



M.V. Lomonosov
Moscow State University



Institute for Theoretical and Mathematical Physics

itmp.msu.ru/en/

December 2023

About ITMP MSU

- ❑ ITMP is a division of Moscow State University, a center for advanced research in fundamental theoretical and mathematical physics.
- ❑ ITMP was founded in December 2018. It is supported by the Theoretical Physics and Mathematics Advancement Foundation “BASIS”.
- ❑ ITMP aims at becoming an internationally recognized research center, a platform for cooperation between national and international researchers, students and PhD students.

Presently, the activity of the Institute is focused on the following areas:

- ❑ string theory and quantum gravity,
- ❑ conformal field theories and AdS/CFT correspondence,
- ❑ integrable systems,
- ❑ quantum field theory and mathematical methods,
- ❑ modified gravity and cosmology.

Scientific Council:

ARKADY TSEYTLIN

ITMP MSU, Lebedev Physical Institute RAS, a Chairman

GLEB ARUTYUNOV

Steklov Mathematical Institute RAS

VLADIMIR BELOKUROV

Faculty of Physics MSU

MIKHAIL VASILIEV

Lebedev Physical Institute RAS

MAXIM GRIGORIEV

ITMP MSU & Lebedev Physical Institute RAS

SERGEY KOZYREV

Steklov Mathematical Institute RAS

DMITRY LEVKOV

ITMP MSU & Institute for Nuclear Research RAS

ALEXEY SEMIKHATOV

Lebedev Physical Institute RAS

The ITMP Scientific Council **develops** strategy and working principles of ITMP, and makes key personnel decisions. The ITMP Scientific Council **includes renowned researchers**, and ITMP employees.

ITMP MSU Team

Director

Prof. Arkady Tseytlin



Research interests of Arkady Tseytlin include quantum field theory and quantum gravity, superstring theory, conformal theories and AdS/CFT correspondence.

He obtained several key results in superstring theory and field theory. In particular, he developed the sigma model approach to string theory, discovered the fundamental role of Born-Infeld action as the open string effective action, developed the method of constructing composite solitonic solutions in supergravity describing supersymmetric bound states of branes, contributed to investigations of D-branes that led to AdS/CFT duality, constructed the action of superstrings in $AdS_5 \times S^5$ space and made substantial contributions to the integrability-based approach to gauge-string duality.

Professor Arkady Tseytlin was awarded the Isaac Pomeranchuk Prize in 2023.

Deputies Director



Maxim Grigoriev
Candidate of Physical and Mathematical Sciences



Dmitry Levkov
Candidate of Physical and Mathematical Sciences



Olga Vasilieva
Candidate of Philological Sciences,
Deputy Director of administration

Administration



Julia Arydzhyan
Records Manager



Anna Kozina
Education Projects Manager



Ivan Potapov
Procurement Specialist

ITMP MSU Team

Scientific Members

! Recruitment via open international calls:

- senior researchers;
- postdoctoral fellows;
- part-time lecturers;
- full-time PhD students;
- fellowships for PhD students.

1 Senior Researcher (professorial level) according to the results of the international open competition

11 Senior Researchers and Research Fellows from the institutes of the Russian Academy of Sciences (RAS) are part-time lecturers

2 Postdoc Researchers

15 PhD students:

3 full-time PhD students

2 of them are foreign nationals (Spain, Columbia)

5 Associated members, leading researchers of RAS institutes who agreed to supervise research work of students and PhD students and give elective courses.

