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projects funded by ISS Reshetnev, Huawei and Gazprom Neft R&D, as well as a mega grant for establishment of a new laboratory that will focus on sensor networks and deep learning for applications in data mining.

Seven Skoltech faculty projects were selected for support within the Skoltech Translational Research and Innovation Program. These projects focus on addressing a variety of modern problems, such as creation of materials for redox batteries, a robotic platform for warehouse automation, a platform for flexible online electronics, a portable wireless electrocardiogram device, a new type of marker for virtual reality systems, devices for ultrasonic applications and hydrocarbon field exploration technologies.

Similar to 2016, faculty publication activity (i.e., the average number of published papers per professor) remained on par with the world’s leading young universities, such as KAIST (Korea), HKUST (Hong Kong) and NUS (Singapore). In addition, Skoltech’s Web of Science citation score soared in 2017, resulting in receipt of the Rising Star of Citation Impact award. In the prestigious Nature Index, despite its small size, Skoltech was ranked third in Russia in the Nature & Science journal group following the Russian Academy of Sciences and Moscow State University.

In 2017, Skoltech focused on transforming student learning experiences by launching a new portfolio of MSc and PhD programs and implementing practices aimed at meeting unique educational needs of centennials (digital natives), such as through learning-by-doing and learning-by-teaching opportunities. In addition to rapid expansion of its local course offerings, Skoltech supported student mobility in a major way: more than 40% of students received support, with approximately one-third opting for domestic mobility trips of various terms, and two-thirds traveling internationally.

The caliber of Skoltech’s newly admitted students in 2017 – including 20% international students – attested to the strength of the institute’s educational program. Against the backdrop of a fiercely competitive admissions process, Skoltech received some 11,000 applications from 123 countries; the admission ratio for MSc programs reached 100:1 (international students) and 35:1 (Russian students). For PhD programs, those figures reached 130:1 (international students) and 31:1 (Russian students). About 50% of the 2017 intake included students who had graduated from universities in the top 300 QS Ranking, while others appeared to be ambitions recent graduates from towns across Russia.

As a reflection of Skoltech’s innovation-oriented education, students successfully participated in domestic and international competitions. Among many other honors, students from the Center for Computational and Data-Intensive Science and Engineering won a prize at a Kaspersky Lab hackathon and placed third at the Data Science Game in Paris, where 340 teams from 40 different countries battled for excellence. Being the only Russian team in the final of the world championship Eurobot Open 2017, the ReSet robotic team took the prestigious 5th place – seven positions higher than its 2016 results. Meanwhile, PhD students of the Center for Hydrocarbon Recovery won the best performance prize at the final of the European stage of the Imperial Barrel Award Competition 2017, an annual competition for geoscience graduate students from international universities.

Highly remarkable was the graduation of the first class of PhD students. 100% of PhD students successfully completed their studies. 87% defended their dissertations in the front of juries that included faculty from the leading Russian universities. 78% received their degrees in accordance with international practices in front of juries that included faculty from the Massachusetts Institute of Technology, Delft University, Imperial College of London, Tel Aviv University, University of Illinois. The percent of PhD degrees conferred is significantly higher than in many leading Russian universities.

In 2017, Skoltech also launched programs to reach out the wider community and, in particular, youth in schools to highlight what university life can offer and to encourage their future participation. A special focus was placed on collaboration with the Skolkovo International Gymnasium and Sirius Educational Center in Sochi: Skoltech professors and students gave dozens of lectures and seminars, as well as hosted schoolchildren at Skoltech labs. A pilot summer school for gifted undergraduates exposed the participants to advanced research by providing opportunities to work with leading scholars from Skoltech, as well as its Russian and international partners.

Skoltech significantly broadened its engagement with the ecosystem of the Skolkovo Innovation Center: 45 faculty and researchers relocated to the Professors’ Quarter and Tetris apartments. I expect, more will relocate in 2018. Very recently, Professor Dmitri Papatsenko passed away after a long and heroic battle with cancer. Dmitry had been in Skoltech since 2015, conducting research and teaching courses in Stem Cell Biology and Developmental Biology, and combining the expertise in biology with his self-taught mathematical skills. He was a man of big personality. This is irreparable loss for our Institute. The Annual Report provides a comprehensive overview of institutional achievements in line with the commitments to excellence and linking research with industry, the economy and society.
Glossary

BOARD OF TRUSTEES
The Board of Trustees of the Autonomous Non-Profit Organization for Higher Education "Skolkovo Institute of Science and Technology"

CAS
Center for Advanced Studies

CDIBB
Center for Data-Intensive Biomedicine and Biotechnology

CDISE
Center for Computational and Data-Intensive Science and Engineering

CDMM
Center for Design, Manufacturing and Materials

CEE
Center for Electrochemical Energy Storage

CEI
Center for Entrepreneurship and Innovation

CES
Center for Energy Systems

CHR
Center for Hydrocarbon Recovery

CPQM
Center for Photonics and Quantum Materials

CREI
Center for Research, Education, Innovation

CTB
Center for Translational Biomedicine

ECTS
European Credit Transfer and Accumulation System

FTE
Full-time equivalent

IAC
International Advisory Committee

KPI
Key Performance Indicator of the development of the Institute

MIT
Massachusetts Institute of Technology

MRA
Master Research Agreement

NGP
"Next Generation Program: Skoltech-MIT Joint Projects"

NTI
National Technology Initiative

PI
Principal Investigator

RFBR
Russian Foundation for Basic Research

RSF
Russian Science Foundation

SBI
Skoltech Biomedical Initiative

SC
Space Center

SEH
Skolkovo Educational Hub (Moscow School of Management, Skoltech, New Economic School)

SKOLKOVO FOUNDATION
Non-Commercial Organization "Foundation for the Development of the Center for the Elaboration and Commercialization of New Technologies" (Skolkovo Foundation)

SKOLTECH, INSTITUTE
Autonomous Non-Profit Organization for Higher Education “Skolkovo Institute of Science and Technology"

STRATEGIC ACTION PLAN (SAP)
Skoltech Strategic Action Plan 2018-2020, which describes the Institute’s vision, strategic goals and initiatives, key tasks and actions, targeted Key Performance Indicators and persons responsible for their achievement, budget and risk analysis (approved by the Board of Trustees, Minutes No. 27, dated 13 December 2017).

TARGET DOMAIN
Strategic focus areas aimed at reaching academic and brand excellence and forming a foundation for value generation; established in the SAP based on technological priorities and experience

WoS
Web of Science database
Focus and Governance
### Key Performance Indicators

**KEY PERFORMANCE INDICATORS**

<table>
<thead>
<tr>
<th>ACADEMIC EXCELLENCE</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACULTY</td>
<td>60</td>
<td>86</td>
<td>104</td>
</tr>
<tr>
<td>POSTDOCS &amp; RESEARCHERS</td>
<td>74</td>
<td>112</td>
<td>184</td>
</tr>
<tr>
<td>PUBLICATIONS (I.E., INDEXED IN WOS, SCOPUS) PER FACULTY MEMBER</td>
<td>2.5</td>
<td>4.4</td>
<td>5.6</td>
</tr>
<tr>
<td>PUBLICATIONS WITH INDUSTRY IMPACT PER FACULTY MEMBER</td>
<td>0.31</td>
<td>0.88</td>
<td>1.41</td>
</tr>
<tr>
<td>KNOWLEDGE EXCHANGE WITH INDUSTRY (DAYS/FACULTY)</td>
<td>14</td>
<td>17</td>
<td>36</td>
</tr>
<tr>
<td>STUDENTS (MSC &amp; PHD)</td>
<td>315</td>
<td>481</td>
<td>706</td>
</tr>
<tr>
<td>EDUCATIONAL PROGRAMS (MSC &amp; PHD)</td>
<td>6</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>INNOVATION PROGRAMS</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>GRADUATES</td>
<td>51</td>
<td>81</td>
<td>92</td>
</tr>
<tr>
<td>% OF GRADUATES INVOLVED IN INNOVATION ACTIVITIES</td>
<td>51</td>
<td>67</td>
<td>67</td>
</tr>
</tbody>
</table>

**VALUE GENERATION**

| ATTRACTION FUNDING (MLN.RUB)* | 265 | 348 | 554.7 |
| NEW ENTERPRISES (INCL. RESIDENTS OF SKOLKOVO) (CUMULATIVE) | 7 | 10 | 14 |
| PATENT APPLICATIONS PER FACULTY MEMBER | – | – | 0.2 |
| NEW EFFECTIVE PRACTICES FOR RUSSIAN UNIVERSITIES | 2 | 1 | 1 |

**PUBLICATIONS WITH INDUSTRY IMPACT**

| PUBLICATIONS WITH INDUSTRY IMPACT PER FACULTY MEMBER | 2.5 | 4.4 | 5.6 |
| KNOWLEDGE EXCHANGE WITH INDUSTRY | 14 | 17 | 36 |
| NEW EFFECTIVE PRACTICES FOR RUSSIAN UNIVERSITIES | 2 | 1 | 1 |

**PUBLICATIONS PER FACULTY**

| PUBLICATIONS PER FACULTY MEMBER | 2.5 | 4.4 | 5.6 |
| KNOWLEDGE EXCHANGE WITH INDUSTRY | 14 | 17 | 36 |
| NEW EFFECTIVE PRACTICES FOR RUSSIAN UNIVERSITIES | 2 | 1 | 1 |

**PUBLICATIONS WITH INDUSTRY IMPACT PER FACULTY MEMBER**

| PUBLICATIONS WITH INDUSTRY IMPACT PER FACULTY MEMBER | 2.5 | 4.4 | 5.6 |
| KNOWLEDGE EXCHANGE WITH INDUSTRY | 14 | 17 | 36 |
| NEW EFFECTIVE PRACTICES FOR RUSSIAN UNIVERSITIES | 2 | 1 | 1 |

**INNOVATION PROGRAMS**

| INNOVATION PROGRAMS | 2 | 4 | 3 |
| KNOWLEDGE EXCHANGE WITH INDUSTRY | 14 | 17 | 36 |
| NEW EFFECTIVE PRACTICES FOR RUSSIAN UNIVERSITIES | 2 | 1 | 1 |

**GRADUATES**

| GRADUATES | 51 | 81 | 92 |
| KNOWLEDGE EXCHANGE WITH INDUSTRY | 14 | 17 | 36 |
| NEW EFFECTIVE PRACTICES FOR RUSSIAN UNIVERSITIES | 2 | 1 | 1 |

**% OF GRADUATES INVOLVED IN INNOVATION ACTIVITIES**

| % OF GRADUATES INVOLVED IN INNOVATION ACTIVITIES | 15% | 15% | 20% |
| KNOWLEDGE EXCHANGE WITH INDUSTRY | 14 | 17 | 36 |
| NEW EFFECTIVE PRACTICES FOR RUSSIAN UNIVERSITIES | 2 | 1 | 1 |

---

* KPIs as indicated in the Grant Agreement with the Skolkovo Foundation

* Calculated as cash received.

### KPIs ANNOTATION

**FACULTY**

Faculty with (i) long-term (over one year) employment agreements with at least 20% working time or (ii) candidates for faculty positions with signed offers for such arrangements; the indicator is calculated as of the end of the calendar year.

**POSTDOCS & RESEARCHERS**

Research staff (excl. faculty) having employment agreements as of the end of the calendar year.

**PUBLICATIONS**

Ratio of faculty publications affiliated with Skoltech, indexed in WoS and/or Scopus, to the average number of faculty during the reporting period.

**PUBLICATIONS WITH INDUSTRY IMPACT**

Ratio of faculty publications affiliated with Skoltech on topics relevant to industry, or in co-authorship with industry representatives, to the average number of faculty during the reporting period.

**KNOWLEDGE EXCHANGE WITH INDUSTRY**

Total number of days spent by each faculty member (on average) on collaborating with industry, funded research, or doing internships in the abovementioned organizations; or (iv) continue at Skoltech to complete PhD programs (MSc graduates), from the total number of MSc and PhD graduates during the reporting period; this indicator is calculated based on alumni surveys.

**STUDENTS (MSc & PhD)**

Total number of MSc and PhD graduates as of the end of the calendar year.

**EDUCATIONAL PROGRAMS (MSC & PHD)**

Total number of MSc and PhD programs as of the end of the calendar year.

**INNOVATION PROGRAMS**

Total number of innovation-oriented courses (educational programs), research programs in the field of innovation, entrepreneurship programs as of the end of the calendar year.

**GRADUATES**

Total number of students that graduated from MSc and PhD programs during the reporting year.

**% OF GRADUATES INVOLVED IN INNOVATION ACTIVITIES**

% of MSc and PhD graduates who (i) are employed in industrial or research organizations in Russia, (ii) have established startups or are employed in the Skolkovo companies, (iii) are doing internships in the Skolkovo companies, (iv) continue at Skoltech to complete PhD programs (MSc graduates), from the total number of MSc and PhD graduates during the reporting period; this indicator is calculated based on alumni surveys.

**ATTRACTED FUNDING**

Income from external sources (excl. Skolkovo Foundation grant) to the total amount of Institute expenses during the reporting year.

**NEW ENTERPRISES (INCL. RESIDENTS OF SKOLKOVO)**

Companies established by Skoltech faculty, researchers, students.

**PATENT APPLICATIONS**

Ratio of total number of Skoltech patent applications to the average number of faculty during the reporting period.

**NEW EFFECTIVE PRACTICES FOR RUSSIAN UNIVERSITIES**

Total number of international practices of research and educational activities disseminated to Russian universities.
Institutional Development

EXPERT REVIEW OF THE CREIs

The Skoltech leadership initiated an expert review of the Institute’s eight CREIs4 for two purposes: (i) to address the IAC’s recommendation to review the CREI portfolio, focus on fewer areas and achieve a critical mass of full-time faculty, which, in turn, would help the Institute to stand out among its competitors and (ii) to form a basis for revising the Strategy of Development.

The evaluation framework focused primarily on research performance, education and innovation activities, and the potential of academic staff, partnerships and research infrastructure (presented and discussed at the meeting of the Academic Council, September 2016). The procedure was organized in the form of an external international review; the pool of experts included 67 representatives of leading universities, research centers, laboratories and industrial companies from Europe, the United States, Russia, Australia and Israel. The expertise was arranged within five key areas, defined in accordance with Skoltech research portfolio.

Table 1. Areas of expertise

<table>
<thead>
<tr>
<th>N</th>
<th>AREA OF EXPERTISE</th>
<th>COORDINATOR OF EXPERT REVIEW (COORDINATOR)</th>
<th>CREI(s) REVIEWED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Materials science, electrochemical energy conversion</td>
<td>Michael Levi, Associate Professor, Bar-Ilan University</td>
<td>CEE</td>
</tr>
<tr>
<td>2</td>
<td>Electrical and electromechanical engineering, optimization and control</td>
<td>Elena Lomonova, Professor, Eindhoven University of Technology</td>
<td>CES, SC</td>
</tr>
<tr>
<td>3</td>
<td>Micromechanics, mechanics of composites and porous media, geomechanics and hydraulic fracture</td>
<td>Mark Kachanov, Professor, Tufts University</td>
<td>CDMM, CHR</td>
</tr>
<tr>
<td>4</td>
<td>Optics, physics of condensed matter, and applied physics</td>
<td>Teun Klipwijk, Professor, TU Delft</td>
<td>CPQM</td>
</tr>
<tr>
<td>5</td>
<td>Biology and medicine</td>
<td>Fazly Ataullakhhanov, Professor, Moscow State University, Dmitry Rogachev National Research Center</td>
<td>CDIBB, CTB</td>
</tr>
</tbody>
</table>

The review was executed in two stages:
- The analysis of materials, including the CREIs’ initial development plans, completed and ongoing research projects as presented by CREI Directors, profiles of academic staff, publications, information on academic and industrial partners, educational courses, research equipment (September-December 2016),
- Site visits and panel sessions with CREI Directors, faculty, senior researchers, postdocs and PhD students (January-February, 2017).

Upon completion of the project, the coordinators and external experts submitted assessment reports on research performance (scale of results, quality of publications, etc.), education and innovation activities, and provided recommendations with respect to priorities for development and prospective partners.

In addition, the coordinators provided the following institution-wide recommendations to Skoltech senior management:
- CREI programs should be substantially revised and more focused; some programs require reorganization;
- An external review of the CREIs should be conducted on a regular basis;
- The following areas should be considered as having strong potential for attracting a critical mass of faculty: Life Sciences and Health, High Tech Systems and Materials and Energy;
- The Institutional organizational structure should comprise a combination of Departments and CREIs.

The results of the expert review were presented to the Academic Council (16 February 2017), the IAC (8-9 March 2017) and the Board of Trustees (26 March 2017). In accordance with the SAP, reviews of the CREIs will be conducted in 2018 and 2020, taking into consideration the recommendations of the Academic Council and the IAC with respect to improving the evaluation procedure.

STRATEGY UPDATE

In 2017, Skoltech senior management launched a planning process which resulted in updating the Institute’s strategic goals as well as a comprehensive review of the KPIs. The SAP planning process included comprehensive consultations with the IAC, the Board of Trustees, the Academic Council, the leadership of international peer institutions5 and international consulting companies. The recommendations considered during the SAP preparation included:
- IAC (8-9 March 2017): implementation of the University 3.0 concept, maintaining cutting-edge research with consideration of use; stratification of areas of excellence to align with both global and national priorities; structuring the Strategy with respect to initiatives, activity plans and appropriate quantitative KPIs;
- Board of Trustees (27 September 2017): importance of Skoltech international positioning; endowment growth; setting mechanisms for recruiting talented students; defining Skoltech advisory function; risk management; reflecting the humanitarian aspect of academic culture;
- Academic Council (14 September 2017, 8 December 2017): reinforcing mechanisms to attract high profile academic staff; the importance of being a student-oriented university; the necessity of defining ways to strengthen students’ entrepreneurial skills; emphasizing Skoltech impact on the Russian economy, technological agenda and society;
- Leadership of peer institutions – managing stakeholders’ expectations in terms of setting up a common vision

6 Discussions held with the leadership of KAIST, Postech, Technion, Weizmann Institute, University of Minho, MIT-Portugal Initiative, Cyprus Institute.

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4 “Review Report of the International Advisory Committee of the Skolkovo Institute of Science and Technology, 26-28 October 2015” (Section 2).

5 Micromechanics, mechanics of composites and porous media, geomechanics and hydraulic fracture.
and realistic KPIs, diversification of international collaborations, deeper integration into national scientific and higher education landscape through proactive cooperation with Russian academic institutions and universities;

- Consulting companies – intensifying work with alumni also in terms of graduates’ placement, importance of industrial contracts and endowment growth; necessity of benchmarking the Institute’s results with leading young peer universities.

The SAP determines five strategic goals:

1. **Focus & Governance**: ensure the Institute’s focus on vision and strategic plan monitoring and evaluation, shared governance and involvement of stakeholders.

2. **Academic Excellence**: perform cutting-edge basic and applied research, educate the next generation of science, technology and business leaders.

3. **Value Generation**: based on the Institute’s academic excellence and unique research facilities create business opportunities in the form of professional education, advisory services, centers of collective use services, industry-funded research and results implementation, technology licensing, new enterprises established by faculty, students and alumni, also in collaboration with the Skolkovo Foundation.

4. **Cooperation**: being a part of the Skolkovo ecosystem, strengthen academic and industrial network, build global cooperation programs and an alumni network, serve and strengthen engagement with the wider community.

5. **Campus**: design, deliver and bring into operation best-in-class space, facilities and infrastructure that enable the Institute’s vision.

In accordance with the SAP, the following Target Domains have been established based on technology priorities and experience:

- Data Science & Artificial Intelligence,
- Life Sciences & Biomedicine;
- Cutting-edge Engineering & Advanced Materials,
- Energy Efficiency,
- Quantum Technology,
- Advanced Studies.

Each domain serves as a lever for Institutional academic and brand excellence as well as forming a foundation for value generation. This foundation comprises the fields that have been and continue to be strong in Russia, i.e., Mathematics and Physics. This solid foundation is shored up with fields that will be of high importance for the future, and where Skoltech aims to be an international leader and a continuing source of future leaders for the Skolkovo community, Russia and the world (Fig. 1).

In addition, the SAP establishes eight strategic initiatives, specific tasks and actions, and strategic and operational KPIs for measuring progress and performance. The SAP has been considered and endorsed by the Board of Trustees (13 December 2017). As the next step, a comprehensive system of Institutional planning, monitoring and reporting on progress will be established.

**ORGANIZATIONAL CHART**

The Institute’s organizational chart (Fig. 2) specifies key functional blocks established in accordance with the SAP priorities: Institutional Development, Academic Excellence, Value Generation, Campus and Administrative Support (Back Office). The chart also indicates the senior management responsible for operational activities and reaching KPIs as well as the Target Domains established in the SAP in accordance with technology priorities and experience. Each Domain is represented by the corresponding CREIs and is a lever for the Institute’s academic and brand excellence as well as a foundation for value generation.

* The planned contribution of the CREIs to the strategic KPIs is indicated in the SAP.
In 2017, the Academic Council consisted of 19 members, including 12 members of the Skoltech faculty and administration, as well as seven external members. In September, Prof. Galina Tsirlina (Lomonosov Moscow State University) terminated her membership for personal reasons.

**Academic Council membership** (as of December 2017)

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Alexander Kuleshov</td>
<td>Chairman, President, Skoltech</td>
</tr>
<tr>
<td>Prof. Rupert Gezer</td>
<td>Deputy Chairman, Provost, Skoltech</td>
</tr>
<tr>
<td>Dr. Alexander Safonova</td>
<td>Academic Secretary, Vice President for Development, Skoltech</td>
</tr>
<tr>
<td>Prof. Iskander Akinatov</td>
<td>Director, CDMM, Skoltech</td>
</tr>
<tr>
<td>Dr. Jean Botti</td>
<td>CEO, Volgograd SAS</td>
</tr>
<tr>
<td>Prof. Alexey Buchachenko</td>
<td>CEE, Skoltech</td>
</tr>
<tr>
<td>Prof. Edward Crawley</td>
<td>Founding President, MIT</td>
</tr>
<tr>
<td>Dr. Alexander Fortman</td>
<td>Director on Science and Education, Skolkovo Foundation</td>
</tr>
<tr>
<td>Prof. Boris Fine</td>
<td>CPDM, Skoltech</td>
</tr>
<tr>
<td>Prof. Clement Fortin</td>
<td>Dean of Faculty and Postdoctoral Affairs, SC, Skoltech</td>
</tr>
<tr>
<td>Prof. Ildar Gabitov</td>
<td>CPOM, Skoltech</td>
</tr>
<tr>
<td>Prof. Grigoriy Kabatiansky</td>
<td>Advisor to the President for Science, Skoltech</td>
</tr>
<tr>
<td>Prof. Nikolay Kudryavtsev</td>
<td>Rector, Moscow Institute of Physics and Technology</td>
</tr>
<tr>
<td>Prof. Artem Oganesov</td>
<td>CEE, Skoltech</td>
</tr>
<tr>
<td>Prof. Andrei Okounev</td>
<td>University of California, San Diego</td>
</tr>
<tr>
<td>Prof. Pavel Pevzner</td>
<td>Moscow State University, Russian Academy of Sciences</td>
</tr>
<tr>
<td>Prof. Valery Rubakov</td>
<td>CEE and CES, Skoltech</td>
</tr>
<tr>
<td>Prof. Keith Stevenson</td>
<td>Dean of Research, Director of CEE and CES, Skoltech</td>
</tr>
</tbody>
</table>

**Academic Council**

During the year the Academic Council held four meetings. Issues of particular importance included:

- **Strategy of Skoltech Development** (recommendations for defining measures for retaining the best students, intensifying industrial collaborations, extending double degree programs to international universities, tracking the academic paths of PhD students, establishing limits for the number of PhD students per professor; and intensifying faculty outreach services),
- **Skoltech Strategic Action Plan 2018-2020**

(recommendations for setting a strategy for attracting the best faculty and researchers, managing stakeholders’ expectations and decreasing the proposed targets of the strategic KPIs, intensifying work with alumni, specifying operational KPIs for technology licensing).

