Approved by the decision
of the MIPT Academic Council
dated May 30, 2024
(protocol No. 01/05/2024)

Federal State Autonomous Educational Institution of Higher Education "Moscow Institute of Physics and Technology (National Research University)"

THE MAIN EDUCATIONAL PROGRAM OF HIGHER EDUCATION

Level of higher education
MASTER

Domain of study
12.04.03 PHOTONICS AND OPTICAL INFORMATICS

Orientation (specialty)
PHOTONICS, QUANTUM TECHNOLOGIES & 2D MATERIALS/ФОТОНИКА, КВАНТОВЫЕ ТЕХНОЛОГИИ И ДВУМЕРНЫЕ МАТЕРИАЛЫ

Starting year of the educational program
2024 y.

Update of the educational program:
decision of MIPT Academic Council dated March 27, 2025 (protocol No. 01/03/2025)

The main educational program of higher education in the field domain of study 12.04.03 Photonics and Optical Informatics, orientation (specialty) Photonics, Quantum Technologies & 2D Materials/Фотоника, квантовые технологии и двумерные материалы, implemented at MIPT, is a set of basic characteristics of education (volume, content, planned results), organizational and pedagogical conditions, forms of certification, which is presented as a general characteristic of the educational program, curriculum, academic calendar schedule, work programs of disciplines (modules), training programs, evaluation and methodological materials. The main educational program of higher education has been created on the basis of the educational standard domain of study 12.04.03 Photonics and Optical Informatics, independently developed and approved by MIPT.

1. General characteristics of the educational program

Qualifications awarded to graduate: master.

Form of education: full-time

Education period: 2 years.

The educational program consists of: 120 credits and includes all types of student's classroom and independent work, training, time, allotted for quality control of the mastering of the educational program by the student.

The contact work of students with teachers consists of, at least, 916 hours.

Program implementation language: english.

Using a network form of educational program implementation: no.

Program goal:

The program is aimed at training high professionals capable of making scientific discoveries at the most advanced frontiers of physics and High-Tech. Students and graduates are aimed at studying problems of the global scientific agenda in conditions of fierce competition and international integration on the horizon of knowledge of physical laws in the field of active plasmonics, optoelectronics of two-dimensional materials and quantum optoelectronics. Graduates continue their HhD and research careers either at MIPT or at other world-leading universities.

2. Characteristics of the professional activity of graduates:

Fields of professional activity and areas of professional activity, in which graduates, who have mastered the master's program, can carry out professional activities:

06 Communication, information and communication technologies (in the field of development of fundamental mathematical and physical foundations of communication and information and communication technologies, innovative and experimental design developments);

29 Production of electrical equipment, electronic and optical equipment (fundamental and applied scientific research in the field of general and applied physics, radiophysics, electrophysics and optics, physical and quantum electronics, modern laser, opto- and nanotechnology, including ultra-high resolution optical microscopy);

40 Cross-cutting types of professional activity in industry (in the field of fundamental and applied research, innovative developments, as well as in the development and implementation of new technological processes for the production of advanced materials (including composites, nano- and metamaterials), opto-, micro-, and nanoelectronics, the development and application of electronic devices and complexes, as well as in the field of monitoring the parameters of materials, the state of complex technical and living systems and the state of the environment, including the development and use for solving tasks).

Graduates can carry out professional activities in other fields of professional activity and (or) areas of professional activity, provided that their level of education and acquired competencies meet the requirements of the employee's qualification.

Types of tasks of professional activity of graduates:

research.

Tasks of professional activity of graduates:

consolidation of the obtained data, independent formation of conclusions and preparation of scientific and analytical reports, publications and presentations of the results of scientific and analytical research, qualified transfer of the results of scientific and analytical research to related subject areas;

definition of promising directions of scientific research and information sources for analytical search in the subject area chosen for specialization, effective collection and processing of scientific and analytical information using modern programs, tools and methods of computer and information technologies and computational mathematics;

planning and conducting scientific work and analytical research in accordance with the approved direction of research in the subject area of specialization;

planning and conducting theoretical research, development of new physical and mathematical, including computer, models of the processes and phenomena under study, analysis and synthesis of analytical research data in the subject area;

planning and development of new methods and technical means for fundamental research and innovative developments;

planning and development of new algorithms and computer programs for research and applied purposes;

planning and independent conduct of observations and measurements, planning, setting up and optimizing experiments in the subject area of research, selection of effective data processing methods and their implementation.

