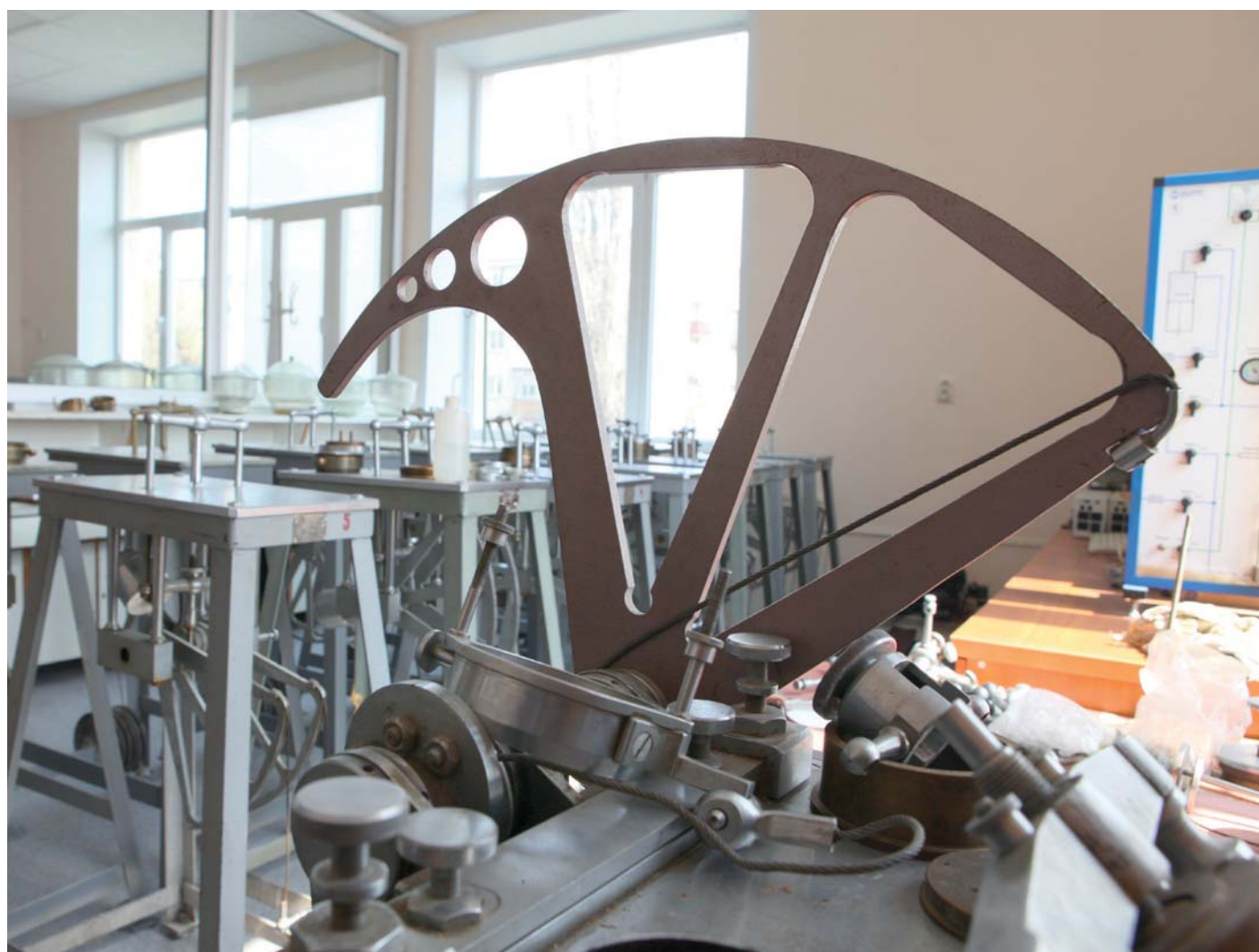
- Determination of physical properties of soils
- Determination of strength properties of soils
- Determination of stress-related properties of soils

Contacts

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Geology, Mineralogy, Geochemistry, and Minerageny of Central Russia in the Precambrian Age



Research area

Mineralogy, petrography, petrology, geochemistry, minerageny

Laboratory equipment

- Sets of geologic and outline maps
- Computer hardware and software
- Polam P 311 polarized-light microscopes
- Polam P 312 ore microscopes, MBS 9 binocular microscope
- JEOL 6380 LV microprobe analyser with a INCA 250 energy-dispersive detachable device
- S8 Tiger X-ray diffractometer (Bruker AXS GmbH, Germany).

Available research methods

- Optical diagnostics of minerals under the microscope in transmitted and reflected light
- Mineralogical analysis of rocks and ores
- Radiographical analysis
- X-ray fluorescence analysis
- Electron microprobe analysis with scanning electron microscopy
- Set of historic and geologic methods of

mineralogical analysis and minerogenic mapping, including: 1) distinguishing of tectonomagmatic cycles in a specified orogen and/or platform; 2) establishing paragenetic connections in ore formations with structural and compositional complexes of tectonomagmatic cycles; 3) isolation of mineragenetic provinces and belts and mineragenetic zones they are comprised of. Mineragenetic zones are designated as belonging to basic small-scale spatial taxon, which is individual for each tectonomagmatic cycle

Challenges

- Conducting mineralogical analysis of black sand and crushed samples, determining mineral composition of rocks and ores
- Petrographic description of rocks
- Mineragenetic assessment of geological features

Major projects:

- Ministry of Education and Science of the Russian Federation, geodynamics roadmap “Magmatism and ore-forming systems of non-ferrous and precious metals, their place in the theory of general evolution of the Precambrian lithosphere in Central

- Russia (assessing the resources and exploration prospects)”
- Ministry of Education and Science of the Russian Federation, Federal target programme “Academic and Teaching Staff...” 1.1 Federal target programme for the Centre for Research and Education 1.1 No. 14.V37.21.0585 “New criteria for localisation of diamond-bearing kimberlites and the forecast for their localisation in the Russian territory of the East European Platform”
 - Ministry of Education and Science of the Russian Federation, Federal target programme “Academic and Teaching Staff...” 1.2.1 Federal target programme 1.2.1 No.14.V37.21.1253 “Geology and petrology of sulphide-platinoid-nickel-copper ore-forming systems in the Voronezh region, their place in the theory of general evolution of the Precambrian lithosphere in Central Russia (assessing the resources and prospects for creating Central European base for mining strategically important metals)”
 - Ministry of Education and Science of the Russian Federation, Federal target programme “Academic and Teaching Staff...” 1.3.2 Federal target programme 1.3.2 No.14.740.11.1273 “Assessing and forecasting non-ferrous and precious metals in the Lgovsky-Rakitnyansky greenstone belt (Central Russia, the Kursk Magnetic Anomaly)”
 - Grant of the Russian Foundation for Basic Research No. 11-05-00316-a “Gold and platinum black-shale stratified Precambrian depositional sequences in Central Russia (types, composition, genesis, resources, forecasting, and integrated development techniques)”

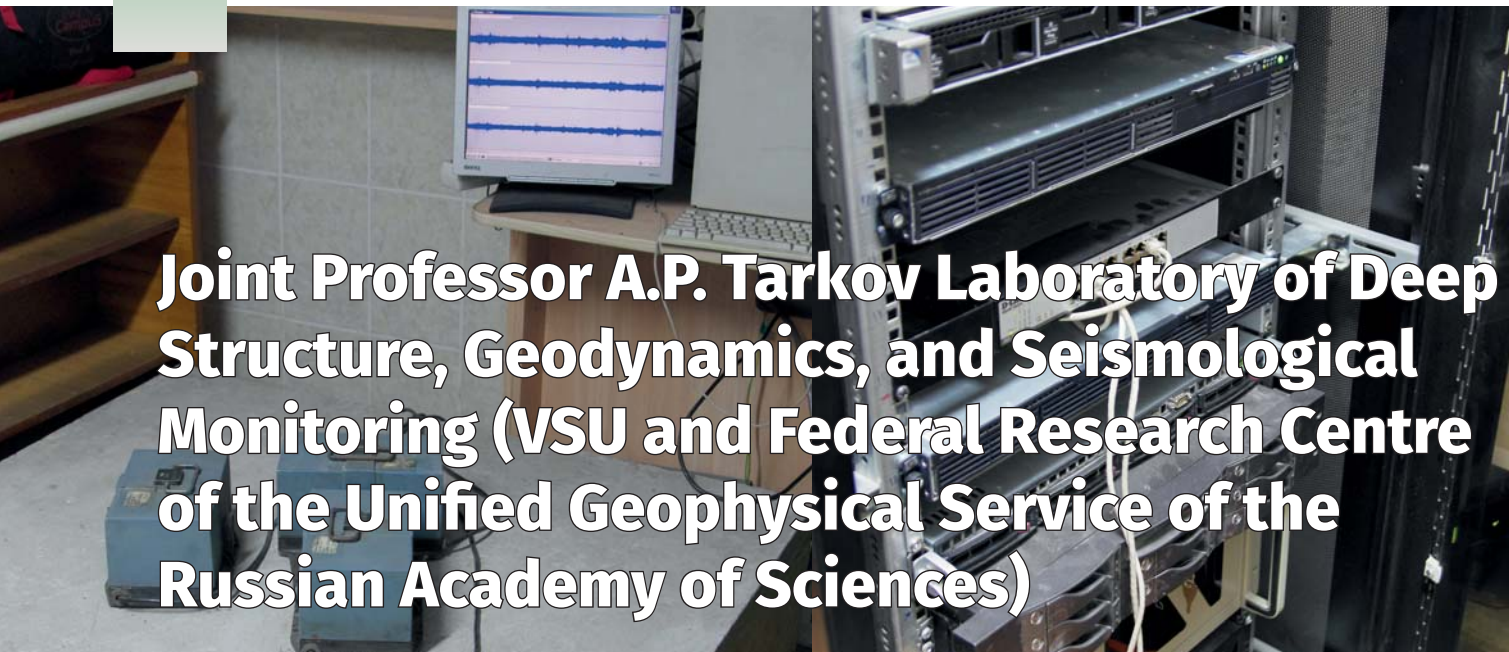
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Joint Professor A.P. Tarkov Laboratory of Deep Structure, Geodynamics, and Seismological Monitoring (VSU and Federal Research Centre of the Unified Geophysical Service of the Russian Academy of Sciences)