ITMP MSU Team (international recruiting)

Results of the last calls for postdoctoral positions:

2023:

201 applications

20 countries

2 winners

2022:

208 applications

29 countries

3 winners

(the winners turned down an offer in March 2022)

2021:

205 applications

39 countries

4 winners

2020:

188 applications

34 countries

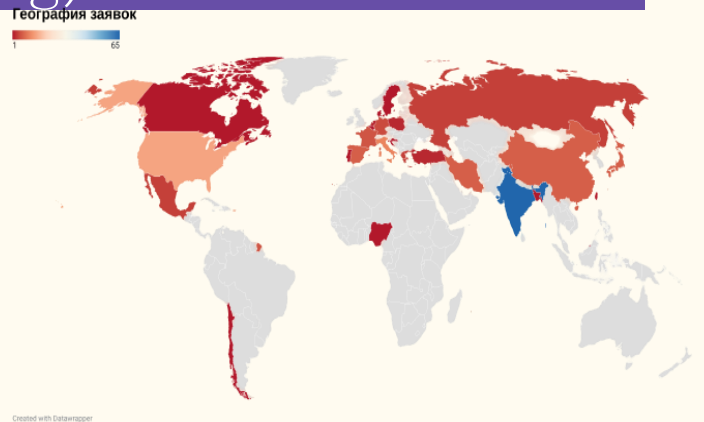
3 winners

2019:

88 applications

25 countries

4 winners



Timeline of the competition

Call for applications

November - January

Evaluation of applications,
interviewing candidates

January - February

Offers

March

Start of the positions

October - November

Cooperation

Cooperation with RAS:

- Lebedev Physical Institute RAS
- Institute for Nuclear Research RAS
- Steklov Mathematical Institute RAS
- Landau Institute for Theoretical Physics

International Cooperation:

- Imperial College London
- CERN
- Université Libre de Bruxelles
- Université de Tours
- Max-Planck-Institut für Gravitationsphysik
- Ludwig-Maximilians Universität München
- Universität Hamburg

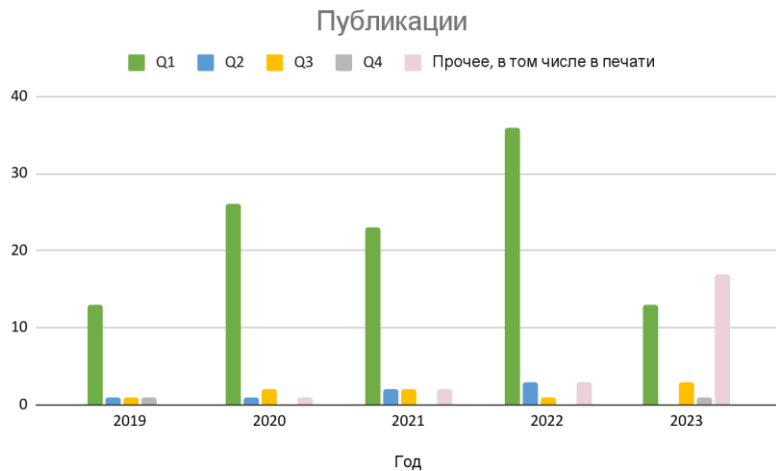
ITMP is a platform for cooperation between students, PhD students, lecturers and researchers from the leading national and foreign research centers and universities.

Researchers from RAS institutes supervise research work of students and PhD students, give courses of the master's program “Quantum gravity and mathematical physics” and “Geometry and quantum fields”, and read elective courses.

Researchers from the international scientific centers give public lectures, take part in the ITMP research seminars, and collaborate with the ITMP employees.

Research

Publications affiliated with ITMP:



The majority of scientific papers by the ITMP research fellows are published in the top 25% of journals according to Thomson Reuters (111 out of 136 published papers).

**as of 14.12.2023*

Invited researchers and ITMP employees present their recent results at the ITMP Research Seminars.

27 seminars were held in 2023. The participants of the seminars include employees of Russian and foreign research centers: University of Oxford, Princeton University, KU Leuven, University of California, Imperial College London, New York University, etc.