Objects of professional activity of graduates, mastered the program Master's:

artificial intelligence optical systems;

optical and quantum computing systems and optical computers;

устройства и системы компьютерной фотоники;

devices and systems based on coherent optics and holography;

fundamental, applied research and development designs in the field of photonics;

element base and systems based on nanoscale and photonic-crystal structures;

element base of semiconductor, fiber and planar lasers;

element base, systems and technologies of integrated, fiber and gradient optics, as well as micro-optics;

element base, systems, materials, methods and technologies providing optical transmission, reception, processing, recording and storage of information.

3. List of professional standard, corresponding to the professional activities of graduates:

40.011 Research and Development Specialist;

29.004 Specialist in the field of design and production support of optics, optical and optoelectronic devices and complexes;

06.054 Research and development specialist in the field of electronic communications.

Code and name of the professional standard	Generalized labor functions			Labor functions		
	code	name	level of qualification	name	code	level of qualification
40.011 Professional standard "Research and Development Specialist"	B	Conducting research and development in the study of independent topics	6	Leading a group of workers in the study of independent topics	B/03.6	6
				Conducting work on the processing and analysis of scientific and technical information and research results	B/02.6	6
	C	Conducting R&D work on the subject of the organization	6	Implementation of scientific management of research on individual tasks	C/01.6	6
				Management of the results of R&D work	C/02.6	6
	D	Implementation of scientific leadership in the relevant field of knowledge	7	Formation of new areas of R&D work	D/01.7	7
				Coordination of the activities of co-executors involved in the performance of work with other organizations	D/03.7	7
				Defining the scope of application of the results of R&D work	D/04.7	7
29.004 Professional standard "Specialist in the field of design and production support of optics, optical and optoelectronic devices and complexes"	C	Scientific research in the field of optical instrumentation, optical materials and technologies	7	Analysis of scientific and technical information on the development of optotechnics, optical and optoelectronic devices and complexes	C/01.7	7
				Simulation of optoelectronic devices operation based on physical processes and phenomena	C/02.7	7
				Experimental research for the creation of new optotechnics, optical and optoelectronic devices and complexes	C/03.7	7

				Development of competitive technologies for obtaining, storing and processing information using optical and optoelectronic devices and systems	C/04.7	7
				Development of new technologies for the production of optotechnics, optical and optoelectronic devices and complexes	C/05.7	7
06.054 Professional standard "Research and development specialist in the field of electronic communications"	D	Development of equipment and devices for quantum communication systems	6	Preparation and conduct of laboratory studies of circuit solutions for quantum communication systems	D/01.6	6
				Documentation of laboratory studies of circuit solutions	D/02.6	6
				Design and construction of equipment and devices for quantum communication systems	D/03.6	6
				Preparation of prototypes of equipment, devices and complexes for quantum communication systems for transfer to the operational stage	D/05.6	6
	E	Development of innovative equipment and complexes for quantum communication systems	7	Design and construction of innovative equipment and complexes for quantum communication systems	E/02.7	7

				Patent security for the development of equipment, devices and complexes for quantum communication systems	E/04.7	7
				Assessment of the effectiveness of solving problems of developing equipment, devices and complexes for quantum communication systems using methods of mathematical, physical, computer modeling and field tests	E/05.7	7
	F	Conducting scientific research in the field of quantum communications and registration of their results	7	Conducting theoretical and experimental research in the field of creation and operation of equipment, devices and complexes for quantum communication systems	F/01.7	7
				Preparation of recommendations for standardization of solutions in the field of creation and operation of equipment, devices and complexes for quantum communication systems	F/02.7	7
				Preparation of publications in the field of creation and operation of equipment, devices and complexes for quantum communication systems	F/03.7	7

				Registration of the results of scientific research in the field of quantum communications in accordance with the standard requirements	F/04.7	7

4. Requirements for the results of mastering the educational program

As a result of mastering the main educational program, the graduate should form universal, general professional and professional competencies.