Also, the Academic Council addressed the evaluation of the CREIs, reviewed the proposal for launching a BSc Program in Physics, established principles for formation of its Committees and carried out the planned rotation of their members.
ACADEMIC COUNCIL COMMITTEES

The Committees continued performing their duties in accordance with the Regulations on the Academic Council; as a rule, the meetings were held on a monthly basis.

Appointment, Promotion and Tenure Committee

Chair
Prof. Igor Krichever, Director of CAS

Members:
Prof. Iskander Akhatov, Director of CDMM
Prof. Maxim Fedorov, Director of CDISE
Dr. Alexander Fertman, Director on Science and Education, Skolkovo Foundation
Prof. Clement Fortin, Associate Provost, Dean of Faculty and Postdoctoral Affairs, SC
Prof. Idar Gabitov, CPQM
Prof. Yury Kotelevtsev, CTB
Prof. Albert Nasibulin, CPQM
Prof. Konstantin Severinov, Director of CDIBB
Prof. Keith Stevenson, Associate Provost, Dean of Research, Director of CEE and CES

Meetings
Regular – 9, absentee – 2

Resolutions
• faculty hiring decisions (16 positive, 67 negative resolutions);
• faculty contracts renewals (7 positive resolutions);
• faculty promotion (1 negative resolution);
• promotion of research scientists to assistant/associate professor (4 positive, 2 negative resolutions);
• nominations of faculty and researchers for scientific awards and scholarships (10 resolutions);
• approval of the compositions of the Expert Groups;
• approval of Policy on the Procedure for Appointment, Promotion and Tenure;
• approval of Faculty Promotion Procedure.

Educational Committee

Chair
Prof. Maxim Fedorov, Director of CDISE

Members:
Prof. Alexei Buchachenko, CEE
Prof. Alexei Cheremisin, CHR
Prof. Michael Cherntkov, CES
Prof. Clement Fortin, Associate Provost, Dean of Faculty and Postdoctoral Affairs, SC
Prof. Mikhail Gelfand, CDIBB
Prof. Anton Ivanov, Director of SC
Prof. Andrei Marshakov, CAS
Prof. Oleg Vasilyev, CDMM
Prof. Kevin Willoughby, CEI
Prof. Timofei Zatsepin, CTB
Prof. Andriy Zhugayevych, CEE

Meetings
Regular – 6, absentee – 0

Resolutions
• approval of MSs/PhD educational program portfolio and admission plan for the AF 2018-2019;
• approval of the principles for invited lecturers’ remuneration;
• recommendations on the Library development plan;
• approval of the mechanism for PhD students’ scholarships rate revision;
• approval of the list of candidates for the Chairs of the Federal State Attestation Committees;
• recommendations for the student industrial immersion program.

Committee on Research Programs and Projects

Chair
Prof. Artem Abakumov, CEE

Members:
Prof. Georgii Bazykin, CDIBB
Prof. Aldo Bischi, CES
Dr. Alexander Fertman, Director on Science and Education, Skolkovo Foundation
Prof. Anton Ivanov, Director of SC
Dr. Dmitry Katalevsky, Director of Department for Industrial Programs
Prof. Yury Kotelevtsev, CTB
Dr. Dmitry Lakontsov, CDISE
Prof. Andrei Osiptsov, CHR
Prof. Arkady Shipulin, CPQM
Dr. Nikolay Suetin, Vice President on Science and Education, Skolkovo Foundation
Prof. Igor Uzhinsky, CDMM

Meetings
Regular – 15, absentee – 6

Resolutions
• purchases of research equipment (11 positive, 2 negative resolutions);
• recommendations based on the results of the review of the CREIs;
• approval of the procedure on evaluating research partnership agreements;
• review of interim reports on active research grants and projects (14 positive resolutions);
• review of scope of work on the MRAs (19 positive resolutions);
• review of interim reports on the MRAs (16 positive resolutions);
• review of new research initiatives and projects (9 cases considered).
Research

During the first phase of establishing and fostering Skoltech highly competitive research strategy (2011-2015), an international competition was conducted to define strategic emerging research areas expected to have high technological importance and an impact both on Russia and the world. The leadership originally planned to determine 15 such research areas, each of which would nucleate the CREIs.

Based on the results of an evaluation conducted by the IAC in 2015, and taking into account various economic and political factors, the leadership decided to reduce the number of research areas in order to concentrate its resources and achieve a critical mass of full-time faculty in these areas. This, in turn, would enable Skoltech to stand out among its competitors.

During the second phase of Skoltech development (2016-2017), the leadership further decided to leverage fields which are traditionally strong in Russia, i.e., Mathematics and Physics. For this purpose, the Center for Advanced Studies was formed, and a team of internationally leading mathematicians and physicists were hired. Collaborations with leading universities in this area were also established. In addition, the Center for Computational and Data-Intensive Science and Engineering (CDISE) was strategically expanded and is now the fastest growing CREI at Skoltech. The concept is to use the CDISE as the basis to integrate the fields of science that will be very important for future growth.

Skoltech CREIs, having specific research focus areas (see Section “Target Domains”), are incorporated into the Target Domains to support the execution of established institutional goals.

In the upcoming phase of Skoltech development, a further step will be introduced. Skoltech will refine strategic areas of growth and development, adopt and adapt to more interdisciplinary approaches and move into new emerging areas of breakthrough technologies. The new research programs will be designed in a way to involve most or all the CREIs as well as leading international collaborators, including MIT.

As the pilot approach Skoltech launched the NGP Program, which complements Phase II of its collaboration with MIT, as well as the Biomedical Initiative. In addition, in December 2017, the Research Initiatives Office arranged a Call for ideas to identify a few emerging breakthrough research topics that can be developed into multidisciplinary programs with a team-based format (e.g. network programs, research-driven collaborative projects, etc.). Within the Call, 13 proposals were submitted by Skoltech faculty and researchers. These proposals will be reviewed and discussed to identify up to three areas for the new Call for Proposals (planned for 2018).

RESEARCH FACILITIES

Skoltech current research facilities (in total 6,150 sq.m) were established to support its strategy and enable collaborations. Several world-class laboratories are fully operational: Enhanced Oil Recovery, Additive Manufacturing, Concurrent Engineering Design, Intelligent Space Robotics, 4D Analysis, Information Technologies for Advanced Manufacturing, Internet of Things, Hybrid Photonics, Nanomaterials, Design, Manufacturing and Materials, Mass Spectrometry, Electrochemical Energy Storage, Soil Informatics, Tensor Networks and a refitted Masterskaya.

All laboratories are outfitted with state-of-the-art equipment; the researchers, engineers and technical staff have been trained at leading international universities to operate and maintain the equipment. In 2017, the Masterskaya laboratory cooperated with several companies, including YG1 and Renova AI on the joint use of the infrastructure to demonstrate the companies’ products. In collaboration with the IoT laboratory and TwinsTech, a pilot project for investigating interactions of modern industrial equipment and IoT technologies was completed. In addition, Masterskaya started working with the Navigator Campus on production of industrial prototypes. The facilities were also used by several startup companies, including Tsuru, Tardis, and Morphing Technologies.

In 2018, three major shared facilities will be operationalized: the Advanced Mass Spectrometry Facility, the Advanced Imaging Facility and the Advanced Genomics Facility. The table and chart below present the current research infrastructure as well as facilities planning in new campus (East Ring).

Table 2. Skoltech research infrastructure

<table>
<thead>
<tr>
<th>TARGET LABORATORY</th>
<th>STATUS (LOCATION)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet-of-Things laboratory (CDISE)</td>
<td>operational (TPOC-4), also planned in East Ring</td>
</tr>
<tr>
<td>Soil Informatics laboratory (CDISE)</td>
<td>operational (TPOC-4), also planned in East Ring</td>
</tr>
<tr>
<td>Tensor Networks and Deep learning for application in data-mining laboratory (CDISE)</td>
<td>operational (TPOC-4), also planned in East Ring</td>
</tr>
<tr>
<td>Laboratory for 4D analysis (CDISE)</td>
<td>operational (TPOC-4), also planned in East Ring</td>
</tr>
<tr>
<td>Comparative OMICS lab (ICBrain project) (CDISE)</td>
<td>operational (TPOC-4), also planned in East Ring</td>
</tr>
<tr>
<td>Joint Lab Skoltech – Dokuchaev Soil Science Institute (CDISE)</td>
<td>operational (Dokuchaev Soil Institute)</td>
</tr>
<tr>
<td>Research Center “Neurostream” (CDISE)</td>
<td>operational (Research Center of Neurology)</td>
</tr>
<tr>
<td>Wireless Sensing Lab (CDISE)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>HPC &amp; Big Data Lab (CDISE)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Automated Innovation Lab (CDISE)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Advanced Computing (CDISE)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Visual Sensing and Data Fusion (CDISE)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Virtual Reality Lab (CDISE)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Distributed Intelligent Systems (CDISE)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Biomedical Image Analysis (CDISE)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Quantum Software (CDISE)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Molecular Informatics (CDISE)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Artificial Intelligence (CDISE)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Computer Vision (CDISE)</td>
<td>in planning (East Ring)</td>
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<tr>
<td>Industrial Analytics Lab (CDISE)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Prototype Lab (CDISE)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>CyberAcademy (CDISE)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Student teaching laboratory (CDBB)</td>
<td>operational (Technopark)</td>
</tr>
<tr>
<td>Laboratory at the Institute of Gene Biology (CDBB)</td>
<td>operational (Institute of Gene Biology)</td>
</tr>
<tr>
<td>Joint Lab Skoltech – All-Russia Rice Research Institute (CDBB)</td>
<td>operational (All-Russia Rice Research Institute)</td>
</tr>
<tr>
<td>Joint Research Center Skoltech – Peter the Great St.Petersburg Polytechnic University (CDBB)</td>
<td>operational (SPbPU)</td>
</tr>
<tr>
<td>Joint Lab Skoltech – Institute of Developmental Biology (CTB)</td>
<td>operational (Institute of Developmental Biology)</td>
</tr>
<tr>
<td>Joint Lab Skoltech – Moscow State University (CTB)</td>
<td>operational (MSU)</td>
</tr>
<tr>
<td>Mass-Spectrometry Lab (CTB)</td>
<td>TPOC-4 (shared facilities in East Ring)</td>
</tr>
<tr>
<td>TARGET DOMAIN</td>
<td>LABORATORY</td>
</tr>
<tr>
<td>---------------</td>
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</tr>
<tr>
<td>Student teaching laboratories (3x) (CDIBB)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Research laboratories (2x) (CDIBB)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Research laboratory (CDIBB)</td>
<td>in planning (East Ring)</td>
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<tr>
<td>Research laboratory (CDIBB)</td>
<td>in planning (East Ring)</td>
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<td>in planning (East Ring)</td>
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<tr>
<td>Research laboratory (CDIBB)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Research laboratory (CDIBB)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Functional Genomics laboratory (CTB)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Composite Materials and Structures laboratory (CDMMI)</td>
<td>TPOC-3 / TPOC-4, also planned in East Ring</td>
</tr>
<tr>
<td>Additive Manufacturing laboratory (CDMM)</td>
<td>operational (TPOC-3), also planned in East Ring</td>
</tr>
<tr>
<td>IT for Advanced Manufacturing laboratory (CDMM)</td>
<td>operational (TPOC-3), also planned in East Ring</td>
</tr>
<tr>
<td>Micro- and Nanomechanics laboratory (CDMM)</td>
<td>operational (TPOC-3), also planned in East Ring</td>
</tr>
<tr>
<td>Mechanical Testing and Material Characterization laboratory (CDMM)</td>
<td>operational (TPOC-3), also planned in East Ring</td>
</tr>
<tr>
<td>Production of aluminum honeycomb panels laboratory (CDMM)</td>
<td>operational (TPOC-3), also planned in East Ring</td>
</tr>
<tr>
<td>Concurrent Engineering Design laboratory (SC)</td>
<td>operational (TPOC-3), also planned in East Ring</td>
</tr>
<tr>
<td>Intelligent Space Robotics Lab (SC)</td>
<td>operational TPOC-3 / TPOC-4, also planned in East Ring</td>
</tr>
<tr>
<td>Joint Skolk – Oerlikon lab (CDMMI)</td>
<td>under construction TPOC-2, also planned in East Ring</td>
</tr>
<tr>
<td>System and Product Development laboratory (SC)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Space Data laboratory (SC)</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td>Space Technologies Laboratory (Nanosatellites, SC)</td>
<td>in planning (TPOC-3 / East Ring)</td>
</tr>
<tr>
<td>Electrochemical Energy Storage laboratory (CEE)</td>
<td>operational (TPOC-3), also planned in East Ring</td>
</tr>
<tr>
<td>Pilot Scale Cathode Materials Manufacturing (CEE)</td>
<td>operational (TPOC-3), also planned in East Ring</td>
</tr>
<tr>
<td>Computational Materials Discovery laboratory (CEE)</td>
<td>operational (TPOC-4), also planned in East Ring</td>
</tr>
<tr>
<td>Energy Systems laboratory (CES)</td>
<td>operational (TPOC-3), also planned in East Ring</td>
</tr>
<tr>
<td>Enhanced Oil Recovery Lab (CHRI)</td>
<td>operational (Renova Lab), also planned in East Ring</td>
</tr>
<tr>
<td>Joint Research Center Skolktech-Dmitry Mendeleev University of Chemical Technology of Russia (CEE)</td>
<td>operational (Dmitry Mendeleev University)</td>
</tr>
<tr>
<td>Joint Research Center Skolktech - Institute of Problems of Chemical Physics (CEE)</td>
<td>operational (Institute of Problems of Chemical Physics)</td>
</tr>
<tr>
<td>Nanomaterials laboratory (CPQM)</td>
<td>operational (TPOC-3), also planned in East Ring</td>
</tr>
<tr>
<td>Hybrid Photonics laboratory (CPQM)</td>
<td>operational (TPOC-4), also planned in East Ring</td>
</tr>
<tr>
<td>Plasmonics laboratory (CPQM)</td>
<td>operational (TPOC-3), also planned in East Ring</td>
</tr>
<tr>
<td>Biophotonics laboratory (CPQM)</td>
<td>operational (TPOC-3), also planned in East Ring</td>
</tr>
</tbody>
</table>

### Figure 3. Skoltech research infrastructure by target domain (including shared facilities), in sq.m

<table>
<thead>
<tr>
<th>TARGET DOMAIN</th>
<th>LABORATORY</th>
<th>STATUS (LOCATION)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atomic Clock laboratory (CPQM)</td>
<td>under construction (TPOC-4), also planned in East Ring</td>
<td></td>
</tr>
<tr>
<td>Nano Electronic and Opto Electronic Lab (CPQM)</td>
<td>operational (TPOC-4), also planned in East Ring</td>
<td></td>
</tr>
<tr>
<td>Optic Communication Lab (CPQM)</td>
<td>operational (TPOC-4), also planned in East Ring</td>
<td></td>
</tr>
<tr>
<td>Advanced Studies</td>
<td>Office premises (CAS)</td>
<td>operational (TPOC-4), also planned in East Ring</td>
</tr>
<tr>
<td>Shared Facilities</td>
<td>HPC Data Center</td>
<td>operational (TPOC-4), also planned in East Ring</td>
</tr>
<tr>
<td></td>
<td>Histology and Phenotyping laboratory</td>
<td>operational (TPOC-4), also planned in East Ring</td>
</tr>
<tr>
<td></td>
<td>Biological Imaging laboratory</td>
<td>operational (TPOC-4), also planned in East Ring</td>
</tr>
<tr>
<td></td>
<td>Genome Sequencing laboratory</td>
<td>operational (TPOC-4), also planned in East Ring</td>
</tr>
<tr>
<td></td>
<td>Mass Spectrometry laboratory</td>
<td>operational (TPOC-4), also planned in East Ring</td>
</tr>
<tr>
<td></td>
<td>Workshops (Student Masterskaya)</td>
<td>operational (TPOC-4), also planned in East Ring</td>
</tr>
<tr>
<td></td>
<td>Vivarium</td>
<td>in planning (East Ring)</td>
</tr>
<tr>
<td></td>
<td>Cleanroom</td>
<td>in planning (East Ring)</td>
</tr>
</tbody>
</table>

![Figure 3. Skoltech research infrastructure by target domain (including shared facilities), in sq.m](image-url)
In 2017, 49 grant proposals within national and international programs (i.e., Horizon 2020, the BRICS framework program in science and innovation, calls for proposals for priority areas (Russian Science Foundation), the Russian Presidential Program for Young Scientists) were submitted by Skoltech faculty and researchers. In all, 19 proposals were awarded funding equal to 256.3 million RUB. While some research projects involve the work of more than one CREI, CDISE, CPQM and CEE have the largest funding recipients (Fig. 4).

Awards from the Russian Science Foundation and the Ministry of Education and Science comprised the largest portions, amounting to 118.8 million RUB and 90 million RUB, respectively. The third highest sponsor is European Funding Horizon 2020 (363,000 EUR). The distribution of newly awarded grants is presented below:

**Russian Science Foundation**
- **Total amount**: 118.8 mln RUB
- **Winners (PIs)**: Prof. Ivan Oseledets (CDISE) 18.0 mln RUB, Prof. Albert Nasibulin (CPQM) 18.0 mln RUB, Prof. Boris Fine (CPQM) 18.0 mln RUB, Dr. Andrey Kazak (CHR) 15 mln RUB, Dr. Oleg Lyakhovskiy (CPQM) 15.0 mln RUB, Dr. Alexander Kruchinin (CEE) 15.0 mln RUB, Prof. Alexey Buchachenko (CEE) 13.8 mln RUB, Dr. Igor Ostanin (CDISE) 3.0 mln RUB, Dr. Olga Sergeeva (CTB) 3.0 mln RUB

**Ministry of Education and Science**
- **Total amount**: 90.0 mln RUB (Megagrant)
- **Winners (PIs)**: Prof. Andrzej Cichocki (CDISE) – establishing the laboratory “Tensor Networks and Deep Learning for Applications in Data Mining”

**Horizon 2020**
- **Total amount**: 363,000 EUR (25 mln RUB)
- **Winners (PIs)**: Prof. Evgeny Nikolaev (CTB) – infrastructural project “European Network of Fourier-Transform Ion-Cyclotron-Resonance Mass Spectrometry Centers” will be implemented during 2018-2020 in consortia with the University of Warwick, the National Center for Scientific Research (CNRS), the University of Liege and the University La Sapienza.

**Russian Foundation for Basic Research**
- **Total amount**: 10.5 mln RUB
- **Winners (PIs)**: Prof. Artem Abakumov (CEE) 5.0 mln RUB, Prof. Konstantin Severinov (CDIBB) 3.4 mln RUB, Prof. Ivan Oseledets (CDISE) 2.1 mln RUB

**Other (Philip Morris)**
- **Total amount**: 12.0 mln RUB
- **Winners (PIs)**: Prof. Konstantin Severinov (CDIBB)

**Projects implemented in 2017**

The total amount of grant funding (contracted) in 2017 reached 141.9 mln RUB. The distribution of these funds between the CREIs is presented below.

**Figure 5. Grant funding 2017 by CREI (mln RUB)**

**CDISE**: 61.0, **CDIBB**: 18.6, **CTB**: 1.5, **CDMM**: 5.0, **CEE**: 27.0, **CES**: 10.8, **CHR**: 17.0, **CPQM**: 30.0, **CAS**: 60.0
29 projects were carried out by Skoltech research teams during the year:

<table>
<thead>
<tr>
<th>PRINCIPAL INVESTIGATOR</th>
<th>CRIE</th>
<th>PROJECT</th>
<th>FUNDING AGENCY</th>
<th>TOTAL GRANT</th>
<th>TIMELINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Dmitry Gilyarov</td>
<td>CDIBB</td>
<td>New antibiotics from natural products: Structure of thiazole/oxazole heterocyclase</td>
<td>RFBR</td>
<td>2.3 mln RUB</td>
<td>2016-2018</td>
</tr>
<tr>
<td>Dr. Evgeny Klimuk</td>
<td>CDIBB</td>
<td>Study of the regulation of expression of the genes of the restriction-modification Kpn2I system</td>
<td>RFBR</td>
<td>5.1 mln RUB</td>
<td>2016-2018</td>
</tr>
<tr>
<td>Prof. Konstantin Severinov</td>
<td>CDIBB</td>
<td>Engineering thermophage particles for studying virus assembly</td>
<td>RFBR</td>
<td>2.25 mln RUB</td>
<td>2016-2018</td>
</tr>
<tr>
<td>Prof. Konstantin Severinov</td>
<td>CDIBB</td>
<td>Identification of Key genetic/epigenetic Marker(s) in cervical carcinogenesis and development of corresponding Molecular Therapeutics for precision medicine of cervical cancer</td>
<td>RFBR</td>
<td>3.4 mln RUB</td>
<td>2017-2018</td>
</tr>
<tr>
<td>Prof. Philipp Khaitovich</td>
<td>CDIBB</td>
<td>Organization of neuronal response mechanisms in primate, rodent and invertebrate brains</td>
<td>RSF</td>
<td>18 mln RUB</td>
<td>2016-2018</td>
</tr>
<tr>
<td>Dr. Alexander Mikhailov</td>
<td>CDISE</td>
<td>Rectangular maximum volume submatrices: theory and applications</td>
<td>RFBR</td>
<td>1.35 mln RUB</td>
<td>2016-2018</td>
</tr>
<tr>
<td>Dr. Alexei Naumov</td>
<td>CDISE</td>
<td>Spectral analysis of random high-dimensional matrices</td>
<td>RFBR</td>
<td>0.9 mln RUB</td>
<td>2017-2018</td>
</tr>
<tr>
<td>Prof. Andrzej Cichocki</td>
<td>CDISE</td>
<td>Tensor methods and machine learning methods for modeling and optimization of complex multiparametric systems</td>
<td>Ministry of Education and Science</td>
<td>90 mln RUB</td>
<td>2017-2019</td>
</tr>
<tr>
<td>Dr. Igor Ostanin</td>
<td>CDISE</td>
<td>Nonlocal methods for modeling physical media</td>
<td>RFBR</td>
<td>5.1 mln RUB</td>
<td>2016-2018</td>
</tr>
<tr>
<td>Dr. Igor Ostanin</td>
<td>CDISE</td>
<td>Massively parallelized environment for modeling the mechanics of nanotubes and nanoparticles using the discrete element method</td>
<td>RSF</td>
<td>3 mln RUB</td>
<td>2017-2019</td>
</tr>
<tr>
<td>Dr. Igor Ostanin</td>
<td>CDISE</td>
<td>Multiscale mechanical modeling of carbon nanotube based materials using generalized discrete element method</td>
<td>RFBR</td>
<td>1.35 mln RUB</td>
<td>2016-2018</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRINCIPAL INVESTIGATOR</th>
<th>CRIE</th>
<th>PROJECT</th>
<th>FUNDING AGENCY</th>
<th>TOTAL GRANT</th>
<th>TIMELINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Ivan Oseledets</td>
<td>CDISE</td>
<td>Methods for solving integral and differential equations on ultrafine grids of a special structure</td>
<td>RFBR</td>
<td>6 mln RUB</td>
<td>2016-2018</td>
</tr>
<tr>
<td>Prof. Ivan Oseledets</td>
<td>CDISE</td>
<td>Tensor methods and machine learning methods for modeling and optimization of complex multiparametric systems</td>
<td>RSF</td>
<td>18 mln RUB</td>
<td>2016-2018</td>
</tr>
<tr>
<td>Prof. Ivan Oseledets</td>
<td>CDISE</td>
<td>Solution methods for large linear systems with block low-rank and sparse matrices</td>
<td>RFBR</td>
<td>2.1 mln RUB</td>
<td>2017-2019</td>
</tr>
<tr>
<td>Dr. Maxim Rakhuba</td>
<td>CDISE</td>
<td>Fast tensor approach to electronic structure calculation</td>
<td>RFBR</td>
<td>1.35 mln RUB</td>
<td>2016-2018</td>
</tr>
<tr>
<td>Dr. Alexander Kvashnin</td>
<td>CEE</td>
<td>Computational design for new materials with optimal hardness and fracture toughness</td>
<td>RSF</td>
<td>15 mln RUB</td>
<td>2017-2019</td>
</tr>
<tr>
<td>Prof. Alexei Buchachenko</td>
<td>CEE</td>
<td>Modeling of stability, structure and spectra of atoms and small molecules in inert gas crystals</td>
<td>RSF</td>
<td>13.8 mln RUB</td>
<td>2016-2018</td>
</tr>
<tr>
<td>Prof. Andry Zhugaevich</td>
<td>CEE</td>
<td>Understanding the dependence of charge transport on morphology in organic semiconductor films</td>
<td>Volkswagen</td>
<td>0.04 mln EUR</td>
<td>2017-2018</td>
</tr>
<tr>
<td>Prof. Artem Abakumov</td>
<td>CEE</td>
<td>Nanoarchitectured Fluorophosphate Cathode &amp; Phosphorene-Based Hybrid Anode for Sodium-Ion Batteries</td>
<td>RFBR</td>
<td>3.4 mln RUB</td>
<td>2017-2018</td>
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<tr>
<td>Prof. Artem Abakumov</td>
<td>CEE</td>
<td>Novel mixed polyanion cathode materials for metal-ion batteries</td>
<td>RFBR</td>
<td>2.1 mln RUB</td>
<td>2017-2019</td>
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<tr>
<td>Prof. Artem Oganov</td>
<td>CEE</td>
<td>New methods for predicting materials with optimal properties</td>
<td>RSF</td>
<td>18 mln RUB</td>
<td>2016-2018</td>
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<tr>
<td>Prof. Keith Stevenson</td>
<td>CEE</td>
<td>Design of advanced organic cathode materials for lithium and sodium batteries</td>
<td>RSF</td>
<td>18 mln RUB</td>
<td>2016-2018</td>
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<tr>
<td>Dr. Diana Susareva</td>
<td>CEE</td>
<td>Design of self-assembling donor-acceptor block-copolymers for highly efficient and stable solar cells</td>
<td>RFBR</td>
<td>4.9 mln RUB</td>
<td>2016-2018</td>
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<tr>
<td>PRINCIPAL INVESTIGATOR</td>
<td>CREI</td>
<td>PROJECT</td>
<td>FUNDING AGENCY</td>
<td>TOTAL GRANT</td>
<td>TIMELINE</td>
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<td>------------------------</td>
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</tr>
<tr>
<td>Dr. Andrey Kazak</td>
<td>CHR</td>
<td>Pore Water as a Key Component of Hydrocarbon Reservoir Model of the Bazhenov Source Rock, West Siberia, Russian Federation</td>
<td>RSF</td>
<td>15 mln RUB</td>
<td>2017-2019</td>
</tr>
<tr>
<td>Dr. Evgeniy Chuvilin</td>
<td>CHR</td>
<td>Gas hydrates as a source of geological risk in the exploration of oil and gas fields in the Arctic</td>
<td>RSF</td>
<td>17 mln RUB</td>
<td>2016-2018</td>
</tr>
<tr>
<td>Prof. Albert Nasibulin</td>
<td>CPQM</td>
<td>New generation of transparent, conductive, flexible and stretchable films of single-walled carbon nanotubes produced by aerosol CVD synthesis method</td>
<td>RSF</td>
<td>18 mln RUB</td>
<td>2017-2019</td>
</tr>
<tr>
<td>Prof. Boris Fine</td>
<td>CPQM</td>
<td>Statistical behavior of thermally isolated many-body quantum systems</td>
<td>RSF</td>
<td>18 mln RUB</td>
<td>2017-2019</td>
</tr>
<tr>
<td>Dr. Oleg Lychkovskiy</td>
<td>CPQM</td>
<td>Quantum adiabaticity in many-particle systems</td>
<td>RSF</td>
<td>15 mln RUB</td>
<td>2017-2019</td>
</tr>
<tr>
<td>Dr. Olga Sergeeva</td>
<td>CTB</td>
<td>Validation of long non-coding RNA L135 as a regulator of gene expression and a potential target for therapy</td>
<td>RSF</td>
<td>3 mln RUB</td>
<td>2017-2019</td>
</tr>
</tbody>
</table>

**Trends in grant funding**

The tables and charts below summarize the general trends of Skoltech grant support occurred from 2015 through 2017, as well as anticipated for 2018 through 2020.

**The amount of funding secured for the period of 2018-2020 (as of December, 2017) is 205.9 million RUB. The distribution of funding per CREI and Target Domain is presented below.**
In 2017, Skoltech academic staff and students published 512 papers that were indexed in WoS and/or Scopus. Of these, 348 were authored by faculty members. There was an increase in the number of papers with international and Russian partners, as well as with the representatives of industrial companies (see Table 3).
The charts below summarize general Skoltech publication trends with regards to productivity and collaborations during the period of 2015-2017.
CREI PARTNERSHIP PROGRAMS

Skoltech is developing networks with top international and Russian universities and research teams in the areas identified in the research priorities. Capacity building for Skoltech leverages faculty, postdoc and student exchange programs, as well as joint research projects, and supports a wide range of education and research events. The initial concept was that many partners would be funded by Skoltech. In this regard a number of one- to six-year MRAs were executed and 21 of them were carried out during the period of 2015-2017. Increasingly, Skoltech has moved to a more mature model and some partnerships were discontinued as they became no longer effective.

In 2017, a new MRA execution procedure was enforced in order to streamline the assessment process. In accordance with the new procedure, Skoltech Dean of Research oversees the execution of the MRAs, while the Academic Council Committee on Research Program and Projects reviews and evaluates scope of activities and performance.

During the year, 27 research-driven projects were implemented within the framework of the respective CREI research focus areas. In addition to collaborative research contributions, the partner organizations have fostered Skoltech capacity building, including the following deliverables:

- joint publications,
- lectures and courses for Skoltech (CES, CEE), hosting Skoltech students for conducting research projects (CES, CDMM, CTB, CEE),
- provision of access to the infrastructure and facilities (CEE, CTB, CHR), assistance with design and commissioning of laboratories (CES, Smart Grids),
- joint scientific events (CES, CHR, CDMM, CTB, CEE),
- support with preparing and submission of proposals for funding to Russian and international governmental organizations, agencies, industry, as well as preparation of joint patent applications (CHR).

MRAs active in 2017

<table>
<thead>
<tr>
<th>Partnership</th>
<th>Institution</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>CES</td>
<td>Caltech, United States</td>
<td>Ongoing since 2015</td>
</tr>
<tr>
<td></td>
<td>The University of Newcastle upon Tyne, United Kingdom</td>
<td>Ongoing since 2014</td>
</tr>
<tr>
<td></td>
<td>Massachusetts Institute of Technology, United States</td>
<td>Project of 2015-2017</td>
</tr>
<tr>
<td>CHR</td>
<td>Heriot-Watt University, United Kingdom</td>
<td>Ongoing since 2014</td>
</tr>
<tr>
<td></td>
<td>University of Calgary, Canada</td>
<td>Ongoing since 2014</td>
</tr>
<tr>
<td></td>
<td>Bashkry State University, Russia</td>
<td>Ongoing since 2014</td>
</tr>
<tr>
<td></td>
<td>Institute of Petroleum and Gas Geology and Geophysics, Russia</td>
<td>Ongoing since 2014</td>
</tr>
<tr>
<td>CDMM</td>
<td>University of Dayton, United States</td>
<td>Ongoing since 2014</td>
</tr>
<tr>
<td></td>
<td>Katholieke Universiteit Leuven, Belgium</td>
<td>Terminated in 2017</td>
</tr>
<tr>
<td></td>
<td>Bashkry State University, Russia</td>
<td>Ongoing since 2016</td>
</tr>
<tr>
<td>CTB</td>
<td>Massachusetts Institute of Technology, United States</td>
<td>Ongoing since 2013</td>
</tr>
<tr>
<td></td>
<td>Lomonosov Moscow State University, Russia</td>
<td>Ongoing since 2013</td>
</tr>
<tr>
<td>CEE</td>
<td>Massachusetts Institute of Technology, USA</td>
<td>Ongoing since 2013</td>
</tr>
<tr>
<td></td>
<td>Lomonosov Moscow State University, Russia</td>
<td>Ongoing since 2013</td>
</tr>
<tr>
<td>CPQM</td>
<td>St. Petersburg National Research Academic University of RAS, Russia</td>
<td>Ongoing since 2017</td>
</tr>
</tbody>
</table>
NEXT GENERATION PROGRAM: SKOLTECH-MIT JOINT PROJECTS

The NGP is one of the formats of the Skoltech-MIT partnership to establish and promote a mutually beneficial long-term collaboration in research, education and innovation through joint research-driven projects, as well as the further development of Skoltech streams within the development programs. During the year, the projects selected under the first Call (2015) were implemented:

<table>
<thead>
<tr>
<th>SKOLTECH PROJECT LEADER (PL)</th>
<th>MIT PL AND CO-PL</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Artem Abakumov, CEE</td>
<td>Yet-Ming Chiang, Kyocera Professor, National Academy of Engineering</td>
<td>Exploring Potassium-Ion Batteries</td>
</tr>
<tr>
<td>Prof. Natalia Belioff, CPQM</td>
<td>Keith Adam Nelson, Haslam and Dewey Professor of Chemistry Department</td>
<td>Polaritronics Providing a Paradigm Shift in Optoelectronics</td>
</tr>
<tr>
<td>Prof. Pavlos Lagoudakis, CPQM</td>
<td>Konstantin Turitsyn, Assistant Professor, Mechanical Engineering</td>
<td>Integration and Control of Heat and Power Systems with Variable Loads</td>
</tr>
<tr>
<td>Prof. Boris Fine, CES</td>
<td>Nuh Gedik, Associate Professor, Physics</td>
<td>Investigations of High-Temperature Superconductors and Other Complex Quantum Materials</td>
</tr>
<tr>
<td>Prof. Victor Lempitsky, CDISE</td>
<td>Associate Professor, Associate Member Department of Biological Engineering, MIT Broad Institute of MIT and Harvard</td>
<td>Deep Learning Tools and Algorithms for Cell Image Analysis</td>
</tr>
<tr>
<td>Prof. Albert Nasibulin, CPQM</td>
<td>A. John Hart, Associate Professor, Dept. of Mechanical Engineering, Xuanbo Zhao, Associate Professor, Dept. of Mechanical Engineering</td>
<td>Carbon Nanomaterial Manufacturing Platforms for Interactive Surfaces and Smart Prosthetics</td>
</tr>
<tr>
<td>Prof. Evgeny Nikolayev, SC</td>
<td>Luis F. Velásquez-García, Principal Scientist, Microsystems Technology Laboratories</td>
<td>3D-Printed, Miniaturized Cassian Trap Mass Spectrometer for Space Research and General Ambient Analysis Applications</td>
</tr>
<tr>
<td>Prof. Ivan Osledets, CDISE</td>
<td>Luca Daniel, Professor of Electrical Engineering and Computer Science, Electrical Engineering and Computer Science</td>
<td>High-Dimensional Uncertainty Quantification: from Component to Systems Design</td>
</tr>
<tr>
<td>Prof. Timofei Zatsespin, CEE</td>
<td>Daniel Anderson, Associate Professor, Chemical Engineering, Institute for Medical Engineering and Science</td>
<td>Regulation of Antitumor Response via Modulation of Ubri-Ubiquitin Ligases In Vivo</td>
</tr>
<tr>
<td>Prof. Athanasios Polimeridis, CDISE</td>
<td>Jacob White, Cecil H. Green Professor, Electrical Engineering and Computer Science</td>
<td>Next Generation Fast Methods for Medical and Nanoscale Technology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SKOLTECH PROJECT LEADER (PL)</th>
<th>MIT PL AND CO-PL</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Konstantin Severinov, CDIBB</td>
<td>Feng Zhang, James &amp; Patricia Poitras Professor in Neuroscience, Department of Brain and Cognitive Sciences</td>
<td>Search and Development of New Genome Editing Tools for Biomedicine and Biotechnology</td>
</tr>
<tr>
<td>Prof. Alexander Shapeev, CDISE</td>
<td>Ju Li, Battelle Energy Alliance Professor, Nuclear Science and Engineering &amp; Materials Science and Engineering</td>
<td>Machine Learning Elastic Strain Engineering</td>
</tr>
<tr>
<td>Prof. Mikhail Skvortsov, CPQM</td>
<td>Karl Berggren, Full Professor, Quantum Nanostructures and Nanofabrication Group</td>
<td>Quantum Materials for Superconducting Nanophotonics</td>
</tr>
<tr>
<td>Prof. Pavel Treshin, CEE</td>
<td>Tonio Buonsante, Associate Professor, Mechanical Engineering</td>
<td>Improved Stability and Performance in Highly Efficient Lead-Free Hybrid Perovskite Solar Cells</td>
</tr>
<tr>
<td>Prof. Dmitriy Tosterukou, SC</td>
<td>Kamal Youssef-Toumi, Professor, Director of Mechatronics Research Lab, Department of Mechanical Engineering</td>
<td>RecyBot: High-Speed Intelligent Robotic System with Computer Vision for Electronics Recycling</td>
</tr>
</tbody>
</table>

The projects interim reports are to be received for review in February, 2018. In 2017, a second Call for Proposals was held to allow recently hired faculty to benefit from the opportunity to collaborate with MIT. Out of the 11 White Papers received – five were selected for submission of Full Proposals. All Full Proposal were evaluated by the group of four experts proposed by the Skolkovo Foundation and MIT. In addition, a joint Skoltech/MIT Steering Committee was established to consider peer reviews and make the final evaluation.

Four projects were supported and partly co-funded by MIT:

<table>
<thead>
<tr>
<th>SKOLTECH PROJECT LEADER (PL)</th>
<th>MIT PL</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Evgeny Burnaev, CDISE</td>
<td>Justin Solomon, X- Consortium Career Development Assistant Professor, MIT Department of Electrical Engineering &amp; Computer Science</td>
<td>Simulation and Transfer Learning for Deep 3D Geometric Data Analysis</td>
</tr>
<tr>
<td>Prof. Grigory Kabatiansky, CDISE</td>
<td>Yury Polyansky, Associate Professor, Electrical Engineering and Computer Science (EECS)</td>
<td>Theoretical fundamentals of random multiple-access channels with applications to massive machine-type communications and digital fingerprinting</td>
</tr>
<tr>
<td>Prof. David Paze, CES</td>
<td>Juan Pablo Vieiria, Associate Professor, Sloan School of Management</td>
<td>Energy Systems Planning for Government Regulations: New Formulations, Models and Algorithms</td>
</tr>
<tr>
<td>Prof. Keith Stevenson, CEE</td>
<td>Fikile Brushe, Assistant Professor, Chemical Engineering, Member of MIT, American Academy of Arts and Sciences</td>
<td>Lithium Redox Flow Batteries for High Power and High Energy Density Energy Storage</td>
</tr>
</tbody>
</table>

The NGP projects are 18 months in duration with the possibility of extension, subject to evaluation of the results and availability of funding. Project funding was released in December 2017; the interim reports are expected in February 2019.
GLOBALLY COMPETITIVE ACADEMIC PROGRAMS

The main achievement of 2017 is that all MSc and PhD educational programs at Skoltech have received Russian state accreditation. The state accreditation permits Skoltech to issue state diplomas, which integrates the Institute in the Russian higher educational landscape and makes it more competitive.

The most essential educational initiatives to build Academic Excellence are aimed at the following goals:

1. Develop globally competitive academic programs;
2. Implement new technologies and practices to educate centennials (digital natives) efficiently;
3. Create a unique educational environment – so-called “Learning Commons” – which will include digital environments.

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Education

The Agreement with the High Council for Evaluation of Research and Higher Education (France) signed to have Skoltech’s PhD programs accredited in accordance with EU standards

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standards
Skoltech extracurricular offerings include such diverse courses as a lecture series on the “Four Metaphors for the Enlightenment” by Tatiana Smoliarova (Associate Professor, University of Toronto), “Science in Contemporary Art” by Stanislav Shpanin (visiting lecturer), “Negotiation Games” by Dmitry Kulish (Professor of Practice, Skoltech) and “Pilot School” led by students, as well as many others.

International Accreditation and Quality Assurance System. Skoltech plans to begin the international accreditation process in order to expand global recognition of its competitive academic programs. The Life Sciences PhD program will be the first educational program up for international accreditation. This pilot case will begin the assessment process for all graduate programs and Skoltech as an institution in accordance with the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG).

Skoltech must further develop its Quality Assurance System. Currently, this system has two components:

- Course evaluations and student feedback,
- Student academic performance, monitoring and analysis.

Skoltech regularly gauges the student learning experience, aiming to elicit feedback from 90% of students. The student response rate to course evaluations surged from 50% in 2016 to 88% in 2017. This is attributable to the introduction of an anonymous on-line survey, featuring short, action-oriented questions, for which students are allocated class time to complete.

Table 5. E&I and “soft skills” courses within curriculum

<table>
<thead>
<tr>
<th>#</th>
<th>COURSE TITLE</th>
<th>E&amp;I / SOFT SKILLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Innovation workshop</td>
<td>E&amp;I</td>
</tr>
<tr>
<td>2</td>
<td>Technology Entrepreneur</td>
<td>E&amp;I</td>
</tr>
<tr>
<td>3</td>
<td>Innovation and Intellectual Property Studies Doctoral Seminar</td>
<td>E&amp;I</td>
</tr>
<tr>
<td>4</td>
<td>Intellectual Property and Technological innovation</td>
<td>E&amp;I</td>
</tr>
<tr>
<td>5</td>
<td>Industrial Applications of Biomedical Science</td>
<td>E&amp;I</td>
</tr>
<tr>
<td>6</td>
<td>Thinking Disruptive for Big Future</td>
<td>E&amp;I</td>
</tr>
<tr>
<td>7</td>
<td>Ideas to Impact: Foundations for Commercializing Technological Advances</td>
<td>E&amp;I</td>
</tr>
<tr>
<td>8</td>
<td>Technology Commercialization: Foundations for Doctoral Researchers</td>
<td>E&amp;I</td>
</tr>
<tr>
<td>9</td>
<td>Academic Writing (Theory and Practice)</td>
<td>soft skills</td>
</tr>
<tr>
<td>10</td>
<td>History and Philosophy of Science. Candidate Examinations</td>
<td>soft skills</td>
</tr>
<tr>
<td>11</td>
<td>Philosophy of Science, Technology and Innovation</td>
<td>soft skills</td>
</tr>
<tr>
<td>12</td>
<td>Pedagogy of Higher Education</td>
<td>soft skills</td>
</tr>
<tr>
<td>13</td>
<td>Academic Communication</td>
<td>soft skills</td>
</tr>
<tr>
<td>14</td>
<td>English for PhD exam</td>
<td>soft skills</td>
</tr>
<tr>
<td>15</td>
<td>Academic English (for GUAP Students)</td>
<td>soft skills</td>
</tr>
</tbody>
</table>
In addition, in 2017 the student survey results were shared with course instructors and program coordinators for purposes of quality improvement.

**Academic Performance Monitoring and Analysis.** Skoltech regularly analyses the academic performance of students in order to:

- Maintain high standards and requirements of academic performance,
- Provide feedback about the quality of the new student cohort,
- Analyze the complexity of the theoretical component and balance of the workload for students.

In addition, a particular focus is placed on academic integrity and ethical norms, which is an essential international standard. The Skoltech Disciplinary Board, which comprises representatives of various stakeholders – i.e. students, faculty members, and the educational and legal departments – makes administrative decisions aimed at improving the quality of education at Skoltech.

**IMPLEMENTATION OF NEW TECHNOLOGIES AND PRACTICES TO EDUCATE CENTENNIALS (DIGITAL NATIVES) EFFICIENTLY**

Recognizing the risk of reverting to and using old-fashioned and passive teaching techniques, Skoltech is taking active steps to embrace and develop new technologies and practices to educate centennials, including:

- Generating an inspiring atmosphere,
- Involving students actively in the learning process and research,
- Increasing the use of active teaching methods, such as “learning by doing” and “learning by teaching,”
- Encouraging a system of student mentorship, with a continuum of peers.

One of Skoltech key principles is to integrate education and science: in addition to course work, graduate students participate in research throughout their educational paths, starting from early research. In addition, Skoltech faculty members and experienced researchers both teach and engage in research, in order to foster excellence and creativity. All research laboratories provide research facilities for MSc and PhD students: Electrochemical Energy Storage Laboratory, IT for Advanced Manufacturing Laboratory, Concurrent Engineering Design Laboratory, Hybrid Photonics Laboratory, Enhanced Oil Recovery Laboratory, Intelligent Space Robotics Laboratory, Mass Spectrometry Laboratory, Energy Systems Laboratory, and Nanomaterials Laboratory.

Examples of putting these initiatives into practice include such courses as Product Lifecycle Management (PLM), the Innovation Workshop and the Independent Study Period (ISP), as well as Industrial Immersion and Academic Mobility.

**PLM.** One example of an active learning course is Product Lifecycle Management (PLM), taught by Prof. Igor Uzhinsky and lab instructor Sergei Nikolaev, utilizing the IT for Advanced Manufacturing Lab (ITAM). The “learning by teaching” and “learning by doing” principles are realized during the PLM course when MSc student teams, under the supervision of doctrorates and research scientists, develop software-tomanned aerial vehicle (UAV) with deployable wings.

Advanced simulation and optimization tools (NX CAD, Simcenter 3D, LMS System Synthesis, LMS Amesim, ANSYS, STAR-CCM, LMS Test.Lab) are used in the educational process for creating a so-called “digital twin” of a real UAV and to achieve the continuity and transparency of the development process (Fig. 19). The Siemens Teamcenter PLM system is used to manage requirements and changes, as well as to secure an ultimate result as a single unit. This course provides the opportunity for prospective engineers to trace the steps of a new product from idea to prototype: starting from requirements and constraints to a global functional and detailed model, then testing all the components in static and dynamic conditions, and examining the final product in the end.

**The Innovation Workshop** is an intensive course that takes place at the start of students’ first term at Skoltech. It was designed to foster innovators, focusing on team work, group projects and sparking entrepreneurial instincts from the very first days of study. Participants in Innovation Workshop 2017 included 242 students divided among 47 team projects under the supervision of 40 mentors and instructors. More than 60 lectures and workshops were delivered by 105 professors and instructors from partner institutions.

**ISP.** Another unique practice in Russia is the Independent Study Period (ISP), which gives students the opportunity to create and attend interdisciplinary courses, allowing them to enhance and expand their knowledge and gain practical experience in the creation of innovative interdisciplinary projects. During ISP 2017-2018, students and faculty members delivered more than 40 varied courses, allowing students to choose a more personalized educational trajectory. All members of the Skoltech community (i.e. students, faculty, postdocs, staff, alumni, etc.) were encouraged to create courses, seminars, workshops, etc. aimed at sharing their expertise, skills and interests with others, including ones not necessarily related to their day-to-day Skoltech roles. ISP is a time to learn new skills and ideas and to broaden the sense of Skoltech community.