Industrial partners

- Nuclear power plants

Research area

- Seismology, seismic safety, microseismology

Laboratory equipment

- 16 seismic stations
- Recorders
- Seismometer
- 2 local servers

Available research methods

- Registration of the seismic wavefield by 16 seismic stations, five of which belong to the Federal seismic observation network in Russia
- Special methods for processing and interpretation of the wavefield
- Detection of far, regional, and local earthquakes, microearthquakes, and explosions by means of modern software
- Statistic and spectral correlation methods of processing microseismic field

Challenges

- Theoretical investigation aimed at studying nonlinear properties of geological environment, cause and effect relationships between physical-geological irregularities of the lithosphere and seismic activity of platform regions today
- Investigation of Earth's global seismic activity
- Studying seismic activity in the central flat terrain of Russia (Central Black Earth economic region and neighbouring territories)
- Assessment of the seismic and tectonic setting in

the territories with nuclear power stations (Kursk, Novovoronezh, etc.).

- Seismic microzoning of urban agglomerations, sites of high environmental sensitivity, planned or existing regions of mineral extraction
- Studying the vibration modes of the geological environment at construction sites of residential and other buildings
- Evaluation of the vibration mode of buildings and facilities, the influence of industrial explosions on building and facility sustainability

Major projects

- “Studying the nonlinear properties of the platform lithosphere based on the analysis of the microseismic field and effect of impulse actions on the geological environment (based on the example of the Voronezh crystalline massif) (2009–2011)
- “Studying lithospheric and ionospheric relationships in the area of the Voronezh crystalline massif” (2013–2015)

Contacts

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Laboratory of Ecological Geology



Contacts

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Industrial partners:

- Department of Natural Resources and Ecology of specific regions of the Russian Federation
- OOO EKO SPETS STROI (Voronezh)
- ZAO Krasnoye znamya (Voronezh)
- OOO ProektGenStroi (Voronezh)
- OOO ARST (Moscow)

Research area:

- Engineering site investigations for construction
- Ecological and geological research of technology-intensive territories
- Ecological modelling and environmental design

Available research methods

- Spectrometric (photometric) method
- Titration-based method
- Potentiometric method

Challenges

- Analytical investigation of soils, terrains, and subterranean waters
- Ecological and geological mapping
- Forecasting effects of specified features on environmental components
- Monitoring environmental components
- Ecological modelling
- Environmental design
- Innovation technologies in environmental education

Laboratory equipment

- SHVk 1200 draft chamber
- SESH 3M dewatering box
- AE 14-“YA-FP” water distilling apparatus
- I 130 laboratory ionomer
- ANION 7000 portable pH meter
- KFK 2-UHL 4.2 photoelectric concentration colorimeter
- Visicolor ECO, HE test-kits
- ADAM HCB 123 laboratory balance
- Electronic Balance HX3001-T
- RKS107 dosimeter-radiometer
- PGA 1 gas analyser
- Testo 816-1 digital sound level meter

Major projects

- Monitoring ground water contamination with petroleum on the premises of a large oil tank farm in Voronezh
- Estimation of flooding areas in the Voronezh region
- Geotechnical exploring for construction in the Voronezh region and neighbouring regions
- Monitoring of exogenetic processes in the Lipetsk region
- Ecological hydrogeochemical monitoring of underground waters in specified districts of the Voronezh, Moscow, Belgorod, Kaliningrad, and Tver regions
- Development of the system of specially protected territories

Academic Manufacturing Centre “Geology”



Research area

Deep structure of the Earth's crust, geodynamics, magma generation and deposit generation, and accumulation conditions in the Precambrian in platform sedimentary basins and fold belts

Laboratory equipment

- Altami CM0745 Greenough-type stereo microscope providing three-dimensional picture in reflected light
- BiOptic BPR-100-series polarised-light microscope

Available research methods

Mineralogical and petrological methods

Challenges

- Conducting basic research in geology
- Carrying out applied works based on the results of the basic research
- Mineralogical and petrological analysis of rocks

Major projects

1. Studying the deep structure and evolution of the crystalline basement and the sedimentary cover of

- the lithosphere in the Voronezh crystalline core-area by means of comprehensive modelling
2. Studying the evolution of the sedimentary cover and titan-zirconium placer formation in the Voronezh anticline by means of paleogeographic and lithologic-and-facies modelling
3. Development of innovative principles for assessing the resource potential of the Voronezh anticline
4. Studying structural, lithologic, and mineralogical criteria of enhancing resources potential and investment attractiveness of titan-zirconium placers of the Voronezh anticline
5. Studying the lithology and material composition of titanium-zirconium sands to enhance complex extraction of major and minor components at the Eastern area of the Central Field

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Electrical Exploration Laboratory

Industrial partners

- OAO Geotechnologia
- OOO AKMA-Universal

Research area

Geophysics and geophysical methods in mineral deposit exploration

Laboratory equipment

- Tanks for physical modelling of electro exploring tasks – 3
- Electrical exploration equipment – 6 sets
- Computers

Challenges

- Conducting field observations
- Interpretation of geoelectrophysical research materials

Available research methods

- Geoelectrical research by resistance and provoked polarisation technique
- Analogue modelling of electro exploring tasks in complex environments

Major projects

Nickel and gold deposit exploration in Primorye, the Kamchatka, and Northern Urals

Contacts

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Engineering Centre “I-TECHNOLOGY”

Industrial partners

- ООО TSKIG “TSITRIN”
- ООО Gidrosfera
- АО Primorzoloto

Research area

Processing technology for enriched tailings of common mineral resources

Laboratory equipment

- Spiral separators
- Magnetic separators
- Concentrating tables
- Shaker screen

Available research methods

- Mineralogical analysis
- Granulometric analysis
- Petrological analysis

Challenges

- Studying mineral raw materials for cost-efficiency of their processing
- Development of technological flows for processing of minerals

Major projects

“Studying the lithology and material composition of titanium-zirconium sands to enhance complex extraction of major and minor components at the Eastern area of the Central Field” (2012–2014)