Universal competencies of graduates and indicators of their achievement:

Code and name of competence	Code and name of the indicator of competence achievement
UC-1 Use a systematic approach to critically analyze a problem and develop an action plan	UC-1.1 Systematically analyze the problem situation, identify its components and the relations between them UC-1.2 Search for solutions by using available sources UC-1.3 Develop a step-by-step strategy for achieving a goal, foresee the result of each step, evaluate the overall impact on the planned activity and its participants
UC-2 Manage all stages of a research project	UC-2.1 Set an objective within a defined scientific problem; formulate the agenda, relevance, significance (scientific, practical, methodological, or other depending on the project type), forecast the expected results and possible areas of their application UC-2.2 Forecast the project outcomes, plan necessary steps to achieve the outcomes, chart the project schedule and monitoring plan UC-2.3 Organize and coordinate the work of project stakeholders, provide the team with necessary resources UC-2.4 Publicly present the project results (or results of its stages) via reports, articles, presentations at scientific conferences, seminars, and similar events
UC-3 Organize and manage a team and develop the team strategy to achieve the objectives	UC-3.1 Organize and coordinate the work of the project stakeholders and help resolve disputes and conflicts UC-3.2 Consider the interests, specific behavior, and diversity of opinions of team members/colleagues/counterparties UC-3.3 Foresee the results (consequences) of both individual and collective actions UC-3.4 Plan teamwork, distribute tasks to team members, hold discussions of different ideas and opinions
UC-4 Use modern communication tools in the academic and professional fields, including those in a foreign language	UC-4.1 Exchange business information in oral and written forms in Russian and at least one foreign language UC-4.2 Use the acquired skills to write, translate, and edit various academic texts (abstracts, essays, reviews, articles, etc.) UC-4.3 Present the results of academic and professional activities in various academic events, including international conferences UC-4.4 Use modern ICT tools for academic and professional collaboration
UC-5 Analyze and consider cultural diversity in intercultural interactions	UC-5.1 Identify specific philosophical and scientific traditions in major world cultures UC-5.2 Define the theoretical and practical significance of cultural and linguistic factors within various interrelated philosophical and scientific traditions
UC-6 Determine priorities and ways to improve performance through self-assessment	UC-6.1 Achieve personal growth and professional development, determine priorities and ways to improve performance UC-6.2 Evaluate performance results in correlation with the set objectives and applied methods

General professional competencies of graduates and indicators of their achievement:

Code and name of competence	Code and name of the indicator of competence achievement

Gen.Pro.C-1 Gain fundamental scientific knowledge in the field of physical and mathematical sciences	Gen.Pro.C-1.1 Apply fundamental scientific knowledge in the field of physical and mathematical sciences Gen.Pro.C-1.2 Able to summarise and critically evaluate experiences and research results in the field of photonics and opto-informatics Gen.Pro.C-1.3 Understands the interdisciplinary links in mathematics and physics and is able to apply them to problems in photonics and opto-informatics
Gen.Pro.C-2 Acquire an understanding of current scientific and technological challenges in professional settings, and scientifically formulate professional objectives	Gen.Pro.C-2.1 Has an understanding of the current state of research in photonics and opto-informatics Gen.Pro.C-2.2 Assess the relevance and practical importance of research in professional settings Gen.Pro.C-2.3 Understand professional terminology used in modern scientific and technical literature and present scientific results in oral and written form within professional communication
Gen.Pro.C-3 Select and/or develop approaches to professional problem-solving with consideration to the limitations and specifics of different solution methods	Gen.Pro.C-3.1 Analyze problems, plan research strategy to achieve solution(s), propose, and combine solution approaches Gen.Pro.C-3.2 Employ research methods to solve new problems, and apply knowledge from various fields of science (technology) Gen.Pro.C-3.3 Gain knowledge of analytical and computational methods of problem-solving, understand the limitations for applying the obtained solutions in practice
Gen.Pro.C-4 Successfully perform a task, analyze the results and present conclusions, apply knowledge and skills in the field of physical and mathematical sciences and ICTs	Gen.Pro.C-4.1 Apply ICT knowledge and skills to find and study scientific literature and use software products Gen.Pro.C-4.2 Apply knowledge in the field of physical and mathematical sciences to solve problems, make conclusions, and evaluate the obtained results Gen.Pro.C-4.3 Justify the chosen method of scientific research
Gen.Pro.C-5 Undertake professional training, achieve professional growth, and become a team leader in a professional sphere, tolerant of social, ethnic, religious and cultural differences	Gen.Pro.C-5.1 Tolerate social, ethnic, religious, and cultural differences in teamwork Gen.Pro.C-5.2 Manage a small professional team Gen.Pro.C-5.3 Apply new knowledge and achieve personal and professional growth