**Industrial Immersion.** In 2017, there were 107 individual and group 2-month projects in 75 high-tech companies, co-supervised by Skoltech faculty and researchers (Table 6). The closing day of Industrial Immersion is “The Big Industry Day”. Students presented the final results of their immersion experiences to other students (MSc first and second year) and company representatives, at an event also attended by faculty and researchers. The best projects received awards.
The purpose of academic mobility varies, from short-term trips, such as talks and presentations at conferences, seminars and competitions, to long-term academic mobility programs to conduct research and credit-bearing activities at leading universities. In 2017, MSc and PhD students went on 237 short-term mobility trips and 65 students went on long-term trips. For MSc students' long-term academic mobility primarily focuses on conducting research as part of thesis projects for a duration of between two and four months, and for PhD students up to one year. Skoltech students have been placed at such leading international universities as: the Massachusetts Institute of Technology, the California Institute of Technology, the Delft University of Technology, Harvard Medical School, the Karlsruhe Institute of Technology, the Max Plank Institute, the Pasteur Institute, the University of California, Berkeley, the University of Manchester, etc. The goal is to increase long-term academic mobility in 2020 to 30%, as a target KPI.

**UNIQUE EDUCATIONAL ENVIRONMENT – “LEARNING COMMONS” INCLUDING DIGITAL ENVIRONMENTS**

At the moment, students have access to 14 universal and topic-specific scientific databases, including Science Direct, Springer and IEEE, as well as four bibliographic databases, in particular, Scopus and Web of Science, a patent database, Cifer. In 2017, Skoltech, started to acquire e-books to enhance the student learning experience and ensure better access to its collection. Now students have access to e-book versions of most of the required books via course syllabi pages at Canvas. The basic needs for a broader range of scientific literature are covered by the Springer e-books collection, which is provided by Russian Foundation for Basic Research grant.

### Table 7. Learning Commons progress

<table>
<thead>
<tr>
<th>#</th>
<th>COURSE TITLE</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Print books collection</td>
<td>200</td>
<td>400</td>
<td>700</td>
</tr>
<tr>
<td>2</td>
<td>E-books</td>
<td>0</td>
<td>0</td>
<td>220</td>
</tr>
<tr>
<td>3</td>
<td>Springer e-books provided by Russian Foundation for Basic Research grant</td>
<td>32 000</td>
<td>32 000</td>
<td>70 000</td>
</tr>
<tr>
<td>4</td>
<td>Full-text documents downloads from library databases</td>
<td>2 600</td>
<td>8 400</td>
<td>50 000</td>
</tr>
</tbody>
</table>

Software. In addition, Skoltech offers a large variety of standard software (e.g. Matlab), as well as granting students access to some of the newest professional software, such as DrCAD, SolidWorks Premium, Vic3D, HydraFLUSH, and Wolfram Research. This experience is valuable for future graduates. Online course catalog. Unusual in Russia, an online course catalog contains the full syllabus of more than 170 courses and is now publicly accessible for all internal and external customers. To facilitate this process, an online syllabus form was developed and launched, with automatic updates. Page views of http://www.skoltech.ru/en/education/ increased dramatically during the fall term of 2017 in comparison with the previous Fall term (2016): 40,224 (22.45% of all page views www.skoltech.ru), as compared with 12,157 (11%). The number of users who visited the education portal per day increased from 20-30 during the first half of the year to about 700 in November-December 2017 (Fig.21). These visible results demonstrates the relevance of the information available at http://www.skoltech.ru/en/education/.

### Academic mobility

Recognizing that international collaboration and networking is a vital component of any modern, competitive institute of higher education, Skoltech provides every student with the opportunity to participate in academic mobility programs. In 2017, 302 students (85 MSc and 217 PhD) received support for academic mobility (Fig.20), with approximately one-third going to domestic (Russia) destinations and two-thirds opting for international mobility trips (Fig.20), with approximately one-third going to domestic (Russia) destinations and two-thirds opting for international mobility trips. The number of full text scientific databases available to students is constantly growing. This is reflected in the growth of full-text document downloads (Table 7).
The PhD defense procedure at Skoltech is conducted in accordance with international practice. Each PhD Defense Jury consists of scientists with specific expertise relevant to the topic of the thesis. At least two of them are international experts, so as to strengthen the checks and balances in the evaluation of the integrity and quality of the thesis.

Members of the PhD Defense Juries were professors from outstanding, international universities, such as Delft University of Technology (Netherlands), Imperial College (London, United Kingdom), the Massachusetts Institute of Technology (MIT, United States), Tel Aviv University (Israel), etc. (Table 9).

Compared to other Russian institutes and universities, Skoltech holds its graduates to particularly stringent PhD defense requirements. The Institute requires at least two papers published in high-impact journals indexed in WoS and Scopus and at least two presentations at reputable international conferences. Skoltech PhD graduates have had publications in Science, Nature Reviews, the Journal of the American Chemical Society and other journals with high impact factors. Skoltech has a higher proportion of PhD graduates who have defended their dissertations than many leading Russian universities (87%).

In 2017, Skoltech graduated its third MSc cohort: 84 students received MSc diplomas, including 25 diplomas with distinction (Fig. 22).

In 2017, the first eight PhD students graduated from Skoltech. All graduates fulfilled their requirements in accordance with Russian legislation and the standards for accredited (Aspirantura) programs, and received their state diploma. The Russian state Aspirantura diploma is not equivalent to the PhD degree, as the Aspirantura program does not include a thesis defense. As Skoltech’s mission is to adapt the best world practices for Russia, Skoltech has implemented an international system of awarding its own PhD degree. The PhD defense is an integral component of Skoltech doctoral program. Seven PhD graduates out of eight, successfully defended their theses and received Skoltech PhD degrees (Table 8).

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The main priority for the immediate future will be the recognition of the Skoltech PhD degree in the Russian Federation. The Russian defense procedure for the Candidate of Science degree differs significantly from international practice. While there is widespread international recognition of the Skoltech PhD degree, it is not equivalent to the Russian State Candidate of Science degree. In order to resolve this situation, Skoltech has drafted amendments to the Federal Law on the Skolkovo Innovation Center and the Federal Law on Science and Technological Policy, which would grant Skoltech the right to award a PhD degree that is also recognized in Russia.
the final product. In 2017, Skoltech held two STRIP and technology entrepreneurs to narrow the services, as well as financial support to priority access to special training and Research and Innovation were granted in Skoltech’s Program for Translational customers, while for marketing, it helps teams technological requirements of potential customers, while for marketing, it helps teams analyze the availability of a relevant market segment or the possibility of its formation. Thus, the Program promotes applied research and motivates scientific teams to take risks and see if their developments are applicable to end-user markets.

In early 2017, seven projects were selected for support within STRIP (Table 10). These projects focus on addressing a variety of modern problems, such as the creation of promising materials for redox batteries, a robotic platform for warehouse automation, a platform for flexible online electronics, a portable wireless ECG device, a new type of marker for virtual reality systems, devices for ultrasonic applications, hydrocarbon field exploration technologies, and more.

Table 10. STRIP projects

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Flexible ultrasound module</td>
<td>Prof. Albert Nasibulin (CPQM)</td>
</tr>
<tr>
<td>2. Components for stretchable skin-like electronics</td>
<td>Prof. Albert Nasibulin (CPQM)</td>
</tr>
<tr>
<td>3. Development of a new method and technology for investigations of traditional and unconventional hydrocarbon reservoirs</td>
<td>Prof. Yuri Popov (CHI)</td>
</tr>
<tr>
<td>4. Magic carpets</td>
<td>Prof. Victor Lampitsky (CDISE)</td>
</tr>
<tr>
<td>5. CardioWave</td>
<td>Prof. Rupert Gertzer (CTB)</td>
</tr>
<tr>
<td>6. PitchToGo</td>
<td>Prof. Dmitry Tsatsurakou (SC)</td>
</tr>
<tr>
<td>7. Advance Ion-exchange Membranes for Redox-flow batteries</td>
<td>Prof. Keith Stevenson (CEE)</td>
</tr>
</tbody>
</table>

Projects selected in 2017 to participate in Skoltech’s Program for Translational Research and Innovation were granted priority access to special training and services, as well as financial support to verify the feasibility of their ideas. Teams also received mentoring from leading experts and technology entrepreneurs to narrow the gap between the laboratory prototypes and the final product.

In 2017, Skoltech held two STRIP conferences to assess the development dynamics of the selected projects. On May 25 and November 21. The conferences were attended by Skoltech’s faculty, representatives of the Skolkovo Foundation clusters, mentors and invited experts from industrial companies. In addition to conferences, project teams regularly meet with assigned mentors. These sessions help teams plan their further work towards the commercialization of the technologies or adjust their inventions to meet market needs. The STRIP program also facilitates visits of project teams to industrial companies.

Innovation Workshop

Educational courses that contain innovation component represent at Skoltech widely. The program "Innovation Workshop" developed specifically for Skoltech on the base of a similar MIT course by Skoltech jointly with MIT faculty has been a successful platform boosting entrepreneurship and innovation spirit, with a special curriculum focused on training all Skoltech students. One of the key tasks of this course is to teach students basic skills and practices to brainstorm innovative ideas and develop concepts of future innovations. Thus, during this training students go through the whole innovation process starting from generating and evaluating ideas following by their actual implementation in the form of prototypes, receiving feedback from potential buyers, investors, possible partners in the industry, etc. In order to achieve greater results from the workshop, students are asked to create teams and work on their educational innovation projects during the course.

In 2017, more than 240 students attended the course. More than 60 lectures on entrepreneurship and innovations were conducted together with 19 parallel practical laboratory works for three days. 105 participant-lecturers from partner institutes and more than 40 mentors were invited to teach and mentor during innovation workshop. As the result, students prepared and presented 47 projects (prototypes and presentations).

UMNIK

UMNIK is a federal program of the Foundation for the Promotion of Innovations to support young scientists. Each UMNIK grant amounts to 500,000 rubles and supports two years’ worth of research. For the third year in a row, Skoltech was accredited in 2017 to conduct the selection process for the program. The 2017 finals were held at the end of December in five areas: IT, future medicine, modern materials and technologies for their creation, new devices and hardware complexes and biotechnologies.

In 2017, 67 applications were submitted for examination. Of those, 14 finalists were selected, who then presented their projects to a jury. More than 20 experts analyzed the potential commercial attractiveness of these projects, and as a result, eight projects were recommended for funding.
Advisory Services

Skoltech provided various advisory services, including:

- analytical support for governmental agencies and institutes seeking to develop scientific and technological policies;
- participation in expert panels and working groups formed for decision-making in key areas of scientific and technological development;
- research, analysis and monitoring of scientific and technological areas;
- financial and economic analyses of new technological programs on request of the Russian Ministry of Education and Science;
- promotion and popularization of Skoltech achievements via participation in conferences and workshops, publications in mass media and scientific journals.

The major activities of the year included:

- active participation in key government and scientific initiatives, including “Digital Economy,” Scientific and Technological program “Photonics,” NTI Competence Centers, Strategy for implementation of R&D in the field of genome editing for the period 2017-2020 (Ministry and RVC),
- active participation and provision of expert support on initiating and developing NTI’s roadmaps and projects, i.e. NeuroNet, AeroNet, TechNet, FoodNet, EnergyNet;
- initiating and providing expert support in implementing intergovernmental BRICS activities related to technological and industry-oriented projects. The 1st BRICS Working Group on Biotechnology and Biomedicine including Human Health and Neuroscience has been organized and hosted at Skoltech;
- organization of the work of the advisory committee of LLC Gazprom Neft NTC in the field of digital technologies with the involvement of leading industry companies (IBM, Intel, McKinsey, BCG, etc.);
- preparation and publication of the White Paper “Advanced technological direction in the oil and gas extraction industry” (Prof. Mikhail Spasennyykh (CHR), Prof. Dmitri Koroteev (CHR), Prof. Artem Myasnikov (CHR), Prof. Andrei Osiptsov (CHR), Prof. Alexey Cheremisin (CHR));
- preparing regular policy briefs for various clients on instruments and policies of the government in planning and implementing its scientific-technological policy (e.g. legislation concerning Federal Research Centers, research mobility, working with the research diaspora, suggestions regarding the program for increasing international competitiveness of Russian universities (Top100), approaches to form consortia, development of international cooperation, university-industry relations, and market analyses of various technological areas),
- financial and economic justifications of new technological programs upon the request of the Ministry of Education and Science (photonics, supercomputer technologies, genome editing). As a result, the Ministry has initiated new calls for proposals and competitive programs in advanced manufacturing and photonics.

ALEXEY PONOMAREV
Vice President for Industrial Cooperation, Skoltech:

“In the autumn of 2017, we held “Industrial Day” for the first time. Such events allow students to get better understanding of modern industrial landscape, while helping businesses to engage the brightest students with useful skills. Skoltech relies that its students will bring best international competences to the industry.”

Professional Training

The CDISE faculty members Prof. M. Fedorov, Prof. E. Burnaev delivered a professional training course in Data Analysis to two groups of Sberbank employees this year. Skoltech and Sberbank plan to further develop their cooperation.

Prof. A. Ivanov of the Space Center presented an advanced course in Systems Engineering for about 70 engineers from leading Russian industrial corporations, including United Aircraft Corporation, United Engine Corporation and United Shipbuilding Corporation. The course was delivered jointly with the Moscow Aviation Institute (MAI) in the framework of the MAI Management School. It is planned to significantly expand such activities in 2018.

In total, Skoltech received 4.8 million RUB for its professional training activities in 2017.
In 2017, Skoltech established contacts with more than 300 companies (including small and medium-sized technological and innovation businesses). There were ongoing projects with more than 40 large and medium-sized companies (Gazprom Neft, Sberbank, Rusagro, Biocad, Soyuzsnab, Agroplaza, ISS Reshetnev and others), negotiations on R&D projects held with RosTelecom, MMK, Severstal, S7, AtomstroEXPORT, Rosatom, IBS, Soyuzsnab, Dataadvance, Yandex, Novostom, Slavnnet, AKADO, UAC, Soesky Kompleks, Generium, Doka Gene technologies, EN Energy and others). Negotiations were held with foreign companies, including Samsung, Bosch, Phillips, IPG Photonics and ENEI. Partnerships were developed with leading consulting companies and IT vendors including IBM, SAS, Deloitte & Touche and KMPG.

An example of establishment of strategic cooperation was the development of a complex program which addresses Gazprom Neft’s needs in oil and gas-related areas (including 6 R&D contracts for a total of 72 million rubles), which launched discussion of more than 10 additional proposals, including the allocation of funding for the period 2018-2019 for more than 90 million rubles.

The Skoltech R&D Contract Office provided legal and administrative support for developing proposals/contracts and 45 industry-oriented projects including complex projects for a total of 424.8 million rubles. Skoltech signed 50 new contracts with industrial partners amounting to a total of 671 million rubles in funding (contracts period 2017-2019).

In 2017, Skoltech established contacts with more than 300 companies including small and medium-sized technological and innovation businesses. There were ongoing projects with more than 40 large and medium-sized companies (Gazprom Neft, Sberbank, Rusagro, Biocad, Soyuzsnab, Agroplaza, ISS Reshetnev and others), negotiations on R&D projects held with RosTelecom, MMK, Severstal, S7, AtomstroEXPORT, Rosatom, IBS, Soyuzsnab, Dataadvance, Yandex, Novostom, Slavnnet, AKADO, UAC, Soesky Kompleks, Generium, Doka Gene technologies, EN Energy and others). Negotiations were held with foreign companies, including Samsung, Bosch, Phillips, IPG Photonics and ENEI. Partnerships were developed with leading consulting companies and IT vendors including IBM, SAS, Deloitte & Touche and KMPG. An example of establishment of strategic cooperation was the development of a complex program which addresses Gazprom Neft’s needs in oil and gas-related areas (including 6 R&D contracts for a total of 72 million rubles), which launched discussion of more than 10 additional proposals, including the allocation of funding for the period 2018-2019 for more than 90 million rubles. The Skoltech R&D Contract Office provided legal and administrative support for developing proposals/contracts and 45 industry-oriented projects including complex projects for a total of 424.8 million rubles. Skoltech signed 50 new contracts with industrial partners amounting to a total of 671 million rubles in funding (contracts period 2017-2019).

**PROJECT PRINCIPAL INVESTIGATOR**

**INDUSTRY FUNDED SUPPORT**

<table>
<thead>
<tr>
<th>DATA SCIENCE AND AI</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Maxim Fedorov (CDISE)</td>
<td>46.7 mln RUB (Aeronet NTI)</td>
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<tr>
<td>Prof. Evgeny Bumarnov (CDISE)</td>
<td>13.0 mln RUB (Sberbank, Ministry subsidies)</td>
</tr>
<tr>
<td>Prof. Alexey Frolov (CDISE)</td>
<td>7.0 mln RUB (HUAWEI)</td>
</tr>
<tr>
<td>Prof. Ivan Oseledets (CDISE)</td>
<td>6.0 mln RUB (HUAWEI)</td>
</tr>
<tr>
<td>Prof. Victor Lempitsky (CDISE)</td>
<td>1.6 mln RUB (Vision Labs)</td>
</tr>
<tr>
<td>Prof. Dmitri Lakontsev (CDISE)</td>
<td>1.0 mln RUB (New Engineering Technologies)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LIFE SCIENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Maria Logacheva (CDIBB)</td>
</tr>
<tr>
<td>Prof. Konstantin Severinov (CDIBB)</td>
</tr>
<tr>
<td>Prof. Philipp Khatovich (CDIBB)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CUTTING EDGE ENGINEERING AND ADVANCED MATERIALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Igor Uzhinsky (CDMM)</td>
</tr>
<tr>
<td>Prof. Dmitry Tsetserukou (SC)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>ENERGY EFFICIENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Mikhail Spassennykh (CHIR)</td>
</tr>
<tr>
<td>Prof. Andrei Osiptsov (CHIR)</td>
</tr>
<tr>
<td>Prof. Dmitri Korotov (CHIR)</td>
</tr>
<tr>
<td>Dr. Natalia Bogdanovich (CHR)</td>
</tr>
<tr>
<td>Dr. Dmitri Titov (CES)</td>
</tr>
<tr>
<td>Prof. Alexey Charimov (CHIR)</td>
</tr>
<tr>
<td>Dr. Stanislav Uresgov (CHR)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>QUANTUM TECHNOLOGIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Idar Gabitov (CPQM)</td>
</tr>
<tr>
<td>Prof. Vladimir Drachev (CPQM)</td>
</tr>
<tr>
<td>Prof. Pavlos Llagiudakis (CPQM)</td>
</tr>
</tbody>
</table>
Skoltech is working on industry-funded research under the contracts with Lukoil, Lukoil Engineering, Huawei, Schlumberger, NOVATEK, RusAgro Group, Vision Labs, TOTAL & RECHERCHE DEVELOPPEMENT, Gazprom Neft R&D Center, Sberbank, Biocad, Geoskan, Zarubezhneft, Yumen R&D Center, Soyuzsnab, Scientific Production Association KvinTech, Rosseti, Chemexpert, and Agroplazma. The institute has also launched interactions with industry leaders in the fields of digital technologies (Intel, IBM, KPMG, E&Y IoT Center of Excellence, Deloitte Big Data Institute, SAS, Borles, ICore, etc.). In total, industry research funds contracted for 2017 amounted to 424.8 million RUB (Fig. 23).

50 new contracts signed in 2017 for a total of 671 mln RUB

### Projects ongoing in 2017

Ongoing projects with more than 40 large and medium-sized Russian and international industrial companies.

The tables and charts below depict trends in attracting industry funds during the period of 2015-2019.

### Trends in industry funded research

The tables and charts below depict trends in attracting industry funds during the period of 2015-2019.
Industry Partnership Network

Development of a Partnership Network is a crucial focus of the Department for Industrial Cooperation. Relevant efforts have included finding proper potential partners, establishing contacts, defining areas of mutual interests and making commercial proposals, resulting in some cases with contracts. The sales funnel of such activities is significantly narrowing down. Accordingly, the Department for Industrial Cooperation has set its sights on about 300 companies, and is constantly expanding its network. The key value, which the Department is trying to bring in, is building trust in its relationships with its partners. This requires a lot of effort and sales skills, as leading and managing negotiations between industry and professors or students is a multicomponent and complexly structured activity. Toward that end, the Department is playing the critical role of a buffer, smoothing and streamlining the process.

With the help of active PR efforts, Skoltech has organized seminars for members of industry on a range of topics (agrotechnology, genomic editing, computer vision for retail, machine learning, digital kernel, etc.) (Table 11); more than 35 companies and 150 participants have taken part in these seminars. These initiatives have helped to strengthen Skoltech partnership with industry and to launch several R&D projects.

Table 11. Seminars for Industry held in 2017

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>SKOLTECH SPEAKERS</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine learning for optimization of hydrocarbon exploration and production processes</td>
<td>Prof. Dmitri Konoitsev (CHR)</td>
<td>23-24 January 2017</td>
</tr>
<tr>
<td>Genomic editing with CRISPR / Cas systems: limitations, new approaches and applications</td>
<td>Prof. Konstantin Severinov (CDIBB)</td>
<td>27 February 2017</td>
</tr>
<tr>
<td>Genomic selection of plants: technologies and possibilities for practical application</td>
<td>Prof. Philipp Khatovitch (CDIBB)</td>
<td>28 February 2017</td>
</tr>
<tr>
<td>Computer vision is a new breakthrough technology for retail</td>
<td>Prof. Victor Lempitsky (CDISE), Dr. Pavel Boyko (CDISE)</td>
<td>13 April 2017</td>
</tr>
<tr>
<td>RNA interference in vivo: opportunities of post-genome technologies for medical applications</td>
<td>Prof. Yuri Kotelyansky (CTB)</td>
<td>20 April 2017</td>
</tr>
<tr>
<td>Mutations in pluripotent stem cells and pluripotency genes</td>
<td>Prof. Dmitri Papatsenko (CDIBB)</td>
<td>18 May 2017</td>
</tr>
<tr>
<td>Internet Initiatives Development Fund (IIDF) and Skolkovo: opportunities for collaboration</td>
<td>Prof. Evgeny Burnaev (CDISE), Dr. Victor Lempitsky (CDISE)</td>
<td>13 June 2017</td>
</tr>
<tr>
<td>CoBrain-Analytics platform: opportunities to work with big medical data</td>
<td>Prof. Philipp Khatovitch (CDIBB), Dr. Mikhail Belyav (CDISE)</td>
<td>28 September 2017</td>
</tr>
<tr>
<td>Seminars on digital kernel and machine learning</td>
<td>Prof. Dmitri Konoitsev (CHR), Dr. Alexey Zaytsev (CDISE), Dr. Leila Ismailova (CHR)</td>
<td>17 October 2017</td>
</tr>
<tr>
<td>Machine learning and its industrial applications</td>
<td>Prof. Evgeny Burnaev (CDISE), Dr. Lasha Ioseliani (CDISE)</td>
<td>2 November 2017</td>
</tr>
<tr>
<td>Projected achievements from related branches of science and technology, potentially applicable in aircraft engine building</td>
<td>Prof. Igor Uzhinsky (CDMM), Dr. Oleg Aladyshev (CDMM)</td>
<td>15 November 2017</td>
</tr>
</tbody>
</table>

In addition, about 30 policy briefs were prepared and provided for governmental bodies, institutes for development and other clients, including Skoltech leadership.