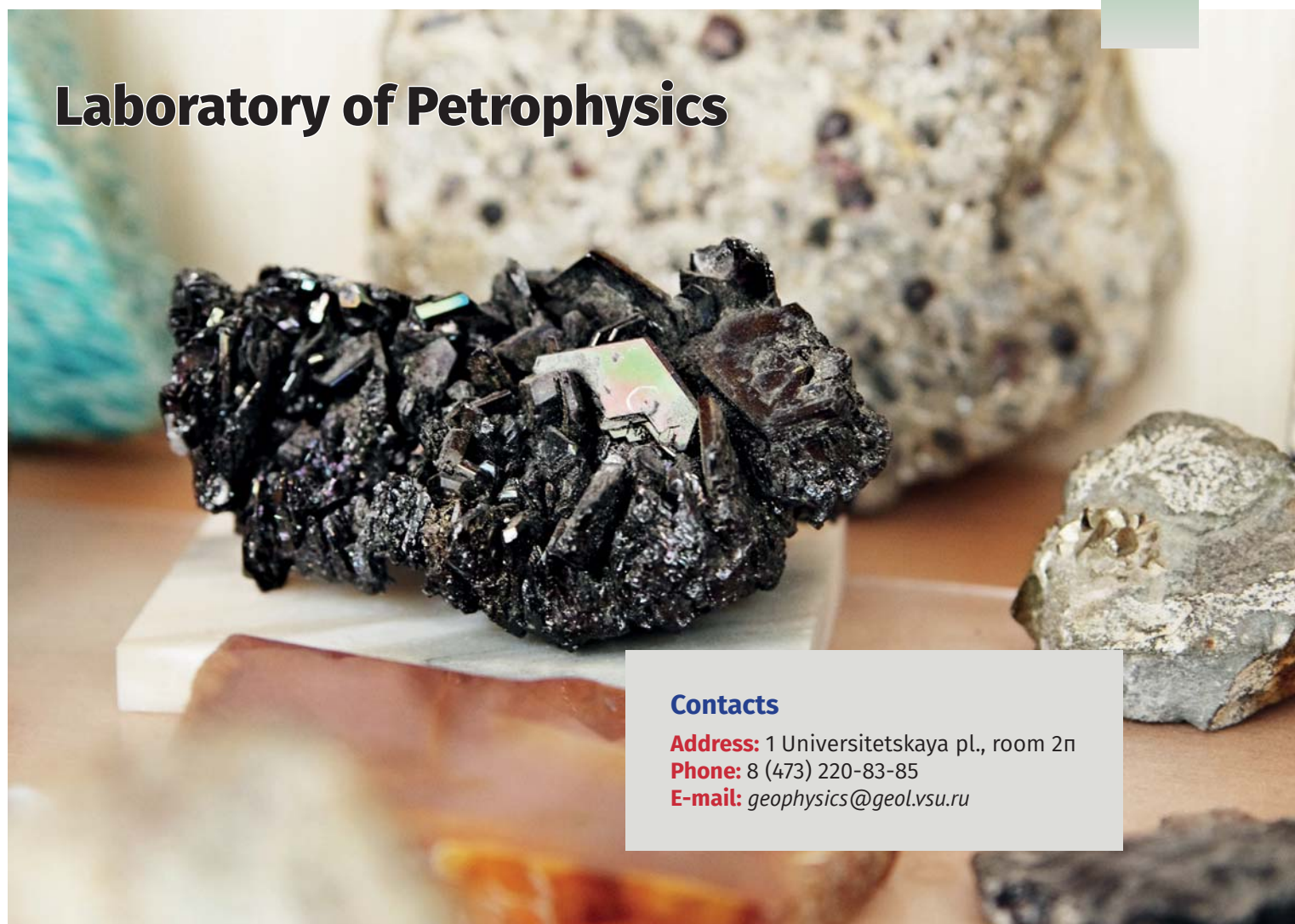
Contacts

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Laboratory of Petrophysics



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Industrial partners

- AO OT-OIL
- OOO AKMA-Universal

Research area

Geophysical research of the Earth's crust and mineral deposit exploration

Laboratory equipment

- Measuring devices for magnetic properties of rocks and ores
- Densitometer
- Seismic-wave velocity meter
- Measuring device for electrical properties of rocks
- Computers with a multimedia system

Major projects

Studying physical properties of sedimentary and crystalline rocks in Primorye, the Kamchatka, Northern Urals, and Central districts of the Russian Federation

Available research methods

Petrophysical investigations of specimens of rocks and ores

Challenges

- Conducting field observations
- Interpretation of geophysical research materials



Laboratory of Ecological Monitoring



Contacts

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Industrial partners

- Branch of the Federal State Budgetary Institution “Centre of Laboratory Analysis and Engineering Measurements in the Central Federal District” of the Voronezh region
- OOO Voronezhvtorma

Research area

Ecological monitoring of the environment situation

Laboratory equipment

- Ohaus Pioneer 214 C analytical balance
- Ohaus Pioneer 114 C counter balance
- KM 2M concentrator
- EK 1 extractor
- KFK 3KM spectrophotometer
- Ta-Lab voltammetric analyser with a muffle-type furnace and “Chisto-Ta” detachable device for ozon treatment of glassware and samples
- ITAN pH meter with a set of ion selective electrodes

Available research methods

- Spectrophotometric and photocolometric research methods
- Voltammetric method of analysis
- Potentiometric and ionometric methods of analysis

Challenges

- Assessment of the environmental condition of natural surface and subterranean waters, analysis of the waste water composition, including identification of oil, petroleum, fat, synthetic surfactant, and heavy metal pollution
- Specification of the chemical composition of air
- Assessment of the environmental condition of soil, including identification of oil, petroleum, and heavy metal pollution
- Specification of the chemical composition of plants

Major projects

- Conducting research in the area of landscape and environmental assessment in the area of Yelan-Koleno copper-nickel deposits
- Conducting works in the area of the irrigation systems engineering in the Buturlinovka, Vorobiovka, Novokhoper, Talovoye districts of the Voronezh region

Laboratory of Molecular Genetics

Research area

- Studying human, animal, plant, and microorganism gene expression under various conditions and physicochemical factor exposure
- Taxonomic identification of organisms of different systematic groups
- Development of molecular genetic methods for fast identification of species of organisms relevant for humans
- Assessment of genotoxicity of various factors for an organism

Laboratory equipment

- CFX96 96-channel real-time amplifier
- Z 36 NK versatile centrifuge
- MDF-U3386S freezer –86 S, 333 L.
- CFX96 touch 96-channel real-time amplifier
- Hitachi High-Technologies F 7000 spectrofluorimeter

Available research methods

- PCR
- Real-time PCR

Challenges

- Studying gene expression
- Development of methods for identification of organisms belonging to different taxonomic groups
- Assessment of genotoxicity of various factors

Major projects

- Russian Science Foundation grant No. 18-76-00027 “Development of new approaches to evaluate the toxicity of pesticides for insect-pollinators”
- Federal target programme No. 14.577.21.0257 “Development of biomolecular methods for quality control of milk and fat-and-oil productions by means of high-performance DNA analysis”
- Russian Science Foundation grant No. 6-14-00176 “Studying and genetic certification of agriculturally significant insects and mites, followed by the genomic selection of pollinating insects and entomophages”

Contacts

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Radio Studio

Research area

Analysis and creation of modern audio content

Laboratory equipment

- Behringer XENYX X 1832 mixer
- ABK PA 3002 amplifier
- B 1 studio microphones (2)
- M-Audio BX5 studio monitor speakers (2)
- Wall mount microphone stands (2)
- Zoom H 2 handy recorder
- Zoom H 4 handy recorder
- Shure SM 58 microphone
- Beyerdynamic microphone

Available research methods

Classification of contemporary radio genres

Challenges

- Providing facilities for innovative educational and research projects implemented within the education programme “Journalism”
- Creating radio content

- Studying the functioning of electronic media, as well as the demands of the youth market
- Studying social and cultural tendencies in information consumption

Major projects

- Image-building videos and shows about the Faculty of Journalism
- A podcast “Obschestvennaya Myata” (Public Mint), run jointly with the Child and Family Protection Centre
- A public transport audio guide “The city’s history in the names of streets and bus stops” (run jointly with the Faculty of Philosophy and Psychology of VSU)
- Literary audio sketches (jointly with the bookshop “Amital”)

Contacts

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Educational Television Laboratory

Research area

Analysis and creation of modern video content

Laboratory equipment

- Mobile television studio
- Non-linear editing systems
- Audio mixing console
- Wireless microphones
- Video cameras
- Studio lighting equipment

Challenges

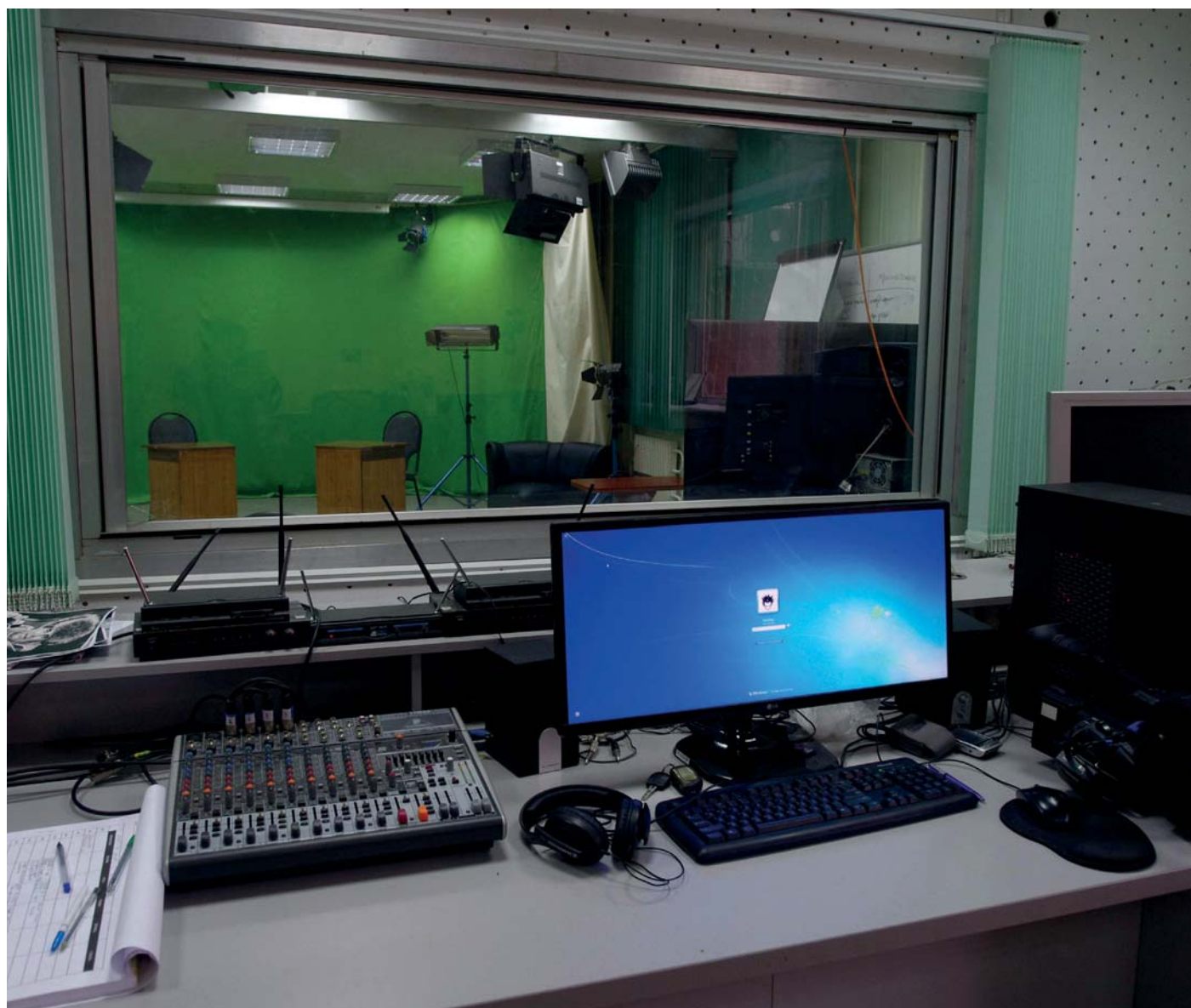
- Creating video content
- Studying the functioning of electronic media, as well as the demands of the youth market