Seminars and presentations announcements are available here:

<https://itmp.msu.ru/en/research/seminar/>

ITMP MSU EDUCATIONAL PROJECTS

ПРОЕКТЫ

- **Master's program «Quantum gravity and mathematical physics»**
(a joint Master's program with the Faculty of Physics MSU started in 2019, Specialist's program started in 2023)
- **Specialist's program «Fundamental Mathematics and Mathematical Physics»**
(a joint program with the MSU Faculty of Mechanics and Mathematics started in 2020)
- **English-taught Master's program «Geometry and quantum fields»**
(a joint program with the MSU Faculty of Mechanics and Mathematics started in 2021)
- **Elective courses and public lectures** for the MSU students of faculty of mechanics and mathematics and MSU Faculty of Physics every semester since 2019
- **Winter School** for the bachelor-level students specializing in theoretical and mathematical physics (every year since 2020)
- Support for the **Master's program in Condensed Matter Physics** and visiting lecturers **in the Department of Particle Physics and Cosmology** (at the Faculty of Physics since 2023)

Master's program “Quantum gravity and mathematical physics”

The joint Master's program of ITMP MSU and the Faculty of Physics MSU started in the fall of 2019.

This program aims at training experts in mathematical methods of quantum field theory, principles of conformal field theory, gauge and supersymmetric theories, classical and quantum gravity, superstring theory, and AdS/CFT correspondence.

Program graduates will be able to develop new mathematical methods and apply them to contemporary problems in theoretical and mathematical physics.

More information can be found here:
<https://itmp.msu.ru/msprogram/>

Directors:



Boris I. Sadovnikov,
professor, head of the Department of Experimental and Theoretical Physics of MSU, head of the Department of Quantum Statistics and Field Theory, MSU



Arkady A. Tseytlin,
professor, director of ITMP MSU and professor at Imperial College London

Lecturers

- ITMP Research Fellows (hold 10 out of 15 core courses);
- Employees of the MSU Faculty of Physics;
- scientists from RAS institutes and other Russian and foreign research centers.

Master's and Specialist program “Quantum gravity and mathematical physics”

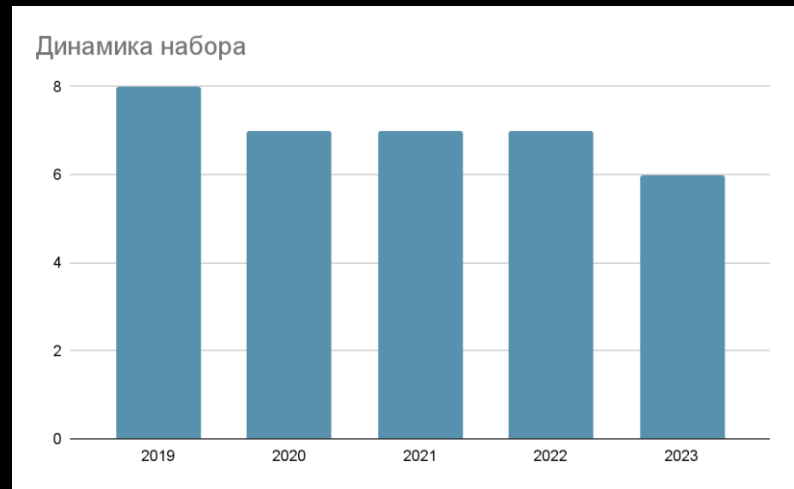
The main focus of the program is a research work of the students. They consult with ITMP researchers on scientific questions.

In 2023 6 students successfully graduated the program.

5 graduate students continue to engage in postgraduate research at leading Russian and foreign research centers:

- Joint Institute for Nuclear Research - 1 student;
- Lebedev Physical Institute RAS- 3 students;
- Université de Tours (France) - 1 student.

1 graduate is a PhD student at ITMP MSU.



The program trains graduates of leading universities, including MSU, St. Petersburg State University, Moscow Institute of Physics and Technology, MEPhI, and ITMO.

In 2023, the specialization “Quantum Gravity and Mathematical Physics” was opened.

The specialist program is conducted from the 3rd year. In the 2023-2024 academic year, 3 students enrolled in the specialization program.

Specialist Program «Fundamental Mathematics and Mathematical Physics»

The joint specialist program with MSU faculty of mechanics and mathematics was launched in 2020.