Professional competencies of graduates and indicators of their achievement:

Code and name of competence	Code and name of the indicator of competence achievement	Basis (professional standarts, analysis of other requirements for graduates)
type of professional activity tasks: research		
Pro.C-1 Assign, formalize, and solve tasks, develop and research mathematical models of the studied phenomena and processes, systematically analyze scientific problems and obtain new scientific results	Pro.C-1.1 Locate, analyze, and summarize information on current research findings within a selected subject field Pro.C-1.2 Make hypotheses, build mathematical models of the studied phenomena and processes, evaluate the quality of the developed model Pro.C-1.3 Able to apply theoretical and/or experimental research methods in photonics and opto-informatics to a specific scientific problem and interpret the results obtained	Research and development specialist in the field of electronic communications
Pro.C-2 Organize and conduct scientific research and testing independently or as a member (leader) of a small research team	Pro.C-2.1 Able to plan and carry out research in photonics and opto-informatics independently or as part of a research team Pro.C-2.2 Conduct tests of research results through scientific publications and participation in conferences	Specialist in the field of design and production support of optics, optical and optoelectronic devices and complexes

Pro.C-3 Professionally use research and testing equipment (devices and installations, specialized software) in a selected subject field	Pro.C-3.1 Understand the operating principles of the equipment and specialized software Pro.C-3.2 Conduct an experiment (simulation), using research equipment (software) Pro.C-3.3 Evaluate the accuracy of the experimental (numerical) results	Research and Development Specialist

5. Curriculum

The curriculum (Appendix 1) determines the list, labor input, sequence and distribution by periods of study of academic disciplines (modules), trainings, other types of educational activities, forms of intermediate and final certification of students. The labor input of the educational program is set in credit units.

The volume of compulsory part, excluding the volume of the state final attestation, is 80,83 persents percent of the total volume of the program.

The matrix of compliance of competencies with the disciplines of the curriculum is given in Appendix 2.

6. Academic calendar schedule

Academic calendar schedule (Appendix 3) shows the distribution of types of educational activities, periods of attestation of students and vacations by year of study (courses) and within each academic year. The academic calendar schedule of the educational program of higher education includes 96 5/6 weeks, of which there are 59 1/6 weeks of theoretical and practical training, 18 weeks of the credit-examination period, 3weeks of the state final certification and 16 4/6 weeks of holidays.

7. Work programs of disciplines (modules)

Work programs of disciplines (modules), including evaluation materials for ongoing monitoring of progress and intermediate certification, are presented in Appendix 4.

8. Practice programs

The educational program provides for the following trainings:

Personal Research Project/Научно-исследовательская работа: practical training.

Work programs of trainings, including assessment materials for ongoing monitoring of progress and intermediate certification are presented in Appendix 5.

9. Program of the state final certification

As part of the state final certification, the following are provided:

Performance of and Defence of Graduation Thesis/Выполнение и защита выпускной квалификационной работы.

The program of the state final certification (Appendix 6) includes requirements for final qualifying works (volume, structure, design, presentation), the procedure for their implementation, the procedure for defending the final qualifying work, criteria for evaluating the results.

10. Material and technical, educational and methodological support of the educational program

The work programs of disciplines (modules), practices determine the material and technical and educational and methodological support of the educational program, including a list of licensed and freely distributed software, a list of electronic educational publications and (or) printed publications, electronic educational resources, a list and composition of modern professional databases and information reference systems.

Classrooms for conducting training sessions provided for by the educational program are equipped with equipment and technical means of training, the composition of which is determined in the work programs of

disciplines (modules) and practices.
The premises for independent work of students are equipped with computer equipment with the ability to connect to the Internet and are provided with access to the electronic information and educational environment of MIPT.
MIPT's electronic information and educational environment provides access to:
– to EBS:
EBS "University Library online": section "Golden fund of scientific classics".