Contacts

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Laboratory of Practical Psychology



Industrial partners

- Ministry of Emergency Situations of the Voronezh Region
- Ministry of Internal Affairs of the Voronezh Region
- State Health Care Institution of the Voronezh Region Voronezh Region Clinical Neuropsychology Centre
- State Health Care Institution of the Voronezh Region Voronezh Region Clinical Neuropsychology Centre
- Novolipetsk Steel (NLMK Group)

Research area

- Psychodiagnostics
- Professional counselling
- Psychological education

Laboratory equipment

- Hardware and software system for psychodiagnostics "Multipsychometre"
- Computer system "Psychometric Expert"
- Diana 04 professional computerized polygraph
- Hardware-software system CONAN pg 4; a 4-channel polygraph
- Psychoemotional correction system (APEK)
- Psychophysiological testing device UPFT 1/30 «Psychophysiologicalist»

Available research methods

- Paper-and-pencil and apparatus-based methods of psychodiagnostics

- Computerized psychodiagnostics
- Polygraph and psychophysiological methods of personality research
- Training programmes

Challenges

- Psychological testing of company employees and government agency staff
- Psychological testing of job applicants
- Preventing psychological problems and encouraging self-development and personal growth of individuals and groups

Major projects

- Conflict management programme for OAO Minudobrenia (Rossosh)
- Project "Development of the communication skills and competencies of top managers" (for heads of local administrations)
- Training programmes "Stress management" and "Leadership and confident behaviour" for mid-level managers of NLMK Group
- Project "Top-manager's professional growth" (for top-managers and personnel reserve of Oskoltsement)

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Professor L.T. Gilyarovskaya Laboratory



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Industrial partners

- Voronezh division of KPMG
- Voronezh division of PwC

Research area

Enhancement of scientific tools for accounting, analytical, and control methods of supporting sustainable development of economic entities

Laboratory equipment

- 16 computer systems equipped with the tools and software for collaborative work, as well as an Internet connection
- MS SQL 2012 database management system
- Electronic document flow system DocsVision

Available research methods

- Analysis and synthesis; systematisation and integration; concretization and abstraction
- Historical and logical approach to argumentation and proof of new theoretical concepts
- Accumulation of data and formation of the information database
- Economic and mathematical methods of economic analysis
- Testing the obtained results as applied to the research subjects

Challenges

- Organising lectures, workshops, course projects, group and individual consultations for students, midterm and final assessment

- Providing adequate facilities and methodological support for bachelor's degree, diploma degree, and master's degree programmes in accounting and economic analysis
- Developing specific professional skills in students (the ability to operate IT databases, telecommunication equipment, and software used by modern economic entities; accounting for expendables and organising the work of technical support centres in accordance with the requirements of the customers; learning the way interactions are organised within the economic entity)
- Organising ACCA examination "upon request", i.e. any day and any time within the working hours of the examination centre

Major projects

- Assessing the economic rationale behind the discount system of OOO Baltika Brewery (November 2016 - April 2017)
- Enhancing the system of performance evaluation of activities by state and municipal institutions in the Voronezh Region (September - October 2017)
- Project "Analysing the export potential of the Russian agricultural products, food, and drinks at the food markets of North Africa, the Middle East, and East Asia" implemented jointly with AO KPMG (November 2017 - March 2018)
- Assessing the economic rationale behind the discount system of OOO Baltika Brewery (November 2017 - June 2018)



Research Laboratory named after the Honorary Doctor of Voronezh State University, Professor Michael A. Popp

Industrial partners

Bionorica SE - a pharmaceutical plant in the Maslovsky industrial park

Research area

Analysis of biologically active substances in plants, pharmaceutical substances, and medicinal products

Laboratory equipment

- Agilent 7100A capillary electrophoresis system
- Micromed 3 Lum LED trinocular microscope
- Densitometer Sorbfil

Available research methods

- Capillary electrophoresis
- Microscopic analysis (transmitted-light microscopy, LED microscopy)
- TLC-densitometry method for quantitative analysis of chemical compounds

Challenges

- Studying microbiologic, plant, and other objects using transmitted-light microscopy and LED microscopy
- Monitoring the quality, identification and safety of natural raw materials, synthetic products, active pharmaceutical ingredients, auxiliary substances, and medicinal products
- Calculating the parameters and the quantitative assessment of the results of the analysis of TLC in visible and ultraviolet regions of the spectrum

Contacts:

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Artificial Intelligence Laboratory

Industrial partners

PAO Sberbank

Research area

- IT
- Machine learning
- Big data

Laboratory equipment

- High-end desktop PCs
- Hardware and software systems

Challenges

- Natural language processing (contact routing and chatbots, detailed monitoring of news, topic modelling, analysis of customer reviews, named entity recognition)
- Designing computer vision systems (analysis of the video stream data, detecting objects in a video, semantic segmentation, quantitative metallography)
- Designing speech recognition and generation systems (providing solutions to identification and diarization problems based on sonogram analysis and voice biometrics)

- Designing recommender systems and decision support systems (collaborative filtering, content-based filtering, recommendations based on the information about the product, and recommendations based on knowledge in a specific area)

Available research methods

Machine learning methods and intellectual data analysis methods, including:

- intelligent medical diagnostics methods and algorithms for developing dialogue systems and chatbots
- recommender systems development methods
- natural language processing methods
- computer vision algorithms (including detections and segmentation of objects in a video)
- banking automation methods

Major projects

Strategic laboratory of the research and education centre in the Voronezh Region

Contacts

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Machine Learning and Data Analysis Laboratory

Contacts

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E-mail: dean@amm.vsu.ru

Industrial partners

- NLMK
- Severstal
- Surf
- Sberbank

Research area

Machine learning and artificial intelligence

Available research methods

Machine learning methods and intellectual data analysis methods, including:

- intelligent medical diagnostics methods and algorithms for developing dialogue systems and chatbots
- recommender systems development methods
- natural language processing methods
- computer vision algorithms (including detections and segmentation of objects in a video)
- banking automation methods