The main feature of the new educational program is a combination of a strong mathematical training with a bias in modern theoretical physics, focus on the physical view of problems and mathematical apparatus needed to understand physical theories.

The program graduates will have a strong mathematics and understanding of modern physical theories, that will allow them to continue a successful academic career in Russia and abroad and conduct interdisciplinary research or develop in the field of high-tech business, including IT.

See more information here:
<https://fmmp.math.msu.ru/>

Program Director



Iskander Asanovich Taimanov

Doctor, full member of the Russian Academy of Sciences, Chief Researcher of the Sobolev Institute of Mathematics (Novosibirsk)

Lecturers of the program

- employees of the MSU faculty of mechanics and mathematics;
- scientists of the National Research University Higher School of Economics, Skoltech and other leading Russian universities;
- scientists from RAS institutes and other Russian and foreign research centers, including ITMP MSU research fellows

Specialist Program «Fundamental Mathematics and Mathematical Physics»

In 2023/2024 academic year there are 5 groups (1- 5 years) and **90 students in total:**

- 1 year - 25 students;
- 2 year - 22 students;
- 3 year - 19 students;
- 4 year – 15 students;
- 5 year - 9 students.

2023 Enrollment Geography: Moscow and Moscow region, St.Petersburg, Republic of Bashkortostan, Chelyabinsk region, Khabarovsk region, Yaroslavl region, Republic of Dagestan, Orenburg region, Kemerovo region, Karachay-Cherkess Republic.

Number of first year students enrolled

| Year | Number of students | FMMP admission score |
|------|--------------------|----------------------|
| 2023 | 25 | 377 |
| 2022 | 25 | 343 |
| 2021 | 25 | 328 |

| Year | Number of Olympiad Winners and Prize-Winners | Number of Gold Medallists |
|------|--|---------------------------|
| 2023 | 15 | 16 |
| 2022 | 11 | 18 |
| 2021 | 12 | 5 |

Specialist Program «Fundamental Mathematics and Mathematical Physics»

2023 special courses list:

- **Introduction to symmetric spaces** – Dr. V.S. Zhgun (Higher School of Economics)
- **Riemann surfaces and applications** - Professor A.B. Bogatyrev (MSU faculty of Mechanics and Mathematics)
- **Introduction to Symmetric Spaces II** - Dr. V.S. Zhgun (Higher School of Economics)

Lectures as part of the spring lectures 2023:

- **Illustration of the course “Geometry-2” of the special group of FMMP with a number of sympathetic problems** – Professor A.A. Tuzhilin (MSU faculty of Mechanics and Mathematics)

Video available here:

https://www.youtube.com/watch?v=0W8B-EfQYIA&list=PLQSyMHq4mInt6vHaY-1oYxZ9DAppb9A_F&index=2

- **Can a curve be three-dimensional?** - Professor S.V. Shaposhnikov (MSU faculty of Mechanics and Mathematics)

Video available here:

https://www.youtube.com/watch?v=VvKaLZfBl_o&list=PLQSyMHq4mInt6vHaY-1oYxZ9DAppb9A_F&index=3

- **Geometry and topology of curvature** - Associate Professor G.I. Sharygin (MSU faculty of Mechanics and Mathematics)

Video available here:

https://www.youtube.com/watch?v=bYwhve2aTC4&list=PLQSyMHq4mInt6vHaY-1oYxZ9DAppb9A_F&index=4

Lecture course for school students and all comers

> 1100
views
of lecture
videos in
2023

Video archive
of the lecture
course:

<https://fmmp.math.msu.ru/lect/archive/>

МЕХАНИКО-МАТЕМАТИЧЕСКИЙ ФАКУЛЬТЕТ
МГУ ИМЕНИ М.В. ЛОМОНОСОВА

ЛЕКТОРИЙ

ДЛЯ ШКОЛЬНИКОВ СТАРШИХ КЛАССОВ
И ВСЕХ ЖЕЛАЮЩИХ

ЛЕКЦИИ БУДУТ ТРАНСЛИРОВАТЬСЯ НА
YOUTUBE-КАНАЛЕ МЕХМАТА

5 мая, 19:00
"ИЛЛУСТРАЦИЯ КУРСА "ГЕОМЕТРИЯ-2"
СПЕЦПОТОКА МЕХ-МАТА МГУ РЯДОМ СИМПАТИЧНЫХ ЗАДАЧ"
ЛЕКТОР - Д.Ф.-М.Н., ПРОФЕССОР А.А. ТУЖИЛИН