The table below presents the list of Skoltech affiliated patent applications submitted by faculty, researchers and students during the period of 2015-2017.

Table 12. Skoltech patent applications during 2015-2017

<table>
<thead>
<tr>
<th>#</th>
<th>TITLE</th>
<th>SKOLTECH AUTHORS</th>
<th>TYPE</th>
<th>YEAR</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Method for correction of the eyes image using machine learning and method for machine learning</td>
<td>Prof. Victor Lempitsky (CDISE), Daniil Kononenko (CDISE)</td>
<td>Russian</td>
<td>2015</td>
<td>granted</td>
</tr>
<tr>
<td>2</td>
<td>An infrared radiation detector based on single-layer carbon nanotubes and graphene</td>
<td>Prof. Albert Nasibulin (CPQM), Dr. Yuri Glushin (CPQM), Alexandra Gorkina (CPQM), Evgenia Gistolov (CPQM), Alexey Taapenko (CPQM)</td>
<td>Russian</td>
<td>2015</td>
<td>granted (expired, not extended)</td>
</tr>
<tr>
<td>3</td>
<td>Learnable visual markers and methods of their production</td>
<td>Prof. Victor Lempitsky (CDISE)</td>
<td>Russian</td>
<td>2016</td>
<td>not granted</td>
</tr>
<tr>
<td>4</td>
<td>A program for calculating static stability of electric power networks based on inverters with adjustable frequency and voltage</td>
<td>Dr. Petr Vorobiev (CES)</td>
<td>Russian</td>
<td>2016</td>
<td>granted</td>
</tr>
<tr>
<td>5</td>
<td>Marking additive</td>
<td>Prof. Albert Nasibulin (CPQM), Dr. Anastasia Goldt (CPQM)</td>
<td>Russian</td>
<td>2016</td>
<td>granted</td>
</tr>
<tr>
<td>6</td>
<td>An extruder for additive manufacturing of products from composite materials</td>
<td>Dr. Andrey Azarov (CDMM), Dr. Fedor Antonov (CDMM), Dr. Mikhail Golubev (CDMM), Dr. Alexey Khaziev (CDMM)</td>
<td>Russian</td>
<td>2016</td>
<td>granted (rights assigned)</td>
</tr>
<tr>
<td>7</td>
<td>A method of producing thin films using carbon nanoparticles</td>
<td>Prof. Albert Nasibulin (CPQM), Dr. Anastasia Goldt (CPQM)</td>
<td>Russian</td>
<td>2016</td>
<td>not granted</td>
</tr>
<tr>
<td>#</td>
<td>TITLE</td>
<td>SKOLTECH AUTHORS</td>
<td>TYPE</td>
<td>YEAR</td>
<td>STATUS</td>
</tr>
<tr>
<td>----</td>
<td>----------------------------------------------------------------------</td>
<td>--------------------------------------------------------</td>
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</tr>
<tr>
<td>10</td>
<td>A method of recognizing objects defined by clouds of points</td>
<td>Prof. Victor Lempitsky (CDISE) Roman Kiskov (CDISE)</td>
<td>Russian</td>
<td>2017</td>
<td>not granted</td>
</tr>
<tr>
<td>11</td>
<td>Learnable visual markers and methods of their production</td>
<td>Prof. Victor Lempitsky (CDISE)</td>
<td>International</td>
<td>2017</td>
<td>not published</td>
</tr>
<tr>
<td>12</td>
<td>A program for modeling an electric power network operating under direct decentralized perturbation-based control</td>
<td>Oleg Khamisov (CES)</td>
<td>Russian</td>
<td>2017</td>
<td>granted</td>
</tr>
<tr>
<td>13</td>
<td>A program for solving electric network power flow equations</td>
<td>Ali Mazhar (CES)</td>
<td>Russian</td>
<td>2017</td>
<td>granted</td>
</tr>
<tr>
<td>14</td>
<td>A database of oil crops genotypes</td>
<td>Prof. Philipp Khaltovich (CDIBB) Dr. Denis Goryunov (CDIBB) Dr. Svetlana Goryunova (CDIBB) Dr. Anna Pavlova (CDIBB)</td>
<td>Russian</td>
<td>2017</td>
<td>granted</td>
</tr>
<tr>
<td>15</td>
<td>Selective tone reservation for papr reduction in wireless communication systems</td>
<td>Prof. Dmitry Lakontsev (CDISE) Dr. Andrey Ivanov (CDISE)</td>
<td>International</td>
<td>2017</td>
<td>not published</td>
</tr>
<tr>
<td>16</td>
<td>A thin-film solar cell based on a heterojunction and a method of its production</td>
<td>Prof. Albert Nasibulin (CPQM) Pramod Malbagal Rajanna (CPQM)</td>
<td>Russian</td>
<td>2017</td>
<td>not granted</td>
</tr>
<tr>
<td>17</td>
<td>A chalcon sulfonyl halides synthesis method</td>
<td>Dr. Oleg Lukin (CDMM) Dmitry Semyonsk (CEE)</td>
<td>Russian</td>
<td>2017</td>
<td>not granted</td>
</tr>
<tr>
<td>18</td>
<td>Magnetic materials</td>
<td>Prof. Artem Oganov (CEE) Rahmanian Koshkaki Saeed (CEE)</td>
<td>Russian</td>
<td>2017</td>
<td>not granted</td>
</tr>
<tr>
<td>19</td>
<td>New materials for cutting surfaces, specifically, drill bit teeth</td>
<td>Prof. Artem Oganov (CEE) Dr. Alexander Khashchin (CEE) Dr. Andrey Osiptsov (CHR) Dr. Leila Ismailova (CHR)</td>
<td>Russian</td>
<td>2017</td>
<td>not granted</td>
</tr>
<tr>
<td>20</td>
<td>Virtual reality systems based on a smartphone and an inclined mirror</td>
<td>Prof. Victor Lempitsky (CDISE)</td>
<td>Russian</td>
<td>2017</td>
<td>not granted</td>
</tr>
<tr>
<td>21</td>
<td>Database of reference sequences of the plants' ITS1 and ITS2 DNA markers</td>
<td>Dr. Maria Logacheva (CDIBB) Dr. Kamil Khaftov (CDIBB) Andrey Aigrin (CDIBB) Dr. Anna Speronskaya (CDIBB)</td>
<td>Russian</td>
<td>2017</td>
<td>granted</td>
</tr>
<tr>
<td>22</td>
<td>Substituted 1,2,4-oxadiazoles as modulators of the receptor-associated receptor 1 (TAAR 1)</td>
<td>Prof. Raul Gainetdinov (CTB)</td>
<td>Russian</td>
<td>2017</td>
<td>not granted</td>
</tr>
</tbody>
</table>
At its foundation, Skoltech is an academic institute committed to applied research and to the commercialization of its best ideas. Its commitment is manifested through all of the aforementioned activities and by the commitment of its faculty. Below is a list of ideas that evolved into commercially viable products and services. These ideas were developed by students, professors and researchers or by a combination of these individuals.

### List of Skoltech startups 2015-2017

<table>
<thead>
<tr>
<th>STARTUP</th>
<th>FOUNDERS</th>
<th>YEAR ESTABLISHED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image Airy</td>
<td>Ekaterina Kotenko-Lengold (SC)</td>
<td>2014</td>
</tr>
<tr>
<td>MIG</td>
<td>Dr. Dmitri Titov (CES)</td>
<td>2014</td>
</tr>
<tr>
<td>Tardis (Skolkovo resident)</td>
<td>Vahe Taamazyan (CDMM)</td>
<td>2015</td>
</tr>
<tr>
<td>Neurisetti Ashmanova</td>
<td>Stanislav Ashmanov (CDISE)</td>
<td>2015</td>
</tr>
<tr>
<td>Anisoprint</td>
<td>Dr. Fedor Antonov (CDMM)</td>
<td>2015</td>
</tr>
<tr>
<td></td>
<td>Dr. Alexey Khaziev (CDMM)</td>
<td></td>
</tr>
<tr>
<td>Tsuru Robotics</td>
<td>Nikita Roditchenko (SC)</td>
<td>2015</td>
</tr>
<tr>
<td>Suprarematic-Razvitie</td>
<td>Anatoly Dymanski (ES)</td>
<td>2015</td>
</tr>
<tr>
<td>Lexy</td>
<td>Roman Zhukov (SC), Dmitry Suvorov (SC)</td>
<td>2016</td>
</tr>
<tr>
<td>Inspector Cloud</td>
<td>Pavel Bloyko (CDISE)</td>
<td>2016</td>
</tr>
<tr>
<td>Komarik</td>
<td>Dmitry Vasilyev (CDISE)</td>
<td>2016</td>
</tr>
<tr>
<td>Rustor</td>
<td>Prof. Keith Stevenson (CEE), Prof. Artem Abakumov (CEE)</td>
<td>2017</td>
</tr>
<tr>
<td>CardioLog Technologies</td>
<td>Natalia Glazkova (CTB)</td>
<td>2017</td>
</tr>
<tr>
<td>Cryptochemistry</td>
<td>Prof. Albert Nasibulin (CPQM)</td>
<td>2017</td>
</tr>
<tr>
<td>Morphing Technologies</td>
<td>Yevgeny Ethan (CDISE)</td>
<td>2017</td>
</tr>
</tbody>
</table>
**Academic Staff**

**Faculty recruitment**

In 2017, 24 faculty members joined Skoltech. In accordance with the Faculty Appointment, Promotion and Tenure Policy and Procedure established by the Academic Council, faculty appointments were primarily made following a search (open competition) process or a targeted hiring of internationally renowned scientists.

To attract high caliber candidates, various recruitment channels were applied, including posting advertisements in specialized media (Nature, New Scientist, MathJobs, Jobs.ac.uk, Academic Keys, Academic positions, etc.), and advertising open positions on the Skoltech website and on Skoltech faculty academic networks.

In 2017, 109 candidates applied for various positions. Each application was reviewed by one of the Expert Panels established by the Appointment, Promotion and Tenure Committee (APTC). Of these applicants, 36 candidates with strong international backgrounds were invited to Skoltech for research presentations and interviews with Skoltech faculty and leadership. Ultimately, 31 candidates were recommended for review and appointment to the APTC, and of those, 24 candidates were appointed as faculty members.

<table>
<thead>
<tr>
<th>PROFESSOR</th>
<th>POSITION</th>
<th>FTE</th>
<th>PREVIOUS AFFILIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dmitry Dylov</td>
<td>Assistant Professor, CDISE</td>
<td>1.0</td>
<td>Princeton University, United States</td>
</tr>
<tr>
<td>Gonzalo Ferrer</td>
<td>Assistant Professor, CDISE</td>
<td>1.0</td>
<td>University of Michigan, United States</td>
</tr>
<tr>
<td>Andrey Somov</td>
<td>Assistant Professor, CDISE</td>
<td>1.0</td>
<td>University of Exeter, United Kingdom</td>
</tr>
<tr>
<td>Jacob Biamonte</td>
<td>Associate Professor, CDISE</td>
<td>1.0</td>
<td>University of Malta, Malta</td>
</tr>
<tr>
<td>Dmitry Lakontsev</td>
<td>Associate Professor of the Practice, CDISE</td>
<td>1.0</td>
<td>Skoltech, Russia (promotion)</td>
</tr>
<tr>
<td>Alexey Vishnyakov</td>
<td>Associate Professor, CDISE</td>
<td>1.0</td>
<td>Rutgers University, United States</td>
</tr>
<tr>
<td>Nikolay Brilliantov</td>
<td>Full Professor, CDISE</td>
<td>1.0</td>
<td>University of Leicester, United Kingdom</td>
</tr>
</tbody>
</table>

**DATA SCIENCE & ARTIFICIAL INTELLIGENCE**

<table>
<thead>
<tr>
<th>PROFESSOR</th>
<th>POSITION</th>
<th>FTE</th>
<th>PREVIOUS AFFILIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sergey Abaimov</td>
<td>Assistant Professor, CDMM</td>
<td>1.0</td>
<td>University of Colorado Boulder, United States</td>
</tr>
<tr>
<td>Oleg Vasilev</td>
<td>Full Professor, CDMM</td>
<td>1.0</td>
<td>Skoltech, Russia (promotion)</td>
</tr>
<tr>
<td>Aleksey Cheremisin</td>
<td>Associate Professor of the Practice, CEE</td>
<td>1.0</td>
<td>Skoltech, Russia (promotion)</td>
</tr>
<tr>
<td>Elena Gryazina</td>
<td>Assistant Professor, CEE</td>
<td>1.0</td>
<td>Skoltech, Russia (promotion)</td>
</tr>
<tr>
<td>Alexey Cheremisin</td>
<td>Associate Professor of the Practice, CHR</td>
<td>1.0</td>
<td>Skoltech, Russia (promotion)</td>
</tr>
<tr>
<td>Dmitry Eskin</td>
<td>Full Professor, CHR</td>
<td>1.0</td>
<td>Schlumberger-Doll Research Center, United States</td>
</tr>
</tbody>
</table>

**CUTTING-EDGE ENGINEERING AND ADVANCED MATERIALS**

<table>
<thead>
<tr>
<th>PROFESSOR</th>
<th>POSITION</th>
<th>FTE</th>
<th>PREVIOUS AFFILIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elena Gryazina</td>
<td>Assistant Professor, CEE</td>
<td>1.0</td>
<td>Skoltech, Russia (promotion)</td>
</tr>
<tr>
<td>Alexey Cheremisin</td>
<td>Associate Professor of the Practice, CHR</td>
<td>1.0</td>
<td>Skoltech, Russia (promotion)</td>
</tr>
<tr>
<td>Dmitry Eskin</td>
<td>Full Professor, CHR</td>
<td>1.0</td>
<td>Schlumberger-Doll Research Center, United States</td>
</tr>
</tbody>
</table>

**ENERGY EFFICIENCY**

<table>
<thead>
<tr>
<th>PROFESSOR</th>
<th>POSITION</th>
<th>FTE</th>
<th>PREVIOUS AFFILIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alexander Pasko</td>
<td>Full Professor, CEE</td>
<td>1.0</td>
<td>Bournemouth University, United Kingdom</td>
</tr>
<tr>
<td>Sergey Abaimov</td>
<td>Assistant Professor, CDMM</td>
<td>1.0</td>
<td>University of Colorado Boulder, United States</td>
</tr>
<tr>
<td>Oleg Vasilev</td>
<td>Full Professor, CDMM</td>
<td>1.0</td>
<td>Skoltech, Russia (promotion)</td>
</tr>
<tr>
<td>Anton Ivanov</td>
<td>Associate Professor, SC</td>
<td>1.0</td>
<td>Ecole Polytechnique Fédérale de Lausanne, Switzerland</td>
</tr>
<tr>
<td>Jean-François Geneste</td>
<td>Associate Professor of the Practice, SC</td>
<td>0.3</td>
<td>Airbus Group, France</td>
</tr>
</tbody>
</table>

**QUANTUM TECHNOLOGY**

<table>
<thead>
<tr>
<th>PROFESSOR</th>
<th>POSITION</th>
<th>FTE</th>
<th>PREVIOUS AFFILIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vladimir Antonov</td>
<td>Associate Professor, CPQM</td>
<td>0.5</td>
<td>Royal Holloway, University of London, United Kingdom</td>
</tr>
<tr>
<td>Arkadi Chipouline</td>
<td>Associate Professor, CPQM</td>
<td>1.0</td>
<td>Technical University of Darmstadt, Germany</td>
</tr>
<tr>
<td>Dmitry Gorin</td>
<td>Full Professor, CPQM</td>
<td>1.0</td>
<td>Saratov State University, Russia</td>
</tr>
</tbody>
</table>

**ADVANCED STUDIES**

<table>
<thead>
<tr>
<th>PROFESSOR</th>
<th>POSITION</th>
<th>FTE</th>
<th>PREVIOUS AFFILIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrei Okounkov</td>
<td>Full Professor, CAS</td>
<td>0.4</td>
<td>Columbia University, United States</td>
</tr>
</tbody>
</table>

**CEI**

<table>
<thead>
<tr>
<th>PROFESSOR</th>
<th>POSITION</th>
<th>FTE</th>
<th>PREVIOUS AFFILIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavel Dorozhkin</td>
<td>Associate Professor of the Practice</td>
<td>0.3</td>
<td>NT-MDT Co., Russia</td>
</tr>
<tr>
<td>Maxim Kiselev</td>
<td>Associate Professor of the Practice</td>
<td>0.4</td>
<td>&quot;Novy Disk&quot; Group of Companies., Russia</td>
</tr>
<tr>
<td>Dmitry Kulish</td>
<td>Full Professor of the Practice</td>
<td>0.4</td>
<td>Drug Development.Ru., Russia</td>
</tr>
<tr>
<td>Alexey Nikolayer</td>
<td>Full Professor of the Practice</td>
<td>0.4</td>
<td>Intel Technologies., Russia</td>
</tr>
<tr>
<td>Eric Achtmann</td>
<td>Associate Professor of the Practice</td>
<td>0.25</td>
<td>Global Capital Advisors LLC</td>
</tr>
</tbody>
</table>

As of the end of the year, Skoltech has 104 faculty members. The composition of faculty by rank as well as distribution between the CREIs and target domains is presented in the figures below.

![Figure 28. Skoltech faculty by rank (2017)](image)

![Figure 29. Skoltech faculty by rank (2016)](image)

![Figure 30. Skoltech faculty by rank (2015)](image)

* Senior faculty (full professors, professors of the practice, adjunct professors), mid-career faculty (associate professors, associate professors of the practice), junior faculty (assistant professors).
In 2017, Skoltech researchers initiated and organized an international cross-disciplinary Gen-Y conference for young scientists in Sochi. MSc and PhD students gathered alongside postdoctoral researchers and young professors from Skoltech’s various CREIs for four days of lectures, seminars, poster sessions and fun. Attendees were able to share their research and forge new partnerships. There were 73 participants, as well as a host of organizers and invited speakers. The conference was a great success and the organizers expressed hope that it will become an annual event, focusing on inspiring and recognizing research excellence.

In 2017, Skoltech continues to attract and develop high-performing researchers. In 2017, 72 new researchers joined CREIs and more than 50% of current research personnel renewed their contracts. As of the end of 2017, Skoltech’s research staff comprised 56 research scientists and 128 postdocs. The distribution of research staff is presented in the figures below.
MSc and PhD students

Throughout 2017, Skoltech faculty members maintained academic collaborations with MIT, in particular through the Next Generation Program. This program supported 19 research projects that included a regular faculty exchange through remote communications and site visits. Skoltech faculty also maintained a significant number of exchanges with other international and Russian universities, mainly through collaborative research projects.

### Colloquia

As shown below, Skoltech colloquia have attracted a number of exceptional speakers that presented new perspectives in research and innovation. In some cases, these events have enabled to attract top candidates to Skoltech faculty positions. In all cases, the colloquia provided ideal occasions for scientific exchanges that increased Skoltech visibility in international circles.

#### Table 13. Colloquia in 2017

<table>
<thead>
<tr>
<th>COLLOQUIA</th>
<th>SPEAKER</th>
<th>AFFILIATION</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantum materials: insights from near field nano-optics</td>
<td>Dmitri Basov</td>
<td>Higgins Professor of Physics, Columbia University, United States</td>
<td>January 31, 2017</td>
</tr>
<tr>
<td>ESA Future missions and Technologies</td>
<td>Franco Ongaro</td>
<td>Director of Technical and Quality Management at European Space Agency (ESA); ESA</td>
<td>March 16, 2017</td>
</tr>
<tr>
<td>Advanced Electron Microscopy of Advanced Materials</td>
<td>Gustaaf Van Tendeloo</td>
<td>Professor, Director of Electron microscopy for materials science (EMAT), University of Antwerp, Belgium</td>
<td>April 18, 2017</td>
</tr>
<tr>
<td>Breakthroughs Towards Aerospace Leadership</td>
<td>Jean-François Geneste</td>
<td>Vice-President – Chief Scientist at Airbus Group Innovations, Toulouse, France</td>
<td>May 18, 2017</td>
</tr>
<tr>
<td>Advanced Electron Microscopy of Advanced Materials</td>
<td>Van Tendeloo</td>
<td>Professor, University of Antwerp, Belgium</td>
<td>April 17, 2017</td>
</tr>
<tr>
<td>First-principle study of phosphors for white-LED applications: light absorption and emission, Stokes shift and thermal quenching</td>
<td>Xavier Gonzé</td>
<td>Professor, Université Catholique de Louvain</td>
<td>October 2-3, 2017</td>
</tr>
</tbody>
</table>

In addition, colloquium (seminars) sessions are arranged by the CREIs. See, for example, open seminars of the CAS (http://crei.skoltech.ru/cas/calendar/sem-mon/), Energy colloquium (http://www.skoltech.ru/en/energy-colloquium/schedule-for-the-winter-spring-2017/), CDISE “Christmas colloquium on computer vision” (http://sites.skoltech.ru/compvision/cccv17)/.

### Recruitment Campaign

The student recruitment campaign, performed by the Student Outreach and Recruitment office for the Academic Year 2017-2018 was initially designed in accordance with the best practices of foreign universities and represents an effort to be proactive and systematic in reaching out to prospective talented students in light of the fact that Skoltech lacks its own Bachelor’s program.

The main target of the student recruitment campaign for the 2017-2018 academic year was to attract, select and enroll talented and ambitious students (target numbers: 225 MSc and 95 PhD students). The recruitment campaign included a variety of online and offline recruitment initiatives, as well as several stages of evaluation, which facilitated the selection of the most qualified candidates. It incorporated special software for processing applications – a unique approach in Russia, and one that corresponds with international student recruitment standards.

To promote Skoltech’s educational programs, the Student Outreach and Recruitment office established key recruitment initiatives, developed a set of marketing materials, designed and updated program pages on the Skoltech website and created a tailored landing page.

### Enrollment

During the recruitment campaign, Skoltech received 8,018 MSc applications and 2,993 PhD applications – five times higher than the results of the 2016-2017 campaign. The MSc admissions ratio for domestic students was 35:1. For foreign applicants, it was 100:1. The domestic PhD admission ratio was 31:1. For foreign applicants, it was 130:1. 71% of MSc and 87% of PhD applications were received from foreign candidates from 123 countries.

Of all submitted applications, 2,533 MSc applications and 1,109 PhD applications were properly filled and submitted – six times higher than the results of the previous campaign. Driven by the aim of selecting talented and motivated students, a two-stage selection process was applied:

1. Pre-selection: evaluation of a candidate's portfolio (CV, recommendation letters, scientific and professional achievements, GPA)
2. Selection: on-site event, which included:
   a. Interview with faculty panel
   b. Written exam (Math part and a Specialization part) or online exam
   c. TOEFL exam

As a result of the pre-selection, 646 MSc and 196 PhD candidates were invited and participated in selection events.

The key recruitment initiatives included target opportunities, recommended by faculty teaching at MIPT, MSU, HSE and other universities, conferences, competitions and contests in which Skoltech faculty were involved; events of various formats, including in-house outreach-events and events in target universities/cities in Russia and abroad. Overall, the Student Outreach and Recruitment office organized and/or participated in 43 events in 15 cities in Russia and abroad, with more than 4,500 participants and 27 Skoltech faculty involved.

In order to increase Skoltech’s visibility and the pool of prospective students, several content projects were launched jointly with media-partners, such as PostNauka (combined, published materials reached more than five million views), VC.RU (more than 600,000 views) and N+1 (more than 900 leads converted to potential candidates). In addition, different formats of Internet marketing (context and targeted ads), including SMM were actively used.