Challenges

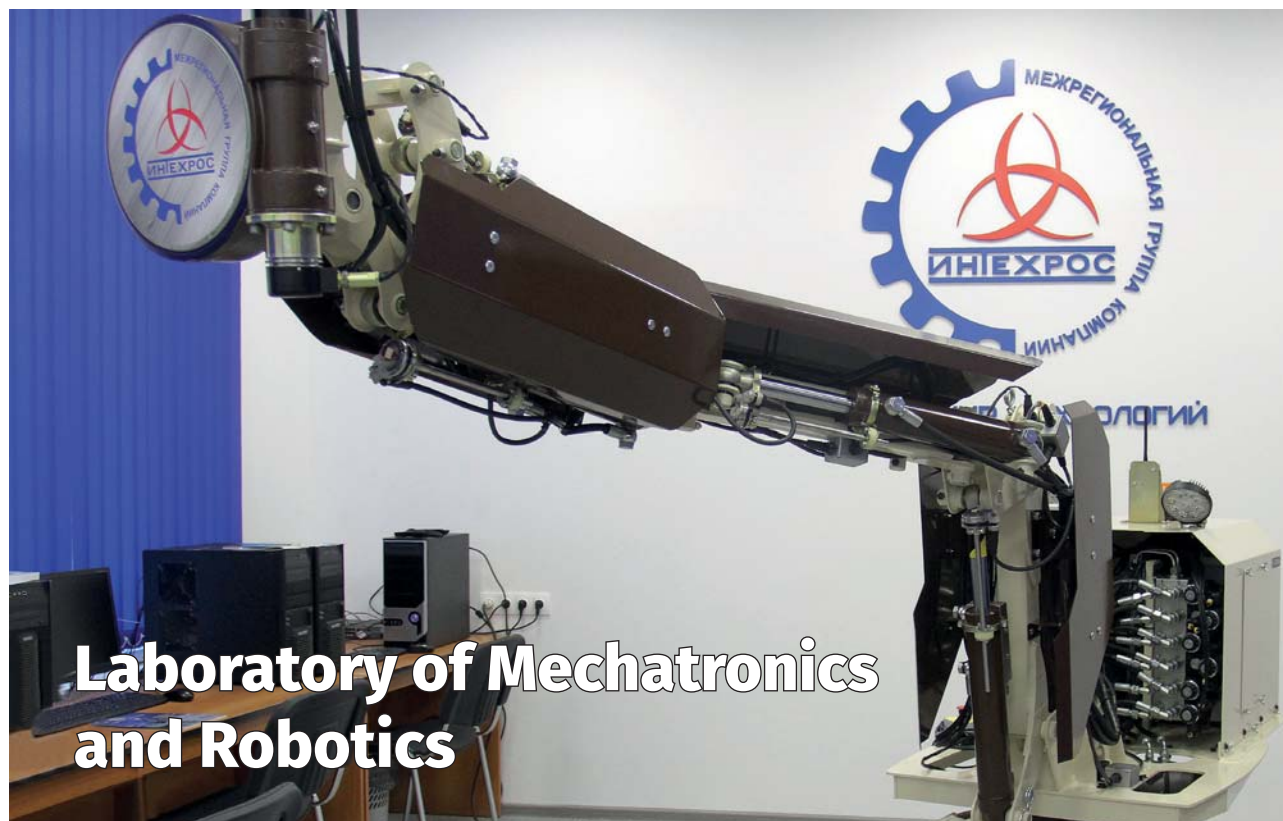
- Advanced training in the following areas: “Machine learning”, “Neural network technologies”, “Artificial intelligence technologies”, “Computer vision”, “Natural language processing”, “Machine learning as the basis of the digital economy”
- Implementing research projects which involve computer vision, natural language processing, developing systems for medical diagnostics, automated analysis of customers reviews, receipt and label recognition, voice-activated chatbots, etc.

Оборудование

- 1615699 Cougar TURRET Tamped Glass ATX Computer Case, black [440787] (without power supply)
- 1583666 Cougar GX 1050 power supply
- GX 1050 power supply (modular, 6 PCIe slots, ATX v2.31, 1050W, Active PFC, 140mm Fan, 80 Plus Gold) [GX1050] Retail 1
- 1490154 CPU Intel Core i9-7920X Skylake Extreme Edition Processor OEM {2.90GHz, 16.5MB, Socket 2066}
- 1495048 Cooler Arctic Cooling Freezer 33 TR — RED2066, 2011-v3 (SQUARE ILM), AM4, TR4 RET (ACFRE00038A)
- 1538371 MSI X299 TOMAHAWK RTL motherboard
- Eight 1477524 Kingston DDR4 DIMM 16GB HX426C16FR/16 desktop memory modules {PC4-21300, 2666MHz, CL16}
- 621457 PALIT GeForce RTX2080Ti Gaming Pro OC11G RTX2080Ti video card 11264Mb 352b GDDR6 1650/14000/HDM RTL

Major projects

- Automatic classification of customer support tickets
- Development of non-invasive techniques of early diagnostics of atherosclerosis in magistral arteries (for the cardiology health centre of the Voronezh Region Clinical Hospital No. 1)
- Forecasting the risks of recrudescence of cardiovascular and oncology diseases (for the Voronezh Region Clinical Hospital No. 1 and the Voronezh Region Clinical Oncology Hospital)
- Development of algorithms and models of machine learning for the automated metallographic identification of the size of steel grain (for NLMK)
- Development of algorithms and models for forecasting the effectiveness of crowdfunding projects (for Boomstarter platform)



Industrial partners

Engineering group INTECHROS

Research area

Designing control systems for small UAV, robot manipulators and similar robotic systems

Laboratory equipment

- Hercules Strong 3D printer
- MakeBlock robotic kits
- Debug modules with 8-bit and 12-bit microcontrollers
- DJI Inspire drone
- Computer vision system PIXY2
- ROIN 200-04 material handling equipment

Available research methods

- Classic methods of the control theory
- Methods based on machine learning algorithms

Challenges

- Implementation of education programmes at the Faculty of Applied Mathematics, Informatics, and Mechanics, namely “Applied Mathematics and Informatics” and “Mechanics and Mathematical Modelling”
- Designing simulators of robotic systems

Major projects

A simulator of a robotic mobile system for the company INTECHROS

VSU’s students now have an opportunity to work with the robotic tool ROIN whose functions are identical to those of the robotic tools designed for the atomic, steel, construction, railway industries, etc. The only difference of the laboratory tool from its industrial counterpart is the speed limit set by the developers for safety reasons.

The robot manipulator arm designed for VSU has 7 degrees of freedom and an infinite 360-degree rotation mechanism on the end joint. The rotation mechanism can be equipped with various grippers and electric tools. Despite being quite small, ROIN has the maximum load capacity of 150 kg.

Contacts

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Laboratory of Mathematical Hydrodynamics of the Research Institute for Mathematics

Research area

Studying the problems of mathematical hydrodynamics

Laboratory equipment

- Sentinel V50 (500kHz) acoustic Doppler current profiler used to measure water current velocities over a range of depths
- Immersion autonomous high performance temperature sensors RBR soloT (12)
- Immersion autonomous high performance temperature sensors RBR soloT (3)
- Autonomous inertialess water temperature sensors RBR Duo (2)
- Thermistor strings (2)

Available research methods

- Modern functional analysis methods
- Topological approximation approach to studying the problems of mathematical hydrodynamics
- Experimental and numerical methods

Challenges

Current problems of mathematical hydrodynamics

Major projects

Grants of the Government of the Russian Federation for the state support of research conducted by the leading scientists in universities, research institutions, and state research centres of the Russian Federation (contract No. 14.Z50.31.0037 of 09.02.2017)

Contacts

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VSU Centre for the Collective Use of Scientific Equipment



The centre is comprised of 5 laboratories

- Structural Study Laboratory
- Molecular Biology Laboratory
- Nanoscopy and Nanotechnology Laboratory
- Electron Microscopy Laboratory
- Physicochemical Research Methods Laboratory

Industrial partners

- OAO NII PM (Voronezh)
- AO RIF (Voronezh)
- OOO ISOMETRICA
- OOO TIGI Cramer
- OOO Suvorovskoye Rudoupravleniye
- AO VZPP-S

Collaboration with the leading Russian research centres:

- Joint Institute for Nuclear Research (Laboratory of Nuclear Physics) (Dubna)
- A.A. Baikov Institute of Metallurgy and Material Science of the Russian Academy of Sciences (IMET RAS)
- Lomonosov Moscow State University
- A.A. Maximov Space Systems Research and Development Institute of the Khrunichev Space Center

- B.P. Konstantinov St.Petersburg Nuclear Physics Institute
- OAO Chemical Automatics Design Bureau
- OAO Concern Rosenergoatom
- Novovoronezh nuclear power station

Collaboration with the leading international research centres:

- BESSY II at Helmholtz Zentrum Berlin (Germany)
- Synchrotron Radiation Center Alladin (USA)
- International Centre for Diffraction Data JCDD (USA)
- National technical university Kharkov Polytechnical Institute (Ukraine)

Research area

- Nanosystem industry
- Bioscience
- Natural resource management
- Transport and space systems
- Energy efficiency, energy conservation, and nuclear energy



The centre's equipment

- Thermo ARL X'TRA powder X-ray diffraction system (Thermo Fisher Scientifics, Switzerland)
- Vertex 70 series FT-IR spectrometer (Bruker Optik GmbH, Germany)
- MPA series FT-IR spectrometer (Bruker Optik GmbH, Germany)
- Lambda 650 spectrometer with a URA module (Perkin Elmer, USA)
- Shimadzu UV-2550 spectrophotometer (Shimadzu Scientific Instruments, Japan)
- JSM-6380LV Series Electron Microscope (JEOL Ltd., Japan)
- JSM-6510LV Series Electron Microscope (JEOL Ltd., Japan)
- INCA Energy 250 microanalysis system (Oxford Instruments, UK)
- SOLVER P47 scanning probe microscope (NT-MDT, Russia)
- Renom-01 X-Ray spectrometer (ZAO NTTs Expertcentre, Russia)
- Fluke 5520A multifunction calibrator (Fluke, USA)
- Fluke 8508A/01 multifunction measurement instrument (Fluke, USA)
- Zeiss LIBRA 120 transmission electron microscope (Carl Zeiss, Germany)
- PANalytical Empyrean X-ray diffractometer (PANalytica, Netherlands)
- BrukerS8 Tiger X-ray diffractometer (Bruker, Germany)
- QUANT-Z-ETA-1 atomic absorption spectrometer (OOO Kortek, Russia)
- Agilent 6230 accurate-mass time-of-flight (TOF) LC/MS system (Agilent Technologies, USA)
- IonPersonal Genome Machine (DNA sequencing system) (Ion Torren, USA)