10 мая, 18:00
"МОЖЕТ ЛИ КРИВАЯ БЫТЬ ОБЪЕМНОЙ?"
ЛЕКТОР - Д.Ф.-М.Н., ПРОФЕССОР С.В. ШАПОШНИКОВ

17 мая, 18:00
"ГЕОМЕТРИЯ И ТОПОЛОГИЯ КРИВИЗНЫ"
ЛЕКТОР - К.Ф.-М.Н., ДОЦЕНТ Г.И. ШАРЬГИН

ПОДРОБНЕЕ О
ЛЕКЦИЯХ:

РЕГИСТРАЦИЯ:

International Master's Program “Geometry and Quantum Fields”

The first English-taught international Master's program in Mathematics at MSU.

The joint master's program “Geometry and Quantum Fields” was developed in 2021 by ITMP MSU and the MSU Faculty of Mechanics and Mathematics.

The focus of the program is on the physics and mathematics of the fundamental interactions, with a special emphasis on quantum gravity. A unique aspect of the program is its aim to integrate a variety of mathematical disciplines, with special attention to geometry, along with courses in quantum field theory, gravity, string theory and holography.

The unique feature of the program is a combination of mathematical disciplines, along with courses on field theory, gravity, string theory and holography.

More information here:

<https://itmp.msu.ru/en/mcgeometry>

Program Directors



Prof. Andrei Shafarevich,
Dean of the Faculty of
Mechanics and Mathematics,
MSU



Prof. Arkady Tseytlin,
Director of ITMP MSU,
Professor of Theoretical
Physics, Imperial College
London