The brand-new CRM system for processing applications was developed and implemented in order to maintain the selection process with regard to its efficiency and submission ratio increase. The system provides integrated communication tools, such as a mobile interface, online chat and integration with Skoltech newsletters.
(including four MSc and two PhD selection waves). In 2017, travel expenses (tickets, accommodation) for the selection events were covered by participants themselves. Upon the results of the selection waves, 260 MSc and 123 PhD students received offers to attend Skoltech. Of those, 250 MSc and 117 PhD students accepted offers and were enrolled in MSc and PhD programs. Six students were enrolled as “visiting.” Among the enrolled, more than 20% are foreigners from 35 countries.

With regards to the academic background – 60% of the enrolled are graduates of top-10 Russian universities. More than 51% graduated from MIPT, MSU and HSE. Some 50% are graduates of the top 300 universities (QS, THE rankings). In total, students of the 2017 intake represent 86 universities in 29 countries. Of these universities, 41 are located in 19 Russian cities from Grozny and Arkhangelsk to Vladivostok and Petropavlovsk-Kamchatsky.
JOINT PROGRAMS
As part of its academic development strategy, Skoltech launched several MSc Programs in partnership with Russian universities (“network” programs). The initiative was proposed with the goal of shaping a community of joint-university students by providing flexible opportunities, including specialized paths of study, research co-advising, one research thesis and one thesis defense.

The partner universities and fields of study were proposed by Skoltech faculty members taking into account ongoing research collaborations, program capacity building and students’ interest, evaluated based on previous recruitment campaigns. The preparatory activities included negotiations with the academic leadership of the partner universities, defining admission requirements, programs structure and curriculum, the status of students in home and host universities and legal frameworks.

The curriculum of the partnership programs includes a Skoltech innovation component, primarily in the form of the Innovation workshop, as well as other courses aimed at increasing entrepreneurial skills (“Ideas to Impact: Foundations for Commercializing Technological Advances,” “Intellectual Property and Technological Innovation,” “Technology Entrepreneurship,” etc.). 6 MSc Programs in a network format were included in the recruitment campaign for AY 2017-2018.

Q1: How would you generally score the performance level of first year MSc students in your courses?

Q2: Comparing the 1st year master students (MSc intake 2017) to the previous ones (MSc intake 2016), the overall level is:

<table>
<thead>
<tr>
<th>Level</th>
<th>2017 MSc</th>
<th>2016 MSc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>13%</td>
<td>15%</td>
</tr>
<tr>
<td>Very Good</td>
<td>47%</td>
<td>35%</td>
</tr>
<tr>
<td>Good</td>
<td>38%</td>
<td>15%</td>
</tr>
<tr>
<td>Fair</td>
<td>2%</td>
<td>12%</td>
</tr>
<tr>
<td>Worse</td>
<td>12%</td>
<td>-</td>
</tr>
<tr>
<td>Much Better</td>
<td>15%</td>
<td>-</td>
</tr>
<tr>
<td>Much Worse</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

MSc AND PhD STUDENT POPULATION
As of the end of the year, 427 MSc and 279 PhD students were studying at Skoltech. The distribution of students per target domain and CREI (based on research advisor affiliation) is presented in the figures below.

Table 14. Network program

<table>
<thead>
<tr>
<th>MSc PROGRAM</th>
<th>PARTNERS</th>
<th>NO OF STUDENTS FROM PARTNER UNIVERSITIES ENROLLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Science</td>
<td>Higher School of Economics, Moscow Institute of Physics and Technology, State University of Aerospace Instrumentation</td>
<td>47</td>
</tr>
<tr>
<td>Mathematical and Theoretical Physics</td>
<td>Higher School of Economics, Moscow Institute of Physics and Technology</td>
<td>11</td>
</tr>
<tr>
<td>Photonics and Quantum Materials</td>
<td>Moscow Institute of Physics and Technology, Kazan Federal University</td>
<td>11</td>
</tr>
<tr>
<td>Computational Science and Engineering</td>
<td>Moscow Institute of Physics and Technology</td>
<td>5</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>Far East Federal University, Baltic Federal University, Kazan Federal University</td>
<td>4</td>
</tr>
<tr>
<td>Petroleum Engineering</td>
<td>Kazan Federal University</td>
<td>1</td>
</tr>
</tbody>
</table>

FACULTY FEEDBACK
To identify the level academic performance of enrolled first year MSc students, a survey was performed among the Skoltech faculty and course instructors that delivered courses during Terms one and two of the Academic Year 2017-2018.

Of 67 professors surveyed, 45 answered all of the questions of the survey. According to the results, 60% of the responders estimated the academic performance of the first year MSc students as “Excellent” and “Very Good,” while 38% selected “Good.” None of the respondents estimated their students’ level as “Poor,” and only one person estimated the level as “Fair.”

Asked to compare the current intake with the 2016, intake, 50% of respondents characterized the level of this year’s students as “Much Better” or “Better,” 38% as “Same” and 12% (four persons) as “Worse.” No one characterized the level of the MSc intake of 2017 as “Much Worse.”
The Skoltech Student Life Office (SLO, Office) provides a host of services aimed at improving the students’ activities outside of regular studies. It also works to develop and maintain fruitful contacts with the Institute’s growing network of alumni.

The main activities of the Office during 2017 are outlined below:

**Keeping students in the loop:** as part of Skoltech Communications team, the SLO informed students on events, opportunities and other issues that may be of interest or concern to them. In this sense, it facilitated all communications between Skoltech departments and the student body.

**Easing the transition for international students:** the Office has developed a new ‘buddy’ system to help international students prior to their arrival in Moscow. Using it, the SLO connects Skoltech students with incoming international students prior to the start of their first term. New students reported that it was very helpful to receive personalized guidance before coming to Skoltech. The SLO also helped international students with visa registrations and extensions.

**Creating community:** the SLO organized events aimed at helping students develop lasting relationships outside of the classroom, including orientation day activities and parties after such academic-intensive programs as the Innovation Workshop. The Office was actively involved in organizing the ringing-the-bell and commencement ceremonies, as well as various student-related elements of Skolkovo Startup Village and Open Innovations Forum.

**Liaising with the Student Council:** in order to best meet the needs of the student body, the Office worked closely with their elected peers in Skoltech Student Council, responsible for social and extracurricular activities. In collaboration with the Student Council, the SLO has organized a range of fun activities, including movie nights, a Secret Santa gift exchange and a guided tour of the Moscow Metro. The Student Council is also responsible for representing student interests, as a result of which the Office helped them negotiate student housing opportunities in Skolkovo Tetris quarter. The SLO has also helped the Student Council establish 18 extracurricular clubs, ranging from the Aircraft Design Club to the Japanese Language Club, the Startup Club to the Basketball Club.

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**Figure 40. Distribution of MSc and PhD students by CREI (incl. CEI), as well as Mathematical and Theoretical Physics students (*)**
Graduates and Alumni Network

The Skoltech Student Life Office strives to maintain contacts with all of the Institute’s graduates as they enter the workforce in Russia and abroad. Toward this end, the Office held alumni gatherings at the Skolkovo Startup Village and Open Innovations Forum, where participants developed action plans for future activities and elected to create an alumni website. The SLO has also begun work on a robust database tracking Skoltech graduates’ employment status and containing their current contact details. In particular, the SLO conducted an extensive survey of all Skoltech alumni (graduation of 2015, 2016, 2017) to find out their career paths. Most of the alumni — about 90% — responded to the questions about geographic distribution, income level, place of work, etc. The results of the survey are presented in the figures below.

Details of the main categories are provided below:

**Industry in Russia**

**Research in Russia**
- Skoltech (research intern), Lomonosov Moscow State University, Burdenko Research Institute of Neurosurgery, Central Research Institute of Mechanical Engineering

**PhD abroad**
- Max Plank Institute, University of Giessen, École Polytechnique Fédérale de Lausanne, University of California, Irvine, University of Cambridge, Swiss Federal Institute of Technology in Zurich, Stone Brook University, Carnegie Mellon University, University of Zurich, The German Aerospace Center, Technion, Rensselaer Polytechnic Institute, University of Amsterdam, Hasso Plattner Institute, Hong Kong University of Science and Technology, Hong Kong Polytechnic University, California Institute of Technology, GFZ German Research Centre for Geosciences

**Industry abroad**
- Badoo, Airbus, Cisco Systems, Astro Digital, the Aerospace Committee of the Ministry of Defense and Aerospace Industry of the Republic of Kazakhstan, Aerostate, LeapMind, German Orbital Systems, Revolut Ltd., KPMG South Korea
Target Domains and CREIs
Research highlights

Over 72 publications indexed in Web of Science/Scopus were published or in press in high impact factor journals in 2017, prestigious conferences and one book.

Selected examples include:


Value generation

CDISE concluded several industrial contracts in 2017 with Huawei (approx. 15 million rubles) in addition to ongoing projects and joint projects with CHIR with Gazprom Neft (preliminary 30 million rubles) with CDISE co-PI and crucial expertise. Several new contracts with Huawei are under consideration (the negotiation process has started). Four spin-offs are under development. Three patent applications have been submitted.
CDISE provides high-quality HPC service for the whole of Skoltech and has begun the process of creating the Center of Collective Usage for HPCs on the basis of the CREI and the Skolkovo Foundation’s equipment. The CREI is deeply involved in the creation of a Russian supercomputer society. Toward the end, it has signed agreements with the Keldysh Institute of Applied Mathematics and the National Research Center – Kurchatov Institute.

CDISE has two internal cross-central Biomedical Initiative Projects with CDIBB, which have become the engine of a relationship between Skoltech and the Scientific and Practical Psychoneurological Center named after Z.P. Solovyov.

Organization and participation in visible conferences, symposia, etc.

CDISE organized at Skoltech a workshop called Soilmatics, which attracted representatives from the most visible Russian soil science institutions (including the Dokuchaev Soil Science Institute, Lomonosov Moscow State University, Moscow Timiryazev Agricultural Academy) and agro-tech startups. Traditionally at the end of December, CDISE organizes “Christmas Colloquium on Computer Vision”, where state-of-the-art work related to computer vision is presented. In addition to Skoltech, this year’s participants included DeepMind, Intel, ENPC Paris, HSE and Facebook AI Research. The colloquium was sponsored by MES, Mapbox, and Yandex.

CDISE also actively participated in the organization of the Skoltech Gen-Y conference. The CREI likewise contributed significantly to the organization of the Conference on Stochastic Processes and their Applications (www.spa2017.org), where Professor Evgeny Burnaev and research scientists Alexey Naumov delivered presentations.

Professor Dmitry Lakontsev organized a Russian university consortium called Modern Network Technologies.

CDISE also hosted an IoT hardware hackathon – an event hosted jointly by Skoltech and Rostelekom joint event.

CDISE faculty and researchers made at least 26 oral and 30 poster presentations at prestigious international conferences including rank A, A* (ICRA, CVPR, ICML, AAAAI, ACL) in 2017.

In an effort to increase Skoltech international visibility of Skoltech, CDISE academic staff gave several invited talks during the year at such universities as the University of Exeter in the United Kingdom, and at RIKEN in Japan.

CDISE members were invited to speak at the International Forum of Technological Development Technoprom 2017, where Professor Dmitry Lakontsev served as chairman of the roundtable Industrial IoT, and Maxim Kuznetsov served as chairman of a roundtable on Artificial Intelligence.

Partners: RIKEN, Helmholtz Society, Huawei, Schlumberger, Philips, Astra Zeneca, MIT, Ohio State University, New York University, University of Strathclyde, University of Cambridge, Deakin, TU Munich, ChemRAR, RusAgro-Invest, Dokuchaev Soil Science Institute of RAS, MSU, Michurinsk State Agricultural Academia, National Research Centre Kurchatov Institute, Sberbank, Zyfra, Elvis, Gazprom Neft, RusAgro-Invest, Innopolis, Geoscan, VisionLabs, New Engineering Technologies, Minimax, MSU, ABBYY, Yandex, RosAtom, Lukoil.

Cyber Academy

In 2017, CDISE established the Cyber Academy, which it considers to be one of the most promising research and development initiatives in the scope of computer and mathematical science, which includes the development of complex AI (intellectual bot), data analysis, data featuring and data streaming.

CDISE has selected the Academy’s research and educational focuses, as well as having chosen a service provider to create a game platform. At present, a professional team is being created and preliminary commercialization discussions are under way with various industry actors, such as Sberbank, Rostelecom, Akado and Visa. A more detailed plan is outlined in the SAP 2018-2020.

CoBrain

CDISE members have played leading role in developing the NIT project CoBrain, which has attracted external funding in the amount of ~300 million rubles. The research group developed several methods for classifying and categorizing of biomedical images and presented their findings at leading conferences (a conference on Medical Image Computing and Computer Assisted Intervention (MICCAI) and the International Symposium on Biomedical Imaging (ISBI)).

CDISE launched several industry-oriented projects during the year. Notably, the P. Prikhodko group developed several algorithms for EEG analysis by request of Neurotrend, a leading Russian neuromarketing company, and Kazarian Epilepsy Center, a private medical company.


ANDRZEJ CICHOCKI

Skoltech professor.

“[W]e hope that after extensive coursework in ML and DL, our students will be equipped to develop a new generation of smart machines that will be useful for humanity, especially for a wide spectrum of biomedical applications.”

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Life Sciences & Biomedicine


**CENTER FOR DATA-INTENSIVE BIOMEDICINE AND BIOTECHNOLOGY**

**Director**  
Prof. Konstantin Severinov

**Research directions**  
Genomic editing  
Genetic-traits based selection  
OMICs analysis of brain function  
Antibiotics research  
Genomic-traits based selection

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**Academic Excellence**

Multiple papers published provided under separate cover (CDIBB faculty and students names shown in bold). Highlight include separate cover (CDIBB faculty and students names shown in bold). Highlight include separate cover (CDIBB faculty and students names shown in bold). Highlight include separate cover (CDIBB faculty and students names shown in bold).


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**Education**

Five graduate students defended their PhD degrees. They were among the first to do so at Skoltech.

The CREI also organized and held a bioinformatics and molecular biology summer school for undergraduates.

For the first time, MSc students from the Far Eastern Federal University and Kazan University were accepted as a part of joint programs with Skoltech.

A special stream of agricultural students were accepted from the Moscow Timiryazev Agricultural Academy.

CDIBB students conceived and performed laboratory projects with talented school children at the Sirius education center in Sochi in the summer of 2017.

**Research infrastructure**

A brand new teaching lab at the Technopark has been planned and equipped. The first students entered the lab at the end of 2017. The CREI has taken steps to organize the obtaining of high-level biological equipment into a communal use center for inside and outside users (the test case is the Skoltech Genomics center, which should be officially signed into being in February 2018).
CENTER FOR TRANSLATIONAL BIOMEDICINE

Director: Prof. Rupert Gerzer

Research directions
- Validation of new targets for diagnostics and therapeutics in cancer
- Fibrosis and neuropsychiatric diseases
- Biomedical applications of mass-spectrometry

Research highlights
In 2017, CTB focused primarily on the validation of novel targets for diagnostics and therapy, and improved vehicles for targeted delivery of RNAs in vivo.

Thus, the two main achievements in 2017 were:
1) participation in a multi-team study of non-viral delivery of CRISPR-Cas9 system in vivo for efficient gene editing; in this study performed in collaboration with MIT (PI Prof. D. Anderson), we provided a crucial piece of the system: novel chemically modified enhanced sgRNAs;
2) participation in a multi-team study of the role of cholangiocytes in liver regeneration (in collaboration with Edinburgh University, PI Prof. S. Forbes).

Additionally, CTB participated in the solution of a structure of yeast telomerase TEN domain, specifying the mechanism of telomerase function and facilitating the design of anticancer drugs (joint lab with MSU, collaboration with EMBL).

CTB obtained significant achievements in studies of molecular pharmacology of monoaminergic signaling in experimental animal models of brain pathology (in collaboration with Saint Petersburg State University).

CTB developed a number of novel approaches for high throughput identification of proteins, lipids, metabolites and hormones in biological samples using the cutting-edge mass spectrometry facility in Skoltech.

Finally, a considerable amount of work on the development of a mass spectrometer based on Cassinian trap was performed that will result in a final prototype in 2018.

In 2017 CREI faculty and researchers published 62 papers in peer-reviewed journals (WoS and Scopus), among them, six were published in the Nature publishing group (Nature (in the 96th percentile), Nature Biotechnology (in the 99th percentile), Scientific Reports and one in Developmental Cell; also among them, about 25 papers belong to Q1 WoS.

Prof. Olga Dontsova became a member of the Russian President Council on Science and Education and a member of the President Scientific Hiring Committee. She is a full member of the Russian Academy of Sciences (Head of Physico-Chemical Branch), head of the expert group for Biology in the Russian Science Foundation, a member of High Council and Bureau in the Russian Foundation for Basic Research, an editor at Biochimie, and a member of the editorial board at Acta Naturae.

Prof. Evgeny Nikolaev (in 2017 professor of SC, from 2018 of CTB) is a corresponding member of the Russian Academy of Sciences (Head of Physico-Chemical Branch), head of the expert group for Biology in the Russian Science Foundation, a member of High Council and Bureau in the Russian Foundation for Basic Research, an editor at Biochimie, and a member of the editorial board at Acta Naturae.
In 2017, Nikolaev received the prestigious European grant Horizon-2020 to provide the EU academic and industrial communities with access to world-class ultra-high-resolution mass spectrometry centers and to foster a European community of mass spectrometry researchers and practitioners. Dr. Olga Sergeeva received a grant for researchers from Russian Science Foundation. CTB currently has two projects supported by NGP grants and one by the SBI programs.

**Value generation**

An agreement for contract research with Generium was prepared (NDA signed and contract prepared, to be signed in early 2018). Yuri Kotelevtsev is a member of Scientific Advisory Board at the Boston Gene company and also became a member of the Scientific Advisory Board at the Skolkovo Foundation. CTB currently has two projects supported by NGP grants and one by the SBI programs.

**Education**

In 2017, four new courses (“RNA biology,” “Instrumental methods in molecular biology,” “Earth observation systems and measurements” and “Advanced practical course on modern methods in molecular/cellular biology”) were developed by CTB faculty members. Currently, the CREI has eight PhD students and 12 MSc students supervised. Only three MSc students from the CREI graduated in 2017, but most of active CTB faculty members were hired in 2016.

**Research infrastructure**

In 2017 the CTB labs at Skoltech, as well as joint labs, were significantly enhanced with new equipment and enhanced with new post-docs. Thus, the CREI can now perform the full pipeline of modern biomedical research – from molecular biology approaches to animal studies empowered by mass spectrometry analyses. The CREI purchased a cutting-edge TiMS-TOF mass spectrometer in 2017, which it anticipates will strongly impact its current studies.

**Cooperation & serving the wider community**

Projects with partners, partners’ contributions

CTB has joint projects with MIT (MRA and NGP supported – training of MSc and PhD students, access to high-level facilities, mentoring), Lomonosov Moscow State University (MRA supported – joint lab, training of MSc and PhD students, access to high-level facilities, mentoring), the Institute of Developmental Biology (joint lab, animal studies in vivarium, transfer of prolonged hepatocellular carcinoma mice model to Skoltech), the Institute of Medical and Biological Problems (joint OMICS studies on the influence of space on health, optimization of mass spectrometry methods), Erlangen-Nurnberg University (modified nucleic acids for cancer-specific action in vivo, organic synthesis of precursors), the Institute of Physical Organic Chemistry (modified nucleic acids for improved targeted delivery, organic synthesis of the cell surface ligands), and the Scottish Center for Regenerative Medicine.

Dr. Olga Sergeeva was a member of the student organizing committee for the conference “Shaping the Future: Big Data, Biomedicine and Frontier Technologies,” which increased Skoltech’s visibility among students and attracted a number of candidates for MSc and PhD studies at Skoltech.
Cutting-edge Engineering & Advanced Materials
Research directions

Advanced and Digital Technologies

Academic Excellence

CDMM conducts basic and applied research aimed at development and implementation of new simulation-driven design and manufacturing paradigms for advanced materials, structures, and engineering systems with enhanced lifecycles, mechanical and physical characteristics demanded in high-tech industries. At the moment, the CDMM CREI consists of four main research and educational thrusts: (1) composite materials and structures (PCM), (2) additive manufacturing (3D Printing), (3) information technologies for advanced manufacturing (PLM), and (4) micro- and nanomechanics of advanced manufacturing.

Research highlights

Over 30 publications indexed in the Web of Science were published or in press in high impact factor journals in 2017, as well as more than 20 publications in conference proceedings. Selected examples include:


Value generation

The development of the project “Experimental-Digital Certification Platform for Advanced Manufacturing Materials and Products” is to be supported by the NTI (about 150 million rubles for three years).

The development of the project to be included to the “Center of Excellence on Advanced Manufacturing” of the National Technology Initiative (about 120 million rubles for three years).

CDMM initiated collaboration with the Technical University of Munich and signed a Collaborative Agreement.

Education

Over 11 courses are available within the licensed and accredited MSc program in Advanced and Digital Engineering Technologies and the PhD program in Mechanics. As of the end of 2017, 19 MSc and 10 PhD students were enrolled in these programs.

Courses: Industrial Robotics; Mechanics and Physics of Advanced Manufacturing; Additive Manufacturing; Composite Materials and Structures; Introduction to Product Lifecycle Management (PLM); Advanced PLM Techniques I: Digital Design and Optimization; Advanced PLM Techniques, II: Digital Manufacturing and Model Validation; Continuum Mechanics; Structural Analysis and Design; Micromechanics; Fracture Mechanics; Numerical Methods in Engineering and Science.

Research infrastructure

The Composite Materials and Structures Laboratory focuses on the development novel composite material; research and certification testing of material components, materials, structures and structural elements; accelerated certification of materials and structures; design models of technological processes for the manufacturing of structural elements from composite materials, providing a transition to “digital” production with the optimization of its parameters.

The Advanced Manufacturing Laboratory consists of three main research facilities: additive manufacturing, industrial robotics, and thermal spraying. The facilities include various high-tech 3D printing equipment capable of the production of a variety of components and tools from metals, ceramics, polymers, and composites, advanced robots and robotic systems with programing capabilities. The thermal spraying facility is planned to be operational in fall 2018.

The Information Technologies for Advanced Manufacturing Laboratory has been put into operation. Research areas include: product lifecycle management methods and tools, simulation-driven product development methodology, experimental methods for structural models’ validation.

The Micro- and Nano-Mechanics Laboratory consists of mechanical characterization and mechanical testing facilities. The key areas of research include: the design and optimization of new materials and the development of new approaches for non-destructive testing and structural health monitoring. The range of studied materials includes polymer fiber-reinforced composites, materials with nano-reinforcement, ceramics, 3D materials, coatings and especially thermal barrier coatings.

Value generation

The development of the project “Experimental-Digital Certification Platform for Advanced Manufacturing Materials and Products” is to be supported by the NTI (about 150 million rubles for three years).

The development of the project to be included to the “Center of Excellence on Advanced Manufacturing” of the National Technology Initiative (about 120 million rubles for three years).

CDMM initiated collaboration with the Technical University of Munich and signed a Collaborative Agreement.
Cooperation & Serving wider community

Prof. Iskander Akhatov
• Member of the National Committee for Theoretical and Applied Mechanics of Russia
• Medal of Kh.A. Rakhmatulin awarded by the National Committee for Theoretical and Applied Mechanics of Russia
• Journal of Nonlinear Engineering (Editorial Board member)
• Chair of the FANO Committee on Evaluation of RAS Institutes in the field of Mechanics

Prof. Sergey Abaimov
• Associate Editor, Frontiers in Interdisciplinary Physics

Prof. Robert Nigmatulin
• Member of Russian Academy of Sciences
• Member of President of Russian Academy of Sciences
• Member of the Academy of Sciences of Republic Bashkortostan, Russia

Prof. Oleg Vasilyev
• Associate Editor, Theoretical and Computational Fluid Dynamics, Springer

Organization and participation in visible conferences, symposia, etc.