VSU Centre for the Collective Use of Scientific Equipment

- U-2900 double beam spectrophotometer (Hitachi, Japan)
- Chromo4 real-time PCR detection system (BioRad, USA)
- Amersham Imager 600 Western Blotting complex (GE Healthcare, USA)
- Agilent 7890B/5977A gas chromatograph (Agilent Technologies, USA)
- Bruker X-flash energy dispersive system (Bruker, Germany)
- Akta start GE chromatography system (Healthcare, Switzerland)
- Nikon ECLIPSE Ni-E/Ni-U optical microscope (Nikon, Japan)
- SONICATOR Q500 ultrasonic dispergator (QSONICA, USA)
- Zetasizer Nano ZSP (Malvern, UK)
- IKA RV-10 rotary evaporator (IKA, Germany)
- Guava easyCyte 8 HT benchtop flow cytometer (EMD Millipore, France)
- Akta Pure 150L chromatography system (GE Healthcare, Sweden-UK)
- PT-PC 75840 RMC-Boeckeler rotary ultramicrotome (RMC-Boeckeler, USA)
- Plazma 50-SE for ultrathin coating (NIIPM, Russia)
- Q150R S/E/ES sample preparation system (Quorum Technologies, UK)

Available research methods

- Determining the phase compositions of powders and thin films by means of X-ray diffractometry
- Determining temperature limits for the thermal phase transitions (25-1100°C) of powder and thin-film samples by means of X-ray diffractometry
- Determining the qualitative and semiquantitative elemental composition of powders and thin-film samples of the elements with the molar mass 40 g/mol by means of X-ray luminescence method
- Calculating and modelling of the crystal lattice of an unknown powder or thin film by means of X-ray diffractometry
- Determining the degree of texture of thin-film materials by means of X-ray diffractometry
- Determining the average grain size of polycrystalline alloys by means of X-ray diffractometry
- Studying thin-film materials and determining their interplanar distances by means of X-ray diffractometry
- Studying thin-film materials by means of transmission electron microscopy
- Studying thin-film and bulk materials, determining the phase composition, and orientation of crystallites in the reflection setup by means of the electron graphical method
- Determining the thickness of films and separate layers of heterostructures by means of electron microscopy

- Studying the surface morphology, determining the lateral extent of the inhomogeneity layer, and height distribution by means of scanning electron microscopy
- Performing qualitative and quantitative element composition analysis of conductor materials in a high vacuum by means of energy dispersion methods
- Performing qualitative and quantitative element composition analysis of conductor materials in a high vacuum by means of energy dispersion methods
- Studying surface morphology by means of atomic force microscopy
- Studying the surface roughness and height distribution by means of atomic force microscopy
- Studying mono- and polycrystalline bulk and film samples of semiconductor and dielectric materials in order to determine the parameters of electron-photon interaction in the self-absorption, excitonic absorption, intracentre extrinsic absorption, and inter-band absorption by measuring the transmission and absorption spectra
- Studying organic and inorganic compounds, determining their concentrations and dependencies between optical properties and chemical processes taking place in these compounds by measuring the absorption spectra
- Studying mono- and polycrystalline bulk and film samples of narrow-bandgap semiconductor and dielectric materials in order to determine the parameters of electron-photon interaction in the self-absorption, excitonic absorption, intracentre extrinsic absorption, and inter-band absorption by measuring the transmission and absorption spectra
- Measuring the scattering absorption spectra of medicinal products for express quality control by means of IR-spectroscopy
- Measuring the absorption spectra of oil products for express quality control by means of IR-spectroscopy
- Measuring the scattering absorption spectra of sugar beet seeds in order to evaluate their quality by means of IR-spectroscopy
- Studying the chemical interactions within various chemical processes by measuring the transmission spectra in solid and liquid samples of organic and inorganic origin in the mid-infrared region ($4000-400\text{ cm}^{-1}$)
- Performing real-time PCR (polymerase chain reaction) detection
- Determining the elemental composition of solutions by means of atomic absorption spectroscopy
- X-ray fluorescence wavelength-dispersive qualitative and quantitative analysis of chemical elements of F-Am range and their stoichiometric compounds. The analysis can be performed in vacuum, low pressure helium (liquids and loose samples), and atmospheric pressure (volatile liquids).
- Identifying copper in rock formations and ores by means of X-ray fluorescence spectroscopy
- Identifying copper, zinc, and lead by means of X-ray fluorescence spectroscopy and internal standards





- Identifying cobalt, copper, nickel, lead, and zinc in rock formations, ores, and their by-products by means of X-ray fluorescence spectroscopy
- Identifying fluorine, sodium, magnesium, aluminium, silicon, phosphorus, potassium, calcium, scandium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, strontium, zirconium, and niobium in rock formations, ores, and their by-products by means of X-ray fluorescence spectroscopy
- Identifying foreign elements in soil, bedload sediment, and rock formations by means of X-ray fluorescence spectroscopy
- Identifying the major elements of silicate minerals, bauxites, carbonate rocks, and banded iron formations by means of X-ray fluorescence spectroscopy
- Determining the genotoxicity of various materials
- Determining the cytotoxicity of various materials
- Production of liposomes and liposome drug loading methods
- Studying thermal phase transition of solid and liquid samples in a wide temperature range
- Registering the spatial structure of various microscopic objects by means of confocal laser microscopy

- Identification, determining the structure, purity analysis (quality control), and control over the concentrations of chemical compounds (quantitative analysis) in order to develop techniques for express analysis and control

Challenges

1. Transmission electron microscopy

- Determining phase compositions of thin films
- Determining phase compositions and carrying out structural analysis of materials (thin films, nanopowders, thinned bulk material, biomaterial) as thin as 0.20 nm.
- Studying surface morphology using the replica method

2. Scanning electron microscopy

- Obtaining nanometre resolution images of conductor and nonconductor materials
- Determining the thickness of alloys and separate layers of heterostructures by means of scanning electron microscopy
- Performing element composition analysis of conductor and dielectric materials

3. Auger electron spectroscopy

- Analysis of the elemental composition of metals and semiconductors, and the distribution of impurities in depth by means of ion etching
- Studying adsorption and desorption on solid surfaces, as well as corrosion and phenomena occurring during surface heterogeneous catalysis

4. Atomic force microscopy

- Obtaining nanometre resolution images of conductor and nonconductor materials by means of atomic force microscopy at temperatures of up to 130°C
- Determining surface parameters (roughness, elevation difference, the extent of the inhomogeneity layer, analysis of the probability of distribution in height) using an atomic force microscope
- Pore size analysis
- Making tables of objects allocation and their characteristics for surfaces with discretely allocated (inhomogeneous) objects
- Determining the domain structure in magnetic and piezoelectric materials and defining the domain size

5. X-ray diffractometry

- X-ray phase analysis with automatic search of elements and existing compounds in ICDD PDF-2 databases
- Qualitative and quantitative phase analysis of alloys, powders, and crystals
- Studying the kinetics of phase transitions of alloys, powders, and crystals in vacuum with temperature changes of up to 1,000°C

- Phase analysis of thin films on substrates, with the influence of the substrate excluded
- Determining the degree of texture of thin-film materials
- Determining the average grain size of polycrystalline materials

6. Chromatography and optical research methods

- Studying the properties of new composite materials (highly ordered composites, high performance sorbents, and highly specific catalysts for materials with set properties)
- Identifying the presence of metals and metalloids in solid, liquid, and gaseous samples of various substances in medium, trace, and ultratrace levels with a sensibility of up to 10-10%
- Analysis of medicinal products and body fluids
- Identifying and confirming the structure of biomolecules and therapeutic proteins in biomarkers
- Identification, determining the structure, purity analysis (quality control), and control over the concentrations of chemical compounds (quantitative analysis) in order to develop techniques of express analysis and control
- Studying the chemical interactions within various chemical processes by measuring the transmission spectra in solid and liquid samples of organic and inorganic origin in mid-infrared region (4000-400 cm^{-1})
- Determining the parameters of electron-photon interaction in the self-absorption, excitonic absorption, intracentre extrinsic absorption, and inter-band absorption by measuring the transmission, absorption, and reflection spectra of mono- and polycrystalline bulk and film samples of narrow-bandgap semiconductor and dielectric materials
- Analysis of oxygen and carbon contents in silicon wafers
- Developing express methods of quality control of medical products when measuring the scattering absorption spectra
- Creating databases of the spectra of pharmaceuticals in the near-infrared region
- Developing express methods of quality control of motor fuels and oils when measuring the absorption spectra

- Measuring the mass fraction of aluminium, barium, beryllium, vanadium, bismuth, iron, cadmium, potassium, calcium, cobalt, silicon, lithium, magnesium, manganese, copper, molybdenum, arsenic, sodium, nickel, tin, lead, selenium, silver, strontium, antimony, thallium, tellurium, titanium, chromium, and zinc in fresh, natural, and waste water by means of atomic absorption spectroscopy