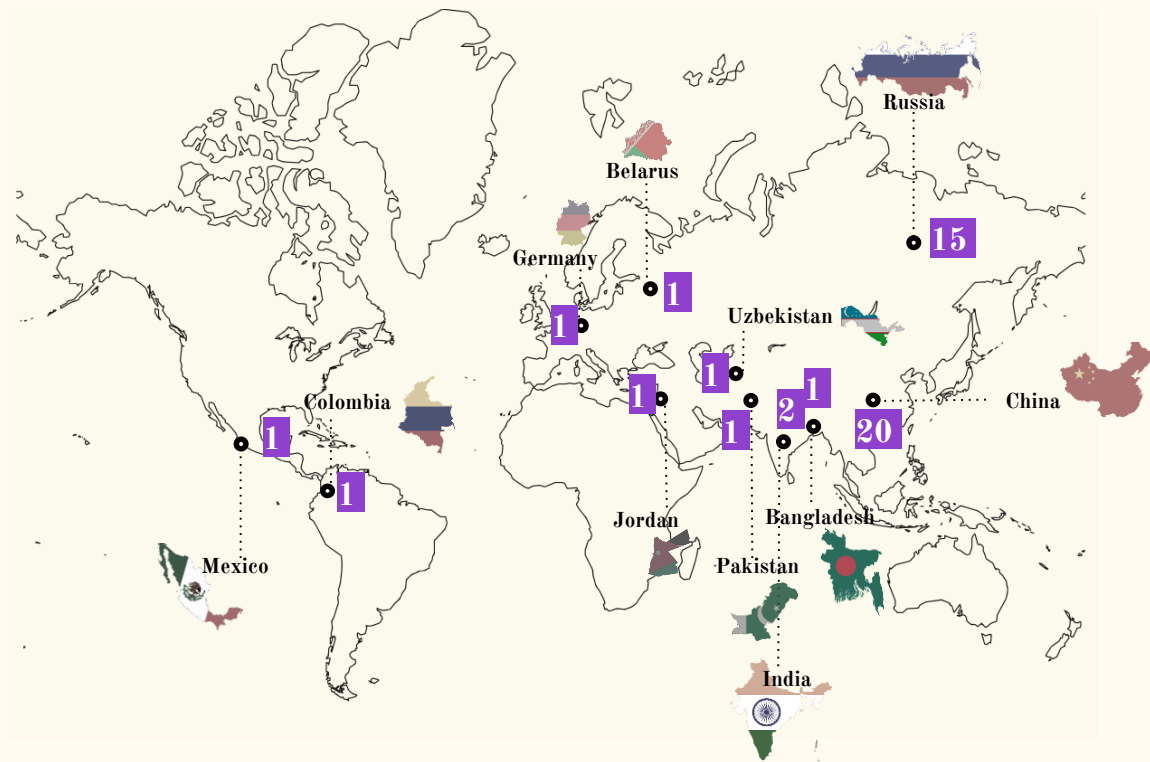
Lecturers

- Researchers of the MSU faculty of mechanics and mathematics;
- Researchers of ITMP MSU;
- researchers from RAS institutes and other Russian and foreign research centers, including ITMP MSU research fellows (FIAN, Steklov Mathematical Institute, Landau Institute for Theoretical Physics, Purdue University, Hamburg University, etc.)

International Master's Program “Geometry and Quantum Fields”



The second international enrollment



The program interested many international students: **45 applications** were submitted from **7 regions** (South and North America, South, East and Southwest Asia, Africa, CIS)

2023 Student Enrollment:

2 students from Russia;
1 student from Belarus;
5 foreign student (citizens of Colombia, Mexico, China and Bangladesh);
2 program students are the winners of the Lomonosov Universiade 2022.

2022 Student Enrollment :

1 student from Russia;
6 foreign students (citizens of China, Colombia, Mexico and India)

International Master's Program “Geometry and Quantum Fields”



NEW COURSES WITHIN THE PROGRAM (compulsory and elective)

- **Basics of homological algebra** - Doctor, Professor T.E. Panov (MSU Faculty of Mechanics and Mathematics)
- **Functional analysis and operator theory** - Doctor, Professor I.A. Sheypak (MSU Faculty of Mechanics and Mathematics)
- **Symplectic geometry and quantization** - PhD G.I. Sharygin (MSU Faculty of Mechanics and Mathematics)
- **Lie groups and algebras** - PhD F.V. Uvarov (HSE)
- **Representation of finite-dimensional and infinite-dimensional Lie algebras** - PhD F.V. Uvarov (HSE)
- **Symmetries and integrability of differential equations** - Doctor, Professor V.V. Sokolov (Landau Institute for Theoretical Physics)
- **Introduction to characteristic classes and the index theorem** - PhD F.Yu. Popelensky (MSU Faculty of Mechanics and Mathematics)
- **Differential geometry and topology** - Doctor, Professor Ye.V. Troitskiy (MSU Faculty of Mechanics and Mathematics)

All courses are open to students of the Faculty of Mechanics and Mathematics and the Faculty of Physics of Moscow State University.

In 2023, **2 foreign students** of the program became winners of the “School” competition of the “BASIS” Foundation and participated in international scientific schools:

- “Geometric, algebraic and topological methods in quantum field theory” (Colombia);
- “Workshop and school on complex lagrangians, integrable systems and quantization” (Oxford, UK).

1 foreign student participates in the interdisciplinary scientific project “Mathematical methods for the analysis of complex systems” (Mechanical, Mathematical and Chemistry Departments of Moscow State University) - the winning project of the grant competition of scientific projects of the NES MSU 2023.