"Book on Lime" by the publishing house "University Book House";
EBS of "Lan" publishing house;
EBS of "Yurait" publishing house;
EBS of "IBooks.ru" publishing house;
EBS ZNANIUM.COM;
access to the source books.mipt.ru;
access to the collections of the National Electronic Library.
- scientific foreign and Russian journals and electronic databases:
database "Uspekhi Fizicheskikh Nauk" (Autonomous non-profit organization Editorial Office of the journal "Uspekhi Fizicheskikh Nauk");
journals of the RAN (Russian Academy of Sciences);
journals of the Steklov Mathematical Institute of the Russian Academy of Sciences: Mathematical journals (mathnet.ru): Izvestia of the Russian Academy of Sciences. Series mathematical, Mathematical Collection, Uspekhi matematicheskikh nauk;
electronic version of the journal "Quantum Electronics" (Lebedev Physical Institute of the Russian Academy of Science);
Russian journals on the East View platform of IVIS;
database full-text collection of journals Bentham Journal Collection (Bentham Science Publishers);
EDP Sciences database
EBSCO eBooks database (EBSCO Information Services GmbH);
Wiley Journal Database;
archival journal collection Wiley Journal Backfiles (2005-2013);
archival collection of journals Wiley Journal Backfiles (2014 -2022);
World Scientific Complete eJournal Collection database (World Scientific Publishing Co Pte Ltd.).

The logistical and technical, educational and methodological support of disciplines (modules) and practices is determined by the specific features of the corresponding disciplines (modules) and includes publicly available and specialized software, access to professional databases, electronic and printed literature sources and other educational resources listed in the work programs of the disciplines. These resources are publicly available or provided by the institute and the base organizations.

11.Features of the educational program implementation for the disabled and persons with special needs

If there are persons with disabilities or persons with special needs among students, the educational program is adapted taking into account the special educational needs of such students.
When teaching according to an individual curriculum for people with disabilities, the period for mastering the educational program can be extended at their request by no more than one year compared to the period for obtaining education for the corresponding form of education.

12. Staff conditions for the implementation of the educational program

Leading Russian and foreign scientists are involved in the lectures including experts in the field of photonics and quantum technologies from the Russian Quantum Center and other leading scientific institutions in this field of research.

The share of scientific and pedagogical staff (in teaching loads reduced to integer values) with an education corresponding to the profile of the discipline (module) being taught, in the total number of scientific and pedagogical staff implementing the Master's program is more than 70 persents.

The share of scientific and pedagogical staff (in teaching loads reduced to integer values) who have an academic degree (including an academic degree awarded abroad and recognized in the Russian Federation) and (or) an academic title (including an academic title obtained abroad and recognized in the Russian Federation), in the total number of scientific and pedagogical staff implementing the Master's program, is more than 60 persents.

The share of scientific and pedagogical staff (in teaching loads reduced to integer values) from the number of managers and employees whose activities are related to the orientation (specialty) of the ongoing Master's program (having work experience in this professional field for more than 3 years) in the total number of employees implementing the master's program is more than 5 persents.

The general management of the scientific content of the master's program is carried out by the Doctor of Physics and Mathematical Sciences Shlyapnikov Georgiy Vsevolodovich, who carries out independent research projects and participates in the implementation of such projects in the field of study, who has annual publications based on the results of this research activity in leading Russian and international peer-reviewed scientific journals and publications, as well as carrying out annual approbation of the results of this research activity at national and international conferences.

Georgy Vsevolodovich Shlyapnikov is a theoretical physicist, professor at the University of Amsterdam, head of the scientific group of the Russian Quantum Center, director of the research department of the Laboratory of Theoretical Physics of the National Center for Scientific Research.

Education: MIPT (1972), diploma qualification: "Engineer-physicist", specialty: "Experimental nuclear physics".
Since 1972 — Kurchatov Institute: postgraduate student (1972-1975), junior researcher (1975-1982), senior researcher (1982-1989), head. laboratory (1989-2003).
1975 - defended the PhD thesis: "Radiation processes in molecular gases".
1989-1996 - Visiting Fellow University of Amsterdam.
1996-2003 - Head of the group at the FOM Institute AMOLF, Amsterdam.
Since 2003, Director of the research department of the Laboratory of Theoretical Physics of the National Center for Scientific Research of France (Orse), Professor at the University of Paris — South. Concurrently, he is the head of the laboratory of the element base of quantum communications at MISIS. Scientific director of the group "Theory of many bodies" of the Russian Quantum Center. Head of the Department of the Russian Quantum Center of MIPT.