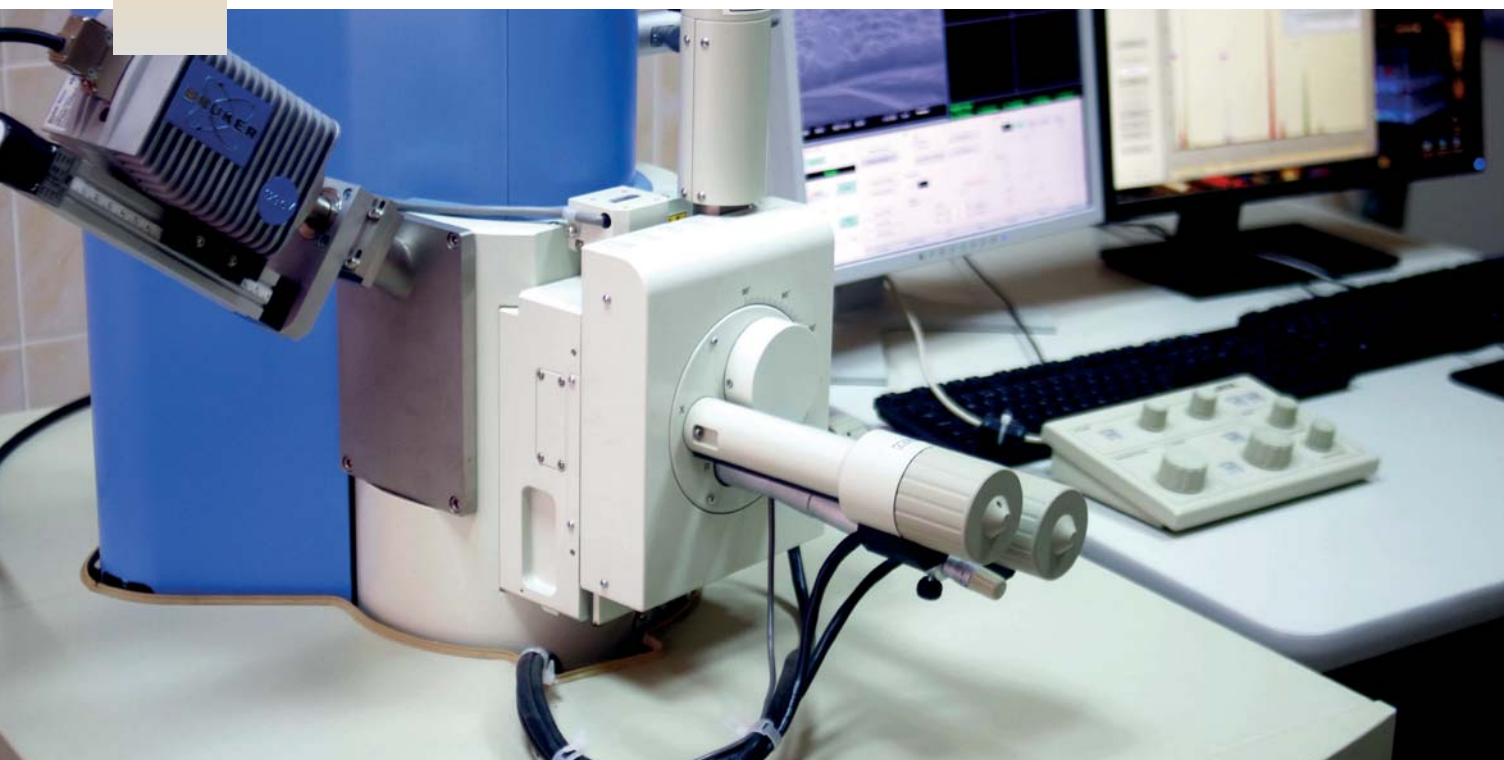
7. Molecular biology methods

- Determining the structure of molecules and their hydration properties
- Studying the heterogeneous electrochemical reactions, membrane and ion-exchange transport of physiologically active substances, water, and low molecular weight electrolytes
- Identifying and studying the level of genes expression by means of real-time quantitative PCR, northern blot, and transformation of bacteria in order to create DNA libraries

8. X-ray fluorescence spectroscopy

- X-ray fluorescence wavelength-dispersive qualitative and quantitative analysis of chemical elements of F-Am range and their stoichiometric compounds. The analysis can be performed in a vacuum, low pressure helium (liquids and loose samples), and atmospheric pressure helium (volatile liquids).
- Identifying copper in rock formations and ores by means of X-ray fluorescence spectroscopy (a certified method)





- Identifying copper, zinc, and lead by means of X-ray fluorescence spectroscopy and internal standards
- Identifying cobalt, copper, nickel, lead, and zinc in rock formations, ores, and their by-products by means of X-ray fluorescence spectroscopy (a certified method)
- Identifying fluorine, sodium, magnesium, aluminium, silicon, phosphorus, potassium, calcium, scandium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, strontium, zirconium, and niobium in rock formations, ores, and their by-products by means of X-ray fluorescence spectroscopy (a certified method)
- Identifying foreign elements in soil, bedload sediment, and rock formations by means of X-ray fluorescence spectroscopy (a certified method)
- Identifying major elements of silicate minerals, bauxites, carbonate rocks, and banded iron formations by means of X-ray fluorescence spectroscopy (a certified method)

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Major projects

Development of the Centre or Collective Use of Scientific Equipment is financed by the Ministry of Education and Science of the Russian Federation within the framework of the federal target programme «Research and Development in Top-Priority Areas of Science and Technology in Russia for 2014-2020», activity 3.1.2.

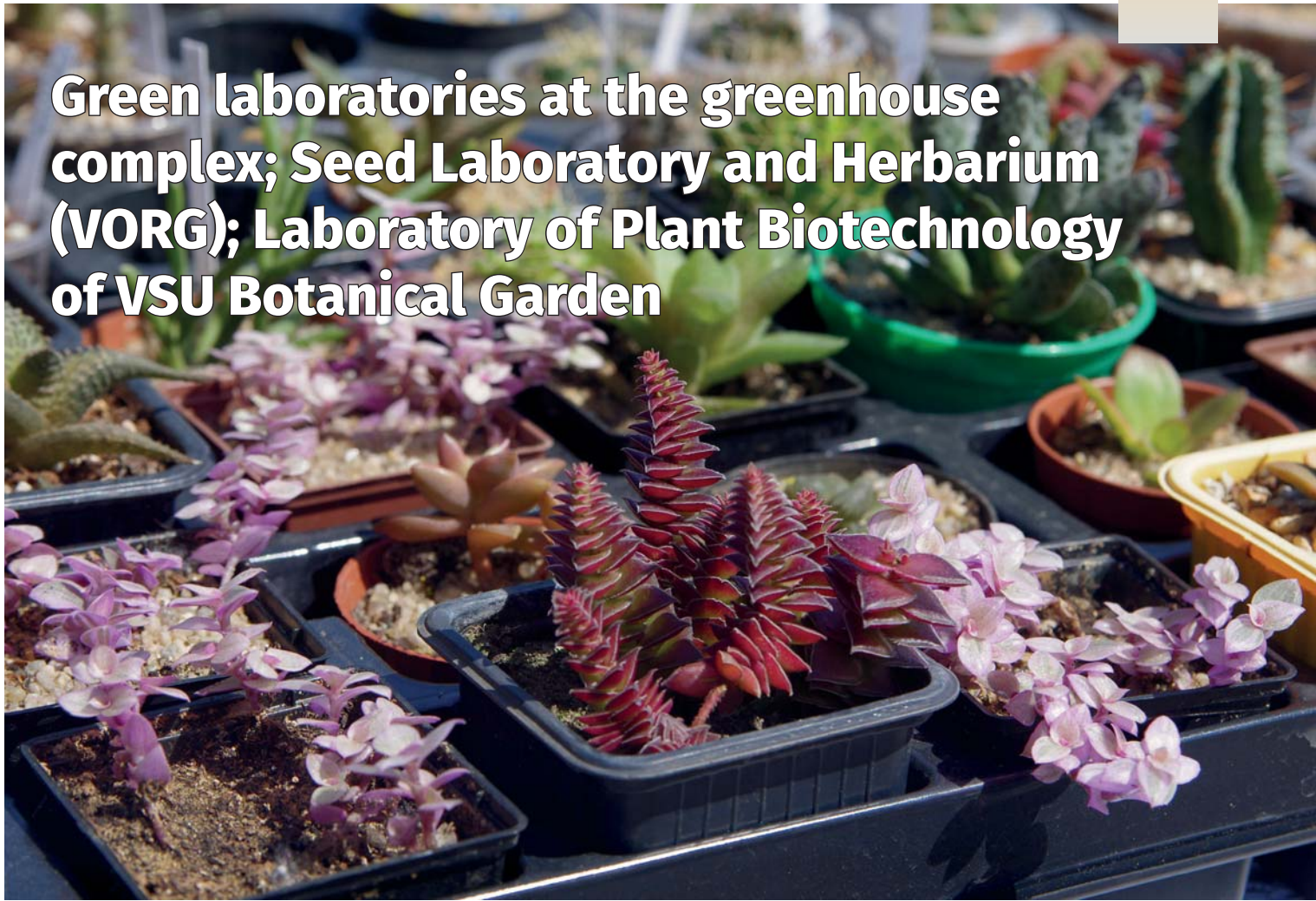
Major projects implemented within the federal target programme:

- “Study of molecular mechanisms of immunocyte destruction in humans under UV radiation and reactive oxygen intermediates”
- “Development and enhancement of nanomaterials nuclear physical and X-ray diagnostic methods”

Projects conducted within the framework of the Decree of the Russian Government No 218 «State support of development of cooperation between Russian educational institutions of higher education, state research institutions and organisations that implement integrated hi-tech production projects as a part of the sub-programme «Institutional development of the research sector»:

- “Developing a hi-tech industry for plant oil and fibre processing and transformation into non-food products”
- “Creating hi-tech production of efficient multifunctional membrane units for the extraction of ultrapure hydrogen”

Green laboratories at the greenhouse complex; Seed Laboratory and Herbarium (VORG); Laboratory of Plant Biotechnology of VSU Botanical Garden



Research area

Environmentally friendly plant introduction; assessing, monitoring and conservation of biodiversity of forest steppe

Laboratory equipment

- Greenhouse facilities
- Nursery gardens
- Plants collection fund
- Herbarium and seeds storage
- Equipment for chemical analysis, medium making, sterilization and inoculation of explants

Available research methods

- Bioindication methods, geobotany methods, and plant introduction methods
- Entome phytopathological research and assessment of woody plant vitality
- Comparative floristics methods
- Micropropagation methods
- Methods of ecological restoration of damaged habitats

Challenges

- Assessing the phytotoxicity of soils
- Assessing the vitality of tree plantations
- Catalogization and taxonomic analysis of tree plantations
- Assessing the state of plant formations
- Characterising zonal and interzonal vegetation
- Assessing plant resources
- Micropropagation of rare and economically valuable plants
- Restoration of vegetation in damaged territories
- Selecting hardy plants for various habitats
- Producing planting material
- Landscaping
- Organising guided tours and environmental education initiatives

Major projects

Grants of the Russian Foundation for Basic Research:

- Project No. 12–05–31215 mol_a “Studying the role of invasive species in breaching zonal biogeographical entity of the ecosystems of the Central Russian forest-steppe”, 2012

- Project No. 14–04–90403 “Assessing the diversity and structure of the adventive flora of the Eastern Europe forest-steppe in order to conserve the ideal function of the specially protected territories”, 2014
- Project No. 16–45–360284 r_a “The Voronezh Region urbanised territories biotechnosphere monitoring as a factor of the region’s sustainable development”
- Project No. 17–05–41072 rgo_a “Geoinformation support of regional systems for medico-ecological monitoring of large industrial centres”, 2017
- Project No. 17–05–00569 “Studying the functioning of ecological and geochemical background and health risks to people living in building and industrial areas of the Central Black Earth Region”, 2017
- Studying the vegetation resources at “Reconstruction of KGMO 1 in the territory between CS Noginsk and CS Yakhroma” for OAO Gasprom, 2017

Projects implemented within the framework of the federal target programme:

- Project No. 2011–1.8–518–011 “Assessing plant resources introduced in the Central Black Earth Region and developing methods for their conservation in the Botanical Garden of Voronezh State University”
- Project No. 2009–07–1.8–00–06 “Global plant resources. Introduction and conservation of the gene pool of new and understudied plants in the Central Black Earth Region. B.M. Kozo-Polyansky Botanical Garden of Voronezh State University. VSU’s Botanical Garden.”

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Laboratory of the Nursery for Carnivorous Birds of “Galichya Gora” Nature Reserve

Industrial partners

- Moscow Zoo
- Lipetsk Zoo
- Ivanovo Zoo
- Russian Falcon Centre
- Qatar Falcon Centre
- UAE Falcon Centre

Research area

- Breeding of carnivorous birds
- Experimental incubation
- Selection

Laboratory equipment

- Incubators
- Electronic scales
- Microscope
- Ovoscope
- Measuring instruments
- Brooders
- Heart rate monitor
- Freezers
- Refrigerators

Available research methods

- Statistics
- Morphology
- Ovoscopy
- Microscopy

Challenges

- Breeding of rare carnivorous birds
- Enhancing fertility
- Selection
- Providing birds for falcon centres

Major projects

- Breeding of carnivorous birds
- Artificial breeding
- Reintroduction
- Training of hunting birds

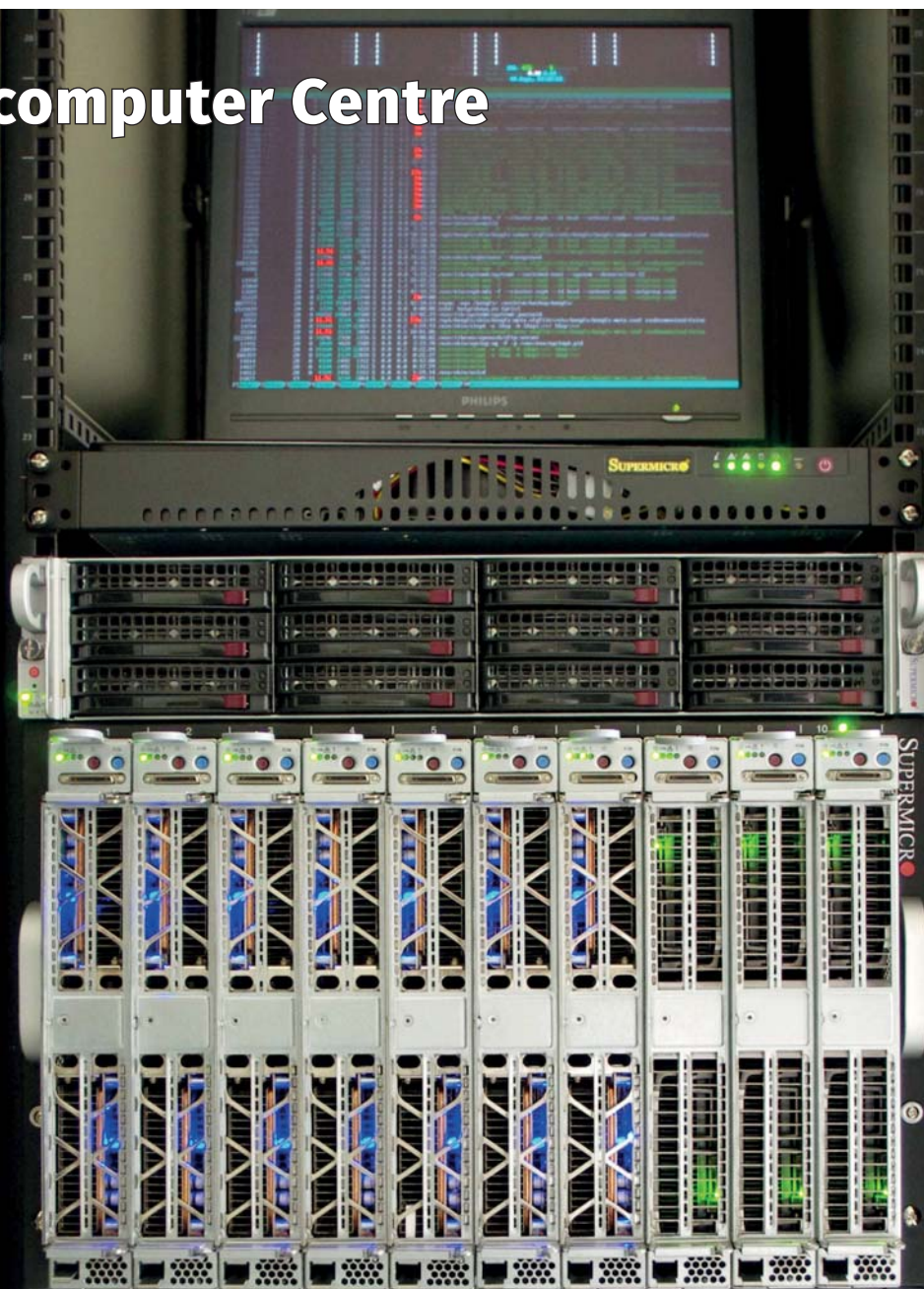
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Supercomputer Centre



Research area

High-performance computing for natural sciences

Laboratory equipment

Supercomputer with the top capacity of 39 Tflops, 28 Tflops in the Linpack test. Description:

- Intel Xeon Core 240
- Intel Xeon Phi Core 840
- 29,952 dataflow cores incorporated in GPU Nvidia Tesla K80
- Fibre optic network Infiniband 56 Gb

Available research methods

- Modelling of artificial neural networks

- Calculations based on the methods of quantum mechanics and statistical physics

Challenges

Simulating chemical and physical properties of materials

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