Education

Elective Courses

During the past 5 years ITMP offered 26 elective courses

2023 Elective courses:

- **Geometry and gravity** – PhD E.T. Musaev(ITMP, MIPT)
- **Hamiltonian approach to general relativity and its application to gravity models** – Doctor A.O. Barvinsky (ITMP, LPI)
- **Modern theory of condensed matter for theorists of all specialties** – PhD E.A. Polyakov(Russian Quantum Center)
- **Classical integrable systems: algebraic approach** – Doctor A.V. Zotov (ITMP, Steklov Mathematical Institute)
- **Differential geometry for physicists** – Doctor D.V. Bykov (ITMP, Steklov Mathematical Institute)
- **Introduction to mathematical physics - the science of worlds similar to ours** – Doctor, Professor A.S. Losev (ITMP, HSE)
- **Seminar on mathematical physics for junior students. Part 2** - PhD A.S. Anokhina (National Research Centre "Kurchatov Institute“)
- **Entanglement entropy and black holes** – Doctor S.N. Solodukhin (ITMP)

VIDEO LECTURES

See video lectures here:

<https://itmp.msu.ru/studentam/videolekczii>

- «Infrared modifications of gravitational theories» by **Professor** at the Université de Tours (France), **Mikhail S. Volkov**
- «Hamiltonian mechanics and classical integrable systems» by **Dr. Andrei V.Zotov** (Steklov Mathematical Institute of RAS)

VIDEO LECTURES ON TEACH-IN

- «Quantum Field Theory in Cosmology » by PhD **Viktor Gorbenko** (Stanford University): <https://teach-in.ru/course/quantum-field-theory-in-cosmology-gorbenko/about>
- «Higher spin theory and holography» by PhD **Dmitry Ponomarev**, ITMP MSU: <https://teach-in.ru/course/higher-spin-theory-and-holography-ponomarev>

Events

ИНСТИТУТ ТЕОРЕТИЧЕСКОЙ
И МАТЕМАТИЧЕСКОЙ ФИЗИКИ МГУ

ЗИМНЯЯ ШКОЛА ИТМФ МГУ
28 января – 5 февраля 2023
Московская область
Для студентов 3–4 курсов,
интересующихся теоретической и математической физикой

Сроки подачи заявок:
ДО 25 декабря 2022
первая волна подачи заявок
ДО 15 января 2023
вторая волна подачи заявок
ДО 20 января 2023
третья волна подачи заявок

**ДЛЯ УЧАСТИЯ В ШКОЛЕ
НЕОБХОДИМО:**
Подготовить конспект доклада по одной из тем одного из курсов или решить несколько задач по выбору из курса (всего 2 ст. в LaTeX). Эти материалы необходимо предоставить заранее из России в виде файла и сделать доступными по адресу: itmf@phs.phys.msu.ru.
Корреспонденту лучше использовать электронную почту. Будет рассмотрено фото - в формате студенческих докладов, семинаров и лекций.

ДВУМЕРНЫЕ СИГМА-МОДЕЛИ
Дмитрий Билос

**МОДЕЛЬ ИЗИНГА
И КОНФОРМНАЯ ТЕОРИЯ ПОЛЯ**
Алексей Литвинов

**ВОЗМУЩЕНИЯ
В МОДИФИЦИРОВАННЫХ
ТЕОРИЯХ ГРАВИТАЦИИ**
Сергей Карлов

**ВЗАИМОДЕЙСТВУЮЩИЕ ТЕОРИИ
БЕЗМАССОВЫХ ПОЛЕЙ**
Дмитрий Пономарев

Расходы на проезд, проживание
и питание отобранных участников
оплачиваются организаторами.
Проезд участникам будет оплачен,
если заявка подана до 25 декабря 2022
года.

ПОДРОБНЕЕ
НА САЙТЕ ИТМФ

ПРИ ПОДДЕРЖКЕ:
БАЗИС
Фонд развития
теоретической физики
и математики



Video lecture by A.M. Semikhatov during
Winter School 2023: “Quantum reality and
the Nobel Prize 2022”:

<https://www.youtube.com/watch?v=KYTFsoT2yCo>

ITMP Winter School on theoretical and mathematical physics for 3-4 year students.

The event is attended by the students
from 7 leading Russian universities (MSU,
SPbU, MIPT, MEPhI, TSU, SFedU, etc.)