CDMM faculty are highly visible participants in international conferences. Selected examples include:

Prof. Iskander Akhatov: Physics and Mechanics of Advanced Manufacturing (Invited lecture in Barcelona Tech University); Additive Manufacturing of Advanced Manufacturing (Invited lecture in Physics and Mechanics Prof. Iskander Akhatov: Selection examples include:


SPACE CENTER

Director

Prof. Anton Ivanov

Research directions

Integrated systems leading to product development with focus on systems of systems approach (space, aero and surface segment)

Academic Excellence

In 2017, the Space CREI underwent significant changes. Interim Director Alessandro Golkar assumed a leadership position at Airbus Defense and Space (on leave from Skoltech). The Space Center is now led by Prof. Anton Ivanov.

The Space CREI’s research supports space exploration efforts, with the aim of addressing current societal challenges and changing nature of today’s complex systems.

Two main research focuses include advanced engineering (including space and systems engineering technologies, robotics and product life cycle methodologies) and remote sensing (the development of commercial services based on system-of-systems research).

Research highlights

• Larina, I.M., Percy, A.J., Yang, J., Borchers, C.H., Nosovsky, A.M., Grigoriev, A.I., Nikolaev, E.N., Protein expression changes caused by spaceflight as measured for 18 Russian cosmonauts, (2017) Scientific Reports, 7 (1), art. no. 8142, DOI: 10.1038/s41598-017-08432-w
resol...Molecular Biology, 51 (4), pp. 627-632., DOI: 10.1134/S0026893317030104

Grants
• Significant grant with Airbus Defense and Space in negotiation for 2018.

Awards
• WarVision received a special prize from Gazprom Neft (150 kRub)
• Eurobot Russia Champions. Skoltech’s reSET team, Russia. 5th place in the World Eurobot Championship, 24-28 May 2017, la Roche-sur-Yon, France.

Value generation
• Apple tree disease detection using a drone with computer vision. Soyu-zSnab-Skoltech Joint grant. Amount: 3.0 million RUB;
• Skoltech provided a Systems Engineering course to the MAI Management School (Prof. Anton Ivanov), 1 full week, 70 participants (United Aviation Corporation, United Motor Corporation, United Shipbuilding Corporation);
• Skoltech participated in advising on road map development for Roscosmos;
• The Space Center and CDISE participated in a 4D mapping project for the Republic of Tatarstan (funded by NTI). Development of an application for monitoring of oil and gas infrastructure;
• New startups are being formed: Lexy Smart, Webot telepresence, Tsuru Robotics, Tardis.AI, CardioLog.

Cooperation & Serving the wider community
Prof. Alessandro Golkar
• Member of the Editorial Board of the journal Concurrent Engineering Research and Applications
• Member of the Editorial Board of INCOSE Systems Engineering journal

Prof. Tatiana Podladchikova
• Managing Editor: REACH – Reviews in Human Space Explorations, Elsevier
• Member of International Space Weather Medals Committee

Prof. Evgeny Nikolaev
• Rapid Communications in Mass Spectrometry, Impact Factor: 2.226
• Spectrometry Reviews, Impact Factor: 9.373
• Corresponding member of Russian Academy of Sciences

Prof. Anton Ivanov
• Co-Chair, Small Satellites section, Reshetnev Readings, Krasnoyarsk
• Engineering Tutor, ESA Alpbach summer school
• Member of the Horizon 2020 Space experts panel (Brussels)

Projects with partners, partners’ contributions
Open lectures etc.
• “In arms of the star called the Sun,” The Spring School for the Oxford Russia Fund fellows.

Experimentarium Science Museum, educational program “Scientists for kids,” Moscow (March 11, 2017).
• “In arms of the star called the Sun,” The Spring School for the Oxford Russia Fund fellows.

Organization and participation in visible conferences, symposia, etc.
The Space CREI faculty were highly active in organizing conferences and workshop. Among many others were the first Friends of the Skolkovo Space Cluster conference involving Skoltech, Skolkovo Industrial Cluster and Roscosmos and its subsidiaries companies (Prof. Anton Ivanov, Dr. Andrey Potapov), as well as active organizers of the Federated Satellite Systems Workshop (Prof. Alessandro Golkar)

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Value generation

Cooperation & Serving the wider community

Prof. Tatiana Podladchikova

Prof. Evgeny Nikolaev

Prof. Anton Ivanov

Projects with partners, partners’ contributions

Organization and participation in visible conferences, symposia, etc.
Energy Efficiency
In application to hard-to-recover and unconventional hydrocarbon resources including brown fields, tight oil reservoirs, heavy oil fields, oil shales, gas hydrate bearing formations and oilfields on the Arctic shelf and in the Polar regions.

**Academic Excellence**

Key R&D directions in the area of petroleum science and engineering disciplines include enhanced oil recovery, exploitation and the production of unconventional hydrocarbons, geomechanics, gas hydrate and permafrost, geophysics, multiphase flow modeling, data science in application to hard-to-recover and unconventional hydrocarbon resources including brown fields, tight oil reservoirs, heavy oil fields, oil shales, gas hydrate bearing formations and oilfields on the Arctic shelf and in the Polar regions.

In 2017, the CHR executed more than 50 research projects including 12 research projects jointly with university partners, 32 research contracts with industry and three contracts in the context of grant supported by the Russian Science Foundation and the Government of the Yamal Nenets Autonomous Okrug; 32 MSc and PhD students were admitted to the Petroleum Engineering program in Russia and abroad; and 51 students in total are studying at the programs (as of the end of the year).

**Research infrastructure**

In 2017, the CHR opened its new world-class research facilities in Skolkovo Research infrastructure building. The facilities include:

- An unconventional petrophysics lab,
- A reservoir geochemistry lab,
- A geomechanics lab,
- A lab for enhanced oil recovery (chemical, thermal, gas and hybrid methods), and
- A gas hydrate and permafrost lab.

**Value generation**

Application of research results for the development of new technologies and the application of new technologies in the oil and gas industry:

- Attracted more than 120 million rubles in external financing in the framework of research contracts executed in 2017 and planned for 2018-2019;
- More than 30 contracts with industry, amounting to more than 130 million rubles in 2017;
- Close collaboration in the framework of research contracts with leading Russian and foreign oil and gas companies, including, Gazprom Neft, Lukoil, Rosneft, Gazprom, Novatek, Total, IBM and others.

**Cooperation & Serving wider community**

**Professor Mikhail Spasennykh**

- Head of Expert Group on innovation in oil and gas of the Commission on Technological Development of Russia’s Economy under the Russian President;
- Head of PhD program committee of Skoltech PhD Petroleum Engineering Program;
- Member of consulting board on the oil and gas industry (Skoltech);
- Member of Society of Petroleum Engineering;
- Member of European Association of Geoscientists and Engineers;
- Organization of more than 50 joint events with industry (workshops, trainings, opening lab and so on); and
- Reviewer in scientific journals.

**Prof. Andrei Osipov**

- Serving on the expert group on Computer Science, IT & Numerical Math of the Faculty Appointment Committee of Skoltech.
TARGET DOMAINS AND CREs

ANNUAL REPORT // SKOLTECH

/05 TARGET DOMAINS AND CREs
Academic Council (selection of Faculty for CDISE);
- Serving on the Committee for Research Projects and Programs (CRPP) of Skoltech Academic Council;
- Member of consulting board on the oil and gas industry;
- Ad hoc reviewer for several journals:
  - Journal of Petroleum Science and Engineering (5 papers),
  - Journal of Fatigue (1),
  - Physics of Fluids (1),
  - Advances in App Maths (1), and
  - Thermal Physics and Aeromechanics (1).

Prof. Yuri Popov
- Member of Skoltech Appointment Committee in 2016-2017;
- Member of consulting board on the oil and gas industry;
- Head of State Examination Commission of RSGPU-MGRI;
- Member of Council on PhD and Dissertations Defending in RSGPU-MGRI;
- Member (Past-Chairman) of International Heat Flow Commission (IASPEI);
- Member of Scientific Council “Problems of Geothermics” of RAS;
- Member of Russian Academy of Natural Sciences;
- Expert of RFBR; and

Prof. Dmitri Koroteev
- Member of consulting board on the oil and gas industry;
- Member of Society of Petroleum Engineering;
- Member of European Association of Geoscientists and Engineers;
- Reviewer in a number of scientific journals.

Prof. Artem Myasnikov
- Member of Skoltech expert panel on Mechanical and Petroleum Engineering;
- Member of consulting board on the oil and gas industry;
- Member of PhD committee on Petroleum Engineering program;
- Member of Society of Petroleum Engineering;
- Member of European Association of Geoscientists and Engineers;
- Reviewer in a number of scientific journals.

Prof. Alexey Cheremisin
- Member of consulting board on the oil and gas industry;
- Member of Society of Petroleum Engineering;
- Member of European Association of Geoscientists and Engineers;
- Member of the Society of Exploration Geophysicists (SEG) Research Committee; and
- Review for the journal Geophysics.

Prof. Marwan Charara
- Member of consulting board on the oil and gas industry;
- Member of Society of Petroleum Engineering;
- Member of European Association of Geoscientists and Engineers;
- Member of RAS Geothermics Scientific Council;
- Member of Academy of Sciences; and
- Review for the journal Geophysics.

Prof. Alexey Cheremisin
- Member of Program committee of Moscow SPE conference, October 2017;
- Member of Program committee of Thermal EOR conference, Kazan, 2017;
- More than 30 events with Industry (Enhanced recovery).

Prof. Yuri Popov
- Member of Program committee of International conference “GeoModel-2017;”
- Chairman of the session “Experimental Geothermics” within IAG-IASPEI Joint Scientific Assembly in Kobe, Japan, July 30-August 4, 2017;
- Chairman of the session “Petrophysics” within International EAGE conference “GeoModel-2017;”
- Chairman of three sessions within International EAGE conference “GeoModel-2017;”
- Chairman of a session within the EAGE conference in Moscow, April, 2017; and
- More than 20 events with Industry related to machine learning; and
- More than 10 lectures at student events (Tyumen, Ufa, Moscow).

GORDON MOORE
Professor at Skoltech and University of Calgary:
“Skoltech has assembled world-class EOR laboratory facilities which provide graduate students with opportunities to perform experiments on leading-edge equipment and to use this data as input to numerical simulation studies on a wide variety of recovery techniques.”
Center for Electrochemical Energy Storage

Director Prof. Keith Stevenson

Research directions
Thrust 1. Advanced metal-ion batteries
Thrust 2. Rechargeable metal-air batteries
Thrust 3. Fuel, electrolysis, redox flow cells
Thrust 4. Organic and hybrid solar cells
Cross-cutting Thrust: Computational materials discovery, screening, modeling and simulation

Research highlights
Over 70 publications indexed in Web of Science were published or in press in high impact factor journals in 2017. Selected examples include:

Education
Over nine courses available with licensed and accredited MSc and PhD programs in Materials Science and Engineering. Approximately 50 MSc and PhD CEE students were enrolled in the programs as of the end of 2017.
- 2nd Conference for Young Scientists (90 Academic & Industry participates)
- 18 new MSc students and 10 PhD students were recruited for fall 2017 enrollment.

Research infrastructure
Solar and Battery prototyping, in operando characterization, battery and fuel cell testing, high throughput material synthesis and characterization facilities, computational resources ranging from classical molecular dynamics to ab initio quantum chemistry.

A pilot scale battery manufacturing facility will be operational March 2018.

Value generation
Several breakthrough materials discoveries have already been made and are in the process of further development and patenting. Five invention disclosures were filed with Skoltech KTO in 2017. Three companies have been formed. One company (Rustor) will commercialize cathodes for Li-ion batteries; another company (yet to be named) will develop materials for both aqueous and non-aqueous redox flow batteries in Russia. A third company (APC Complex) founded by A. Oganov focuses on material discovery with the USPEX code. Also, ongoing discussions with Bosch, LG electronics, Rusal and others are considering the establishment of joint laboratories at Skoltech.
Cooperation & Serving wider community

Prof. Keith Stevenson
- Member of a working group on NTI e-mobility
- Program manager for NGP
- Program manager for SBI
- Co-organizer of joint MIT-Skoltech conferences (1st, 2nd, and 3rd meetings)
- Editorial Board Member of ACS Advanced Energy Materials.

Prof. Artem Abakumov
- Member of a working group on NTI e-mobility
- Chair of the Special Interests Group on Aperiodic Crystals of the European Crystallographic Association.
- Chair of the CO2 Review Committee of the European Synchrotron Radiation Facility.

Prof. Artem Oganov
- Award Committee, RUSNANOPRIZE
- Member of Russian delegation and panelist at sessions “AI and Manufacturing” and “Global innovation: A View from Russia” at the World Economic Forum (Dalian, June 2017)
- Organizing Committee, “Science of the Future” conference of the Ministry of Education and Science
- Member of the Russian President Council on Science and Education

Prof. Alexey Buchachenko
- Board member of Russian Science Foundation
- Chair of an Expert Panel of the Commission on the Assessment of the Performance of Scientific Organizations under the Federal Agency of Scientific Organizations (in Physical Chemistry, Chemical Physics, Polymers reference group)

Organization and participation in visible conferences, symposia etc.

CEE faculty are highly visible organizers and participants in international conferences (over 30 invited talks). Selected examples include:

Center for Energy Systems

Director
Prof. Keith Stevenson

Research directions
- Smart Grids
- Integrated Energy Infrastructures
- Energy Markets and Regulation
- Power Electronics and Devices

Academic Excellence

CES has established itself as an internationally-leading center of research on advanced mathematical methods for energy systems and as an internationally-recognized center of research on energy system integration. Over 30 publications indexed in Scopus were published in 2017 (13 accepted for publication). Examples of journal publications include:
- F. M. Ibanez, E. Jose, F. Luis: “Master–slave DC droop control for parallelising auxiliary DC/DC converters in electric bus applications,” IET Power Electronics, v.10
- Y. Apertet, H. Ouerdane: “Small-signal model for frequency analysis of thermo-
electric systems," Energy Conversion and Management, v.149


C. Elsid, A. Bisci, P. Silva, E. Martelli: "Two-stage MINLP algorithm for the optimal synthesis and design of networks of CHP units," Energy, v.121


Grants, awards and honors received in 2017:

Value generation
1. Two industry R&D contracts signed in 2017 for 13.5 million rubles in total:
   a. PJSC “DGC of Urals” (daughter company of PJSC Rosseti): “Technology of condition diagnostics of insulators of overhead lines and switchgears 6-220 kV by the method of ultraviolet control”;
   b. “MAP Maker” for PJSC Rosseti.

2. FONDAZIONE BRUNO KESSLER (FBK, Italy): PhD studentship at CES.
3. A2A multi-utility group and OPTIT consultancy company: Mol to bidding for European Bank of Reconstruction and Development (EBRD) tender in Kazakhstan.

4. “Monitoring ice conditions in the regional electric network”
5. FONDAZIONE BRUNO KESSLER (FBK, Italy): PhD studentship at CES.
6. A2A multi-utility group and OPTIT consultancy company: Mol to bidding for European Bank of Reconstruction and Development (EBRD) tender in Kazakhstan.

Cooperation & Serving wider community

Prof. Janusz Bialek
• Editorial Board of special section on Energy System Integration, IEEE Trans. Smart Grids;
• International Scientific Advisory Board,

Education
CES developed a balanced curriculum for the 2017/2018 academic years and introduced five new courses. Now all courses are delivered by CES faculty members. In total, 17 MSc students and 25 PhD students were supervised, and 10 new MS students and 11 PhD students enrolled in fall 2017.

Research infrastructure
• Microclimate control lab created and commissioned under Skoltech-MIT NGP; Room 403 has been equipped with sensors and actuators to control room climate in an energy efficient way and test optimized control strategies, including Reinforcement Learning ones.
• Power electronics lab for education and research purposes has been created as a part of the Smart Grid Lab. Half of the “Power electronics” course (F. Ibanez) is held in that lab, including guided experiments and experimental projects.

Prof. Aldo Bischli
• Guest editor on Integrated Energy Infrastructure, Energy the international journal; and
• NGP project lead.

Prof. Elena Gryazina
• Organizer of the 9th Traditional Summer School “Control, Information and Optimization” June 14-20, 2017 (Institute for Control Sciences, Higher School of Economics, Skoltech);
• Guest editor for special issue “Traditional school on control, information and optimization” in Advances in System Science and Applications, 17(13), 2017.

Prof. Mikhail Chertkov
• Editorial Board of the Journal of Statistical Mechanics, JSTAT;
• Editorial Board of Scientific Reports, Nature Group;
• Editorial Board of IEEE CONES (Control of Networks); and
• Editor for the special issue of IEEE CONES on “Special Issue 2019: Analysis, Control and Optimization of Energy System Networks.”

Prof. Yuri Maximov
• Editorial Board of Lecture Notes on Computer Science (Springer), special issue on Intelligent Data Processing Conference (IDP-16).

Organization and participation in visible conferences, symposia, etc.

• CES organized its 3rd International Conference “Science for Energy Systems Regulation,” at Skoltech in October 2017, for over 40 participants and nine invited international experts.
• Examples of international conferences (invited talks) CES faculty and researchers have been invited to:
   a. Prof. Janusz BlialLnce in Manchester (United Kingdom)
   b. Prof. David Pozo: VII Workshop of Energy Economy, “Reliable Integration of Renewable Energy to Support Climate Mitigation” (Chile)
   c. Prof. Mikhail Chertkov IREP 2017, September, Porto (Portugal)
   d. Prof. Mikhail Chertkov NIPS 2017 (December, Long Beach, CA), CDC 2017 (December, Melbourne)
   e. Prof. Yuri Maximov NIPS 2017 (December, Long Beach, CA),

Prof. Keith Stevenson
Dean of Research, Director of CEE and CES
“..."
Quantum Technology
Internal grants:

- 2 projects at Skoltech Translational Research Innovation Program (STRIP) (prof. Albert Nasibulin)

External funding:

- The ERA-NET Plus project (under European Union program Horizon 2020) “Flexible hybrid heterojunction nanostructures for optoelectronic applications” (Germany, Estonia and Russia). Ministry of Science and Education of Russian Federation. (prof. Albert Nasibulin)

Education

12 courses available with licensed and accredited MS and PhD program. Approximately 30 MS and 22 PhD students are enrolled in PQM programs.

Courses: Quantum Mechanics, Advanced Quantum Mechanics, Introduction to Solid State Physics, Advanced Solid State Physics, Fundamentals of Photonics, Hybrid Photonics, Nanoptics, Non-linear Optics, Fiber Optics, Biomedical Application of Photonics, Fundamentals Device Physics, Carbon nanomaterials.

Twenty new MS students and 10 PhD students were recruited for Fall 2017 enrollment.

Research infrastructure

- The Hybrid Photonics Laboratory, including small “clean room” facilities, is fully functional;
- The Nanomaterials Laboratory, with six research project groups, is fully functional;
- The research infrastructure for the Nanophotonics Laboratory has been established;
- The Biophotonics Laboratory research concepts have been approved, a research infrastructure has been established, and purchases have been initiated;
- The research infrastructure for the project “Development of ultrastable signal generator to increase by order of magnitude precision of geolocation, space navigation and to form new mass market segments of GNSS applications” has been established.

Value generation

Two high-impact industrial projects supported within subsidies (contracts under Federal program Research and development in priority areas of development of Russia’s scientific and technological complex for 2014-2020 (1.4) of the Russian Ministry for Education and Science are running at CPQM: “Development of technologies and components of integrated microwave photonics” (as part of consortium of MEPHi, Skoltech & NSU) and “Development of ultrastable reference signal generator based on cold Yb ions for increased precision GNSS applications” (as part of consortium of Lebedev Physical Institute, Russian Space Systems, Institute of Laser Physics SB RAS & Avesta Ltd). The start-up company “CryptoChemistry” was established. Three patent application were submitted and two patents granted. Ongoing discussions and cooperation are under way with RTI, RSS, T8, HUAWEI, Sberbank, Vanttelecom, IPG Photonics, En+ Group, RUSAI, IBM, Connector Optics, Varton, Lassard, Cambridge Quantum Computing company, Moscow Oncology Research Institute, Jenoptik, LASSOS (Germany).
Cooperation & Serving the wider community

- A series of PostNauka online lectures in photonics (prof. Ildar Gabitov, prof. Nikolay Gippius, prof. Vasily Perebeinos)
- Member of the consulting group of the federal initiative “Digital Economy”;
- Steering committee of the Project “Multiply,” United Kingdom (prof. Arkady Chipouline).
- Member of Advisory board on ESPRC Programme on Hybrid Polaritonics;
- Invited member of the Board of Directors of Schwinger Foundation (prof. Natalia Berloff).

Organization and participation in visible conferences, symposia, etc.

CPQM faculty members have organized and participated in many international conferences (over 40 invited talks).

Selected examples:

- (Co-organizer) prof. Vasily Perebeinos CleoEurope 2017 Two-dimensional Materials, Munich, Germany, June 2017;
- (Co-organizer) prof. Boris Fine Perspectives on High-Temperature Superconductivity, Skoltech, October 2017;
- (Co-organizers) prof. Natalia Berloff and prof. Pavlos Lagoudakis Conference on Hybrid Photonics and Materials, Mykonos, Greece, September 2017;
- (Invited talk) prof. Dmitry Gorin “Photonic tools for imaging & navigation of remote controlled theranostic carriers,” 1st Nano-Bio materials and Raman characterization workshop, Ghent, Belgium, September 2017;
- (Co-organizer) prof. Mikhail Skvortsov, Workshop on localization, interactions and superconductivity, Chernogolovka, Russia, December 2017.

ILDAR GABITOV
Professor, CPQM

“Quantum technologies are an important element of our research and technology projects that have two principal drivers. First, the miniaturization of electronic devices underscores the need for addressing small-dimension quantum effects. Second, the evolution of technology, as such enables the use of remarkable features of the quantum world in a wealth of diverse applications.”
Center for Advanced Studies

Director
Prof. Igor Krichever

Research directions
Mathematical Physics

Academic Excellence

Research within the CAS is focused mainly in the areas of geometric representation theory, string theory, conformal and gauge field theory, integrable models, combinatorics and singularity theory, symplectic geometry, topology, statistical physics, dynamical systems and hyperbolic geometry.

Research highlights

Over 40 publications indexed in Web of Science were published or in press in high impact factor journals in 2017.

Selected examples include

• A. Kemppainen, S. Smirnov, “Conformations of FK Ising interfaces and hypergeometric SLE”.

Education

Over 17 courses are available with licensed and accredited MSc and PhD programs in Mathematical and Theoretical Physics. Approximately 17 MSc and PhD students are enrolled. Four PhD students are winners of the “Young Math of Russia” Call.

Selected courses:

• Lie Groups and Lie algebras and their representations.
• Hamiltonian mechanics,
• Geometric representation theory,
• Dynamical systems and Ergodic theory,
• Gauge theory and Gravitation,
• Differential topology,
• Random Processes,
• Integrable systems

Cooperation & Serving wider community

The CAS faculty are highly visible organizers and participants in international conferences (over 50 invited talks). In 2017 the following conferences and Workshops were organized by CAS:

• Workshop “Moduli Spaces in Moscow: Dynamics and Geometry”, Moscow, June 5-9, 2017.

Organization and participation in visible conferences, symposia, etc.

The CAS faculty, with its multidisciplinary approach, is the ideal choice: offering graduates knowledge with clear, real application. Successful graduates of our master’s program can be confident that they will obtain spots at our postgraduate school, but we also hope they will be sought after candidates at leading scientific centers abroad.