Research interests: atomic, molecular and laser physics, quantum physics, theoretical physics, condensed matter physics, experimental and computational physics, nuclear physics.
Publications:
Shlyapnikov G.V. is the author of about 160 publications (for 2024 according to Scopus), associate editor of the journal Advances in Physics, co-editor of the journal European Physics Letters.
h-index: 66 (Google Scolar), 56 (Scopus).
Awards:
1999 — Humboldt Prize (Germany)
2000 — Kurchatov Prize
2011 — International Bose-Einstein Condensation Award (International))
2013 — European Research Council (ERC) Research Award.

Recent publications on the topic of the educational program:
1. Enhanced Drude weight in a one-dimensional system of fermions with pair-hopping events// Bahovadinov, M.S., Sharipov, R.O., Altshuler, B.L., Shlyapnikov, G.V. Physical Review B, 2024, 109(19), 195159

2. Tomonaga-Luttinger liquid-Bose-glass phase transition in a system of one-dimensional disordered fermions with pair hoppings// Bahovadinov, M.S., Sharipov, R.O., Altshuler, B.L., Shlyapnikov, G.V. Physical Review B, 2024, 109(1), 014203
3. Disordered impenetrable two-component fermions in one dimension// Kurlov, D.V., Bahovadinov, M.S., Matveenko, S.I., ... Altshuler, B.L., Shlyapnikov, G.V. Physical Review B, 2023, 107(18), 184202
4. Superfluid transition in quasi-two-dimensional disordered dipolar Fermi gases | Transition superfluide dans des gaz de fermions dipolaires désordonnés quasi bidimensionnels// Pinchenkova, V.Y., Matveenko, S.I., Yudson, V.I., Shlyapnikov, G.V. Comptes Rendus Physique, 2023, 24
5. Many-body localization transition in a frustrated XY chain// Bahovadinov, M.S., Kurlov, D.V., Matveenko, S.I., Altshuler, B.L., Shlyapnikov, G.V. Physical Review B, 2022, 106(7), 075107
6. Rotons and their damping in elongated dipolar Bose-Einstein condensates// Matveenko, S.I., Bahovadinov, M.S., Baranov, M.A., Shlyapnikov, G.V. Physical Review A, 2022, 106(1), 013319
7. Many-body localization of 1D disordered impenetrable two-component fermions// Bahovadinov, M.S., Kurlov, D.V., Altshuler, B.L., Shlyapnikov, G.V. European Physical Journal D, 2022, 76(7), 116
8. Scalable quantum computing with qudits on a graph// Kiktenko, E.O., Nikolaeva, A.S., Xu, P., Shlyapnikov, G.V., Fedorov, A.K. Physical Review A, 2020, 101(2), 022304

13. Information about the departments involved in the implementation of the educational program

Chair of the Russian Quantum Centre: head of Chair – Doctor of Physics and Mathematical Sciences Shlyapnikov Georgiy Vsevolodovich, scientific Director of the Russian Quantum Center. The RQC developments – ultra-sensitive sensors, solid–state photomultipliers, femtosecond lasers, an ultra-sensitive magnetic cardiograph and others – are designed for financial, telecommunications, medical and other industries. The key development is a quantum communication system for secure transmission of information in banking, military, government and other fields. At the RQC department, students can choose a promising topic of research work, solve up-to-date theoretical and experimental problems under the supervision of experienced mentors, work with advanced equipment that has no analogues in Russia and sometimes in the world, participate in conferences and interact with the international scientific community.

Basic organisations:

Общество с ограниченной ответственностью «Международный центр квантовой оптики и квантовых технологий» The Russian Quantum Center (RQC) is a unique for Russia non-profit science and technology center that in a short time has taken leading positions in its field of research, as well as in the development of high-tech commercial products based on quantum technologies. The RQC's developments – supersensitive sensors, solid-state photomultipliers, femtosecond lasers, supersensitive magnetic cardiograph and others – designed for financial, telecommunication, healthcare and other industries. The key development is a quantum communication system for completely secure data transmission in the banking, government and other fields. World-renowned scientists and high-tech business leaders jointly supervise the development of the RQC. This unique format allowed the RQC to become in its field the leading scientific center of Russia and one of the best in the world, as well as to start creating high-tech commercial products. The leading researchers of the RQC are selected by an open international competition and work in collaboration with leading Russian and foreign scientific groups. Training and entry in the work of brighter undergraduate and graduate students allows them to become specialists quickly.