2023:

- 54 students applied
- 28 participants
- 4 lecturers
- 1 popular science lecture

2022 год:

- 50 students applied
- 25 participants
- 5 lecturers



Working Environment

ITMP has several furnished classrooms and open-space offices for comfortable working environment.

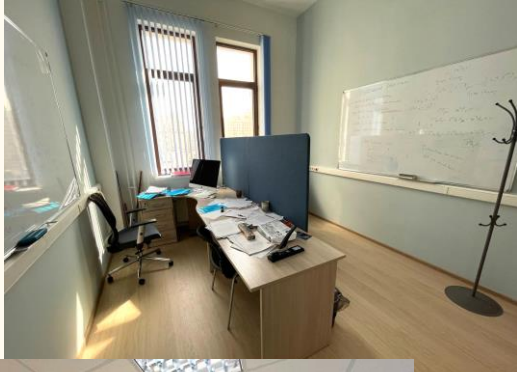


- 2 offices for classes and scientific seminars
- 1 room for independent work of students and graduate students



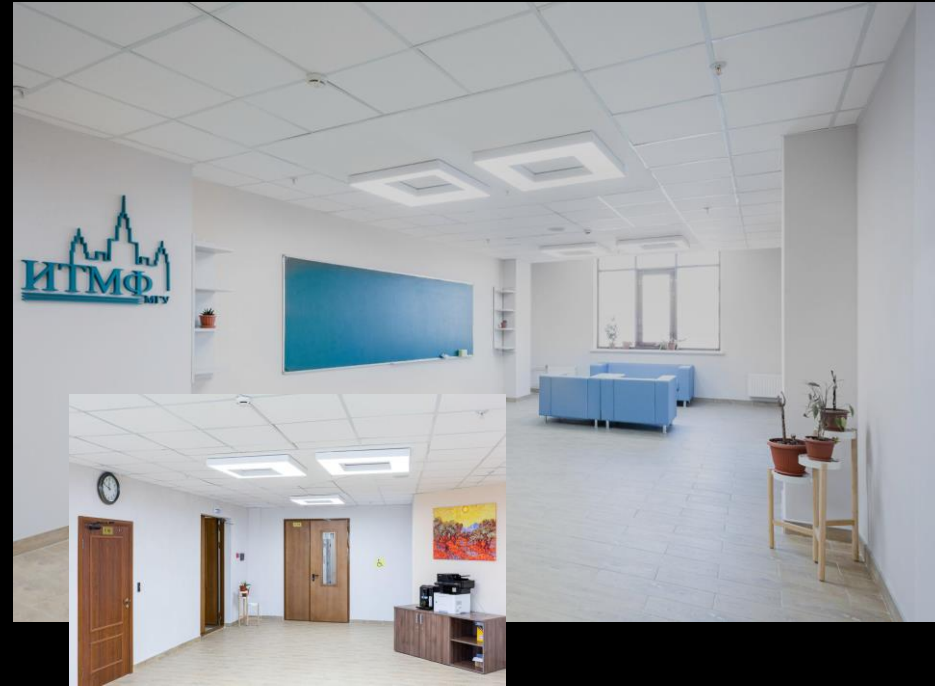
Workplaces for researchers and administrative staff:

- open-type offices for 14 workplaces
- office for leading researchers
- meeting room
- administrative room



Corridor of block "Г" 7 floor

In 2022, the corridor of block "Г" on the 7th floor was redecorated. It became possible to create a comfortable atmosphere and several additional areas for discussions and communication. The exhibition of the Russian Geographical Society "Immense Russia" was organized. Photo images are updated annually.



Support Tools:

- Contracts for provision of charitable assistance
- Courses grant competitions;
- scholarship competition for students of the international master's program “Geometry and Quantum Fields”;
- Winter School for 3-4 year students in theoretical and mathematical physics.

**ITMP is supported by the
Theoretical Physics
and Mathematics Advancement
Foundation
«BASIS»**