Prof. Grigory Olshanski
• Member of several Editorial Boards: Functional Analysis and its Applications; Transformation Groups; Journal of Lie Theory; SIGMA (Symmetry, Integrability and Geometry: Methods and Applications);
• Member of the Board of the Moscow Mathematical Society.

Prof. Semen Shlosman
• Member of Editorial Boards: Uspekhi Matematicheskii Nauk; Moscow Mathematical Journal.

Prof. Anton Zabrodin
• Member of the Editorial Board of “Analysis and Mathematical Physics.”

Dr. Anton Zorich
• Member of the Scientific Committee of Max-Planck-Institut for Mathematics, Bonn; and
• Member of Editorial Boards: Journal of Modern Dynamics; Journal of the Institute of Mathematics of Jussieu.
Skolkovo
Innovation
Ecosystem &
Wider
Community

06
Skolkovo Ecosystem

Skolkovo Ecosystem
In 2017 Skoltech significantly broadened its engagement with the ecosystem of both the Skolkovo Innovation Center and Skolkovo Education Hub, a joint venture with Moscow School of Management Skolkovo (MSM Skolkovo) and the New Economic School (NES).

**Skolkovo Innovation Center**

Throughout 2017, Skoltech faculty, students and staff have had multiple and continued engagement with residents of the Skolkovo Innovation Center, Technopark Skolkovo and Skolkovo International Gymnasium.

In 2017, Skoltech and Skolkovo Gymnasium had two joint events in form of two lectures conducted between two institutions. The first lecture took place at the end of September, where Skoltech Professor N. Gippius read course «Theory of interaction between light and matter». Another lecture on topic of «Blackholes paradox» by Prof. Anatoly Dymarskiy took place on 13 of December 2017. Interactions with Skolkovo Gymnasium started by kick-off meetings last year, where major activities for implementation in future years where decided. For the year of 2018, expansion of variety of lectures by Skoltech professors and extra curriculum courses organized by master and PhD students of Skoltech is planned. These courses will be adopted to meet the education level of high school pupils. Furthermore, mentoring program of scientific projects by post graduates and professors of Skoltech will be initiated in 2018. Lastly, Skoltech managed to provide an opportunity to conduct master classes and workshops at Skoltech labs as well as providing our internal facilities in order to achieve the best mutual long-term collaboration. Skoltech MSc and PhD students have conducted seminars for the Gymnasium students and organized visits and workshops at Skoltech laboratories. Skoltech faculty regularly speak at events organized by the Skolkovo Technopark. Skoltech takes active part in all major events at the Skolkovo Innovation Center, including the Startup Village, Open Innovation Forum, Skoltech AI conference, Skolkovo Jazz and more. Most of these events are held partially on the Skoltech campus and students are regularly engaged as volunteers. Various units of the Skolkovo Innovation Center held over 30 events on the Skoltech campus with the participation of the Skolkovo community in 2017. These included investment competitions among Skolkovo residents and industrial partners, hackathons, visits of international business delegations and many others.

**Skolkovo Education Hub (SEH)**

On December 27, 2016, at the Sochi International Investment Forum, Skoltech signed an agreement with MSM Skolkovo and the NES, which set the framework for cooperation between the three institutions along the avenues of joint research, education and innovation activities. The Skolkovo Education Hub (SEH) aims to maximize the synergetic effect of the three schools in order to create new joint educational products to be offered on the corporate education market as well as to benefit the students. In 2017, Skoltech faculty and leadership participated in multiple events held on all three campuses and were engaged in teaching courses offered by the MSM Skolkovo to its corporate clients. Joint faculty club meetings are held quarterly to identify areas of potential research collaboration. The three institutions participate in all major Skolkovo events under the umbrella of the SEH. The Institute is also a key element of the large project “Large Skolkovo”, a joint endeavour of Skoltech, MSM Skolkovo, NES, Millhouse Capital and the municipal authorities of Zarechie and Novoivanovskoe. The goal of the project is the overall joint development of the Skolkovo territory into an alternative intellectual and innovation agglomeration in Moscow.

**SIRIUS**

In March 2017, Skoltech began active cooperation with the Sirius Educational Center in order to evoke a sustainable interest in science among young people, raise the educational level of Sirius students and fulfill their scientific potential, involve Sirius students and graduates in advanced research projects, set up a round-the-year cooperation program to help young talents acquire competitive project skills and scientific competences and provide tutelage and mentoring by Skoltech faculty. In particular, the scope of cooperation covers the following activities.

- Implementation of in-depth core-discipline and interdisciplinary programs, including workshops at Skoltech leading labs and student projects;
- Engagement of Sirius graduates in the development and implementation of grant-funded R&D projects in the advanced fields of science and technology;
- Set up lectures for Sirius students in Sirius during educational shifts by Skoltech professors, researchers, heads of laboratories and employees;
- Set up online webinars for Sirius graduates in Sirius’ e-learning environment by Skoltech leading researchers;
- Encourage Sirius graduates to participate in Skoltech events (conferences, tournaments, competitions, olympiads, etc.) aimed at promoting research and innovative activity;
- Encourage Sirius graduates to participate in other public cultural, awareness-raising, educational and industry events conducted by Skoltech independently or in partnership with other entities;
- Set up Sirius-based internship and student teaching programs for Skoltech students;
- Engage Skoltech staff in the implementation and expert assessment of student research and design projects;
- Contribute to the development and implementation of specialized educational programs based on the Sirius model for newly created regional talent discovery and support centers and participate in their activity;
- Provide information support for Sirius educational programs launched at schools cooperating with Skoltech;
- Establish links and information exchange as part of the campaign aiming to disseminate scientific knowledge, promote state of the art science and technology.

**ALEXEI SITNIKOV**

*Vice President for Communications and Community*

“Skoltech is an essential element and the intellectual nucleus of the Skolkovo ecosystem. Professors, researchers, and students actively participate in the Innovation Center’s key events.”

**ALEXANDER SAFTONOV**

*Vice President for Academic Development, Academic Secretary*

“One of Skoltech’s priorities is to engage young talents in the world of big science and cutting-edge technologies.”
The following activities were held during the year:

<table>
<thead>
<tr>
<th>DATE</th>
<th>BUILDING (LOCATION)</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 2017</td>
<td>Two lectures by prof. Konstantin Severinov related to (1) “genomic medicine” and (2) “Admission to Skoltech. Sirius, Sochi”</td>
</tr>
<tr>
<td>April 2017</td>
<td>Four lectures of prof. Boris Fine. Sirius, Sochi</td>
</tr>
<tr>
<td>April 2017</td>
<td>Attendance of a joint conference hosted by Skoltech and MIT: Shaping the Future. Big Biomedicine, Biomedicine and Advanced Technology by Sirius graduates and employees</td>
</tr>
<tr>
<td>June 2017</td>
<td>Attendance and presentation of the projects of Sirius graduates during the Skolkovo Startup Village 2017</td>
</tr>
<tr>
<td>July 2017</td>
<td>Participation in the project shift Bolshie Visovi 2017 in the division of “agro- and biotechnology” by Skoltech biotechnology students as project coordinators</td>
</tr>
<tr>
<td>July 2017</td>
<td>Participation of Skoltech employees in the project “Big challenges 2017” as experts during final presentations of project teams</td>
</tr>
<tr>
<td>July 2017</td>
<td>Preparation of reviews of viewed project presentations during project shift “Big challenges 2017”</td>
</tr>
<tr>
<td>August 2017</td>
<td>2 lectures of prof. Maxim Kiselev related to (1) How to make a successful presentation (2) Basis of innovative entrepreneurship. Sirius, Sochi</td>
</tr>
<tr>
<td>August – September 2017</td>
<td>Organization and holding of remote-learning webinar: Turbo-science for Sirius graduates. Skoltech</td>
</tr>
<tr>
<td>September 2017</td>
<td>Organization and holding of an open lecture of prof. Nikolay Gopius on the topic “Theory of interaction of light and matter” for Sirius graduates, the recipients of presidential grants and the students of the Skolkovo gymnasium. Skoltech</td>
</tr>
<tr>
<td>October – December 2017</td>
<td>Conducting a pilot version of the distant tutoring program “Turbo-Science” for the graduates of the Center “Sirius.”</td>
</tr>
<tr>
<td>November 2017</td>
<td>A report on the status of the Sirius laboratory complex and the possibilities for its improvement</td>
</tr>
<tr>
<td>December 2017</td>
<td>Organization and holding an open lecture of prof. Anatoly Dymarsky on the topic “Black hole information paradox” for Sirius graduates, the recipients of presidential grants and the students of the Skolkovo gymnasium. Skoltech</td>
</tr>
<tr>
<td>December 2017</td>
<td>Organizing and conducting of a lecture on the topic “About the human genome” by prof. Konstantin Severinov for math students in December 2017. Sirius, Sochi</td>
</tr>
<tr>
<td>December 2017-ongoing</td>
<td>A number of meetings were held with the head of the Talent and Success Foundation regarding the participation of Skoltech project teams in the project “Big challenges 2018” in the division of “agro- and biotechnology.”</td>
</tr>
<tr>
<td>December 2017-ongoing</td>
<td>Preparation of the first draft of a cooperation agreement between Skoltech and the Talent and Success Foundation.</td>
</tr>
</tbody>
</table>

**SUMMER SCHOOL**

Within the activities for gifted school kids and undergraduate students, Skoltech piloted the Summer School in Theoretical Physics, Bioinformatics and Molecular Biology (August 25th-September 4th). The School focused on exposing talented students to advanced research by providing the opportunity to work with leading scholars from Skoltech and its partners from Russia and abroad.

The School was attended by 42 students from 17 Russian universities, including Ufa Technical University, Ural Federal University, Saint Petersburg Academic University, Tuymen State University, Kazan Federal University, Baltic Federal University, Kemerovo State University, Volgograd State University and others. The selection of the participants was conducted by an organizing committee that comprised Skoltech faculty, as well as invited experts in the relevant fields:

1. Prof. Konstantin Severinov, Skoltech (CDI/BB)

Lectures of the Summer School

**Section “Theoretical Physics”**

Prof. Gregory Falkovich, Weizmann Institute of Science (Israel)
Prof. Leonid Levitov, MIT (United States)
Prof. Dmitry Kharcheev, Stony Brook University (United States)
Prof. Yuil Nazarov, Delft TU (Netherlands)
Dr. Dmitri Aibanin, Russian Quantum Center (Russia)
Dr. Alexey Loselevich, HSE (Russia)

**Section “Bioinformatics”**

Dr. Mikhail Tamn, HSE (Russia)
Dr. Andrei Mironov, MSU (Russia)
Dr. Sergey Ulianov, MSU (Russia)
Dr. Alexander Gorsky, Institute for Information Transmission Problem RAS (Russia)
Dr. Alexander Chertovich, MSU (Russia)
Dr. Sergey Nechaev, French National Center for Scientific Research (France)
Dr. Ekaterina Khrameeva, Skoltech (Russia)

**Section “Molecular Biology”**

Dr. Mikhail Gelfand, Skoltech (CDI/BB)
Prof. Mikhail Skvortsov, Skoltech (CDI/BB)
Prof. Gregory Falkovich, Weizmann Institute of Science
Prof. Leonid Levitov, MIT
Dr. Mikhail Feigelman, Landau Institute of Theoretical Physics and CPQM at present
Dr. Elizaveta Boch-Osmolovskaya, Research Center of Biotechnology RAS

The School program was developed in a way to cover various activities, including lectures, seminars, individual mentoring sessions, a laboratory practicum (section “Molecular Biology”), projects and presentations of results, site visits to academic institutions and technoparks and self-study time. The study program was delivered by faculty and researchers from Russian and international universities and academic institutions (Skoltech, MIT, Delft TU, MSU, HSE, Landau Institute for Theoretical Physics, Stony Brook University, Weizmann Institute of Science and others).
Campus and Administrative Support
2018
step-by-step relocation to the new campus

Project and Construction Management-New Campus and Interim Facilities
• Delivery dates for the East Ring have been extended in accordance with the Foundation’s decision. All move plans have been revised to 2018. This task will carry-over to the SAP. All lab designs and other project documentation in accordance with agreed schedules have been completed in full.
• All interim facilities and space plans have been delivered and completed and the budget has been fully executed.

Space Planning and Management
• To the extent that local regulation allow, we have provided all necessary facilities for labs and materials management functions. Space has been allocated to all functions in accordance with available budget and Presidential directives.
• A basic system of projecting space needs has been implemented. An automated system is under development in conjunction with the back-office program to develop/implement automated business processes.

Facilities Management and Operations
• The development and execution of a cost-effective facilities management plan that minimizes the down-time of engineering and support facilities is complete, but under continuous revision to improve performance on a regular basis, rather than on a periodic, project-type basis.

EHS
• The EHS policy has been revised, new lab safety plan developed and approved with Directors of “high-risk” labs identified during a regular audit in 2017.
• The EHS-audit plan has been revised with respect to labs, shared facilities and educational facilities complete and under review.

Real Estate Management
• Budget planning and execution of the control system are partially complete (budget planning system), with the remainder planned for 2018 in accordance with planning for automation of business processes.
• Income-generating (where possible) profitable and leasing plan for available space in the East Ring. Preliminary plans indicated, and will be developed and approved for execution in 2018 in accordance with revised East Ring delivery schedule.

ADMINISTRATIVE SUPPORT

The goal of the Back Office is to provide financial and administrative services in support of the Institute’s mission. The functions of recording financial transactions, safeguarding physical and financial assets, allocation of resources, human resources services, procurement, IT and legal compliance are handled by the Department of Financial Planning and Controlling, Finance Department, Office of Internal Control, IT Department, Legal Support Department, Procurement Department, along with appropriate financial and administrative systems.

Financial and operational resources
• A renewed financial concept was developed as the framework for budgeting and business intelligence system implementation. Financial control and reporting on the Institute activities.
• An on-line cash office has been launched for events and short-term programs.
• An on-site audit for 2014-2016 was conducted by the Social Security Fund. Skoltech was audited for 2014-2016.
• New approach for housing was developed and implemented. As a result, over 30 relocated Skoltech employees moved to the premises of Skolkovo Innovation Center.
• Updated Procurement Regulations were implemented for centralized procurement process.
• Total annual savings amounted to 15% (direct savings, calculated from initial maximum estimated prices) thanks to the implementation of standard competitive tendering procedures. The savings provided the Institute additional financial resources for projects and initiatives in its’ core functions.

Information systems improvement
• A budgeting IT system (IBM Cognos TM1) was implemented for quality process (including headcount).
• An Electronic Document Management System (EDMS – DIRECTUM) was introduced as an essential tool for building a complete document management solution tailored to the requirements of the Institute.
• Implementation of EDMS builds out an information infrastructure giving central control over operation content ensuring secure electronic documents archive, streamlining approval process, providing staff co-op-eration, improving operational effectiveness and clarity, cutting costs and reducing risks.
• Electronic archive. The conceptual approach and design of the archive was developed (to be implemented in 2018).

Reengineering of business processes.

Internal Control System
• Business process reengineering project (cross-functional) was conducted related to educational, research, operational, facilities management activities.
• Annual risk Assessment (Risk Register) was performed including the CREIs’ and Departments’ highest risks to the Institute. Risk mitigation action plan was developed for 2018.
• Internal control was documented and embedded into processes for further integration with IT infrastructure.
• Internal control policy was developed. Risk and Control Matrices were developed on the basis of business processes correction.
The section provides a review of Skoltech’s financial results for 2017 based on cash approach, as well as key issues related to management reporting.

**OPERATING REVENUE SOURCES**

In 2017, Skoltech received a total of 6,539.3 mln RUB in funding from various sources, as presented below. A Skolkovo Foundation Grant and income from the Endowment were the two largest sources of funding, representing 84% and 7% of total funding during the Fiscal Year 2017, respectively.

In 2017, operating revenue amounted to 1,047.8 mln RUB, 114.5 mln RUB more than in 2016. The following table shows the key components of the revenue boost.

<table>
<thead>
<tr>
<th>Component</th>
<th>2016 ACTUAL</th>
<th>2017 ACTUAL</th>
<th>2017 BUDGET</th>
<th>2017 ACTUAL VS</th>
<th>ACTUAL 2017 VS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating revenue</td>
<td>933.27</td>
<td>1,047.80</td>
<td>1,092.20</td>
<td>-4%</td>
<td>12%</td>
</tr>
<tr>
<td>Professional training</td>
<td>0.00</td>
<td>4.80</td>
<td>0.00</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Industry funded research</td>
<td>278.50</td>
<td>427.11</td>
<td>413.52</td>
<td>3%</td>
<td>53%</td>
</tr>
<tr>
<td>Research grants</td>
<td>69.56</td>
<td>122.77</td>
<td>85.85</td>
<td>43%</td>
<td>76%</td>
</tr>
<tr>
<td>Other revenue</td>
<td>114.77</td>
<td>32.07</td>
<td>117.42</td>
<td>-73%</td>
<td>-72%</td>
</tr>
<tr>
<td>Income from Endowment</td>
<td>470.45</td>
<td>461.05</td>
<td>475.42</td>
<td>-3%</td>
<td>-2%</td>
</tr>
</tbody>
</table>

A key reason for such a significant increase of operating revenue was the expansion of industry-funded research. In 2017, the Institute launched professional training programs that generated operating revenue totaling 4.8 mln RUB.

**OPERATING EXPENSES**

In 2017, operating expenses amounting to 4,084.1 mln RUB were derived from the categories shown below (Fig. 46) and were 458.5 mln RUB higher than in 2016.

The Institute continues to manage its expenses responsibly, aligning institutional resources from all sources to support the execution of the Strategic Action Plan. In 2017, expenditures totaled 5,878.5 mln RUB, including capital investment projects (Fig. 45).
In 2017, staff costs increased by 460.8 mln RUB, or 31% as compared to 2016, due mainly to the recruitment of academic staff (24 faculty and 72 researchers), as well as to an increase in staff involved in research grants and contract activities.

Teaching and scholarships costs increased by 123.9 mln RUB in comparison to 2016, due to an increase of scholarship payments based on the number of students enrolled.

In 2017, repairs and maintenance costs increased by 163.8 mln RUB, or 116% as compared to 2016, and included costs for the rental, design, renovation and interior fit-outs of laboratories.

In 2017, additional space for laboratories were rented due to the growing number of employees and students.

**ENDOWMENT**

The Endowment Fund has a long-term endowment strategy designed to enhance the Institute’s financial independence and support the implementation of its strategy. The primary goal of the Endowment Fund investment policy is to ensure the reliability, liquidity, yield and diversification of investments. According to the Investment Declaration approved by the Management Board of the Endowment Foundation, investments can be made in the state bonds of the Russian Federation, Russian corporate bonds (from a specified list) and deposits in Russian Rubles in state-owned banks.

Endowment funds are managed by professional asset management companies, including:

- Management Company Alfa Capital
- Management Company VTB Capital Asset Management.

Asset Management Companies manage the Endowment Fund based on the rules stipulated in the Investment Declaration. The following assets comprise the portfolio of the Endowment Fund as of December 31, 2017:

<table>
<thead>
<tr>
<th>ASSETS</th>
<th>TOTAL</th>
<th>ALFA</th>
<th>VTB</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUO THOUSAND</td>
<td>%-</td>
<td>%-</td>
<td>%-</td>
</tr>
<tr>
<td>Russian government bonds</td>
<td>2 138 399</td>
<td>45,33%</td>
<td>1 817 266</td>
</tr>
<tr>
<td>Corporate bonds</td>
<td>1 752 127</td>
<td>37,14%</td>
<td>1 752 127</td>
</tr>
<tr>
<td>Deposits</td>
<td>699 322</td>
<td>14,82%</td>
<td>0,00</td>
</tr>
<tr>
<td>Cash and Cash Equivalents</td>
<td>127 824</td>
<td>2,71%</td>
<td>126 527</td>
</tr>
<tr>
<td>Other receivables/payables</td>
<td>-414</td>
<td>-0,01%</td>
<td>-243</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4 717 258</td>
<td>100,00%</td>
<td>3 695 677</td>
</tr>
</tbody>
</table>

All income generated by the Endowment Fund is distributed to the Institute for the purposes listed in Institute’s Charter. In 2017, the Management Board gained approval to transfer 370 mln RUB in investment returns. The Management Board of the Endowment Fund has been approved to transfer a portion of the annual return from investment at 2017 equal to 370 mln RUB to the Institute. The rest of the income generated by the Endowment Fund, amounting to 168 mln RUB was reinvested in the portfolio. In 2016, the amount distributed to the Institute was 303 mln RUB.

**CAPITAL INVESTMENT**

In accordance with the Strategic Action Plan, the Institute has committed to a long-term capital expenditure plan to assure its future sustainability, including the construction of the new Campus. In 2017, the Institute incurred capital expenditures amounting to 797.9 mln RUB, including 1 212 mln RUB spent on research equipment and 585.9 mln RUB on the construction of laboratories.

The Institute spent 1 016 mln RUB on the construction of training and laboratory facilities in the new Campus in 2016-2017.
The Endowment Fund’s income and expenses for 2017 included:

<table>
<thead>
<tr>
<th>RUB THOUSAND</th>
<th>TOTAL</th>
<th>ALFA</th>
<th>VTB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net assets as at 31 December 2016</td>
<td>4 556 361</td>
<td>3 557 538</td>
<td>998 823</td>
</tr>
<tr>
<td>Net assets as at 31 December 2017</td>
<td>4 717 258</td>
<td>3 695 677</td>
<td>1 021 581</td>
</tr>
<tr>
<td>Donations in 2017</td>
<td>3 719</td>
<td>0</td>
<td>3 719</td>
</tr>
<tr>
<td>Annual return from investing activities</td>
<td>461 047</td>
<td>375 627</td>
<td>85 420</td>
</tr>
<tr>
<td>Distribution to the Institute in 2017</td>
<td>303 934</td>
<td>237 724</td>
<td>66 210</td>
</tr>
<tr>
<td>Expenses for assets management services</td>
<td>950</td>
<td>865</td>
<td>85</td>
</tr>
<tr>
<td>Expenses for success fee</td>
<td>970</td>
<td>714</td>
<td>256</td>
</tr>
<tr>
<td>Financial results</td>
<td>461 112</td>
<td>375 863</td>
<td>85 249</td>
</tr>
<tr>
<td>Annual return in 2017, %</td>
<td>10.42%</td>
<td>10.82%</td>
<td>9.00%</td>
</tr>
<tr>
<td>Annual return in 2014-2016, %</td>
<td>9.53%</td>
<td>9.37%</td>
<td>10.10%</td>
</tr>
</tbody>
</table>

Notwithstanding a decrease in average market rates, the financial results from the management companies’ investment activity in 2017 is not dramatically lower than those of 2016. This is attributable to changes in the investment strategy, including an increase in the proportion of corporate and federal bonds. Also responsible were reinvestments into the Endowment Fund, as well as a shift in the income distribution schedule to the end of the year.

<table>
<thead>
<tr>
<th>2017</th>
<th>2016</th>
<th>DIFFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual return, RUB thousand</td>
<td>461 112</td>
<td>470 445</td>
</tr>
<tr>
<td>Annual return, %</td>
<td>10.42%</td>
<td>11.39%</td>
</tr>
</tbody>
</table>

The Management Board of the Endowment Fund has approved for 2018 a set of measures aimed at increasing annual returns:

- To increase the share of corporate bonds
- To increase the duration of bonds in the portfolio from three to five years
- To increase the share of corporate bonds

In addition, the Endowment Fund Management Board considers the opportunities of investing in short-term strategies in corporate shares and real estate resulting from market analysis.