



Lomonosov Moscow State University



Institute for Theoretical and Mathematical Physics

<https://itmp.msu.ru>

December 2022

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 foreign 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, Imperial
College London (UK)

GLEB ARUTYUNOV

Hamburg University (Germany)

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 includes renowned researchers from international scientific centers and ITMP employees. It develops the strategy and working principles of ITMP, makes key personnel decisions.

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 AdS₅ x S⁵ space and made substantial contributions to the integrability-based approach to gauge-string duality.

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

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

1 Postdoc Researcher
(9 postdocs have been working at ITMP at the beginning of the year, 6 postdocs are foreign nationals)

12 PhD students:

3 full-time PhD students

2 of them are foreign nationals (Spain, Columbia)

6 **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:

2019:

88 applications

25 countries

4 winners

2020:

188 applications

34 countries

3 winners

2021:

205 applications

39 countries

4 winners

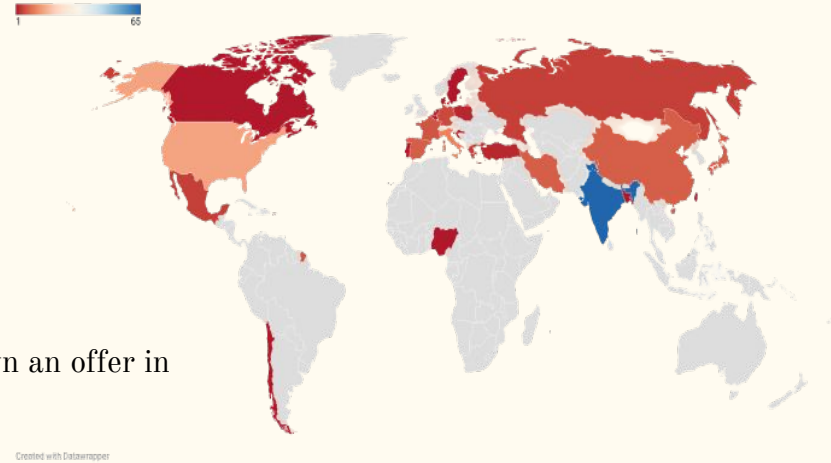
2022:

216 applications

29 countries

3 winners

(the winners turned down an offer in March 2022)



Timeline of the competition

Call for applications

Evaluation of applications,
interviewing candidates

Offers

Start of the positions

November - January

January - February

March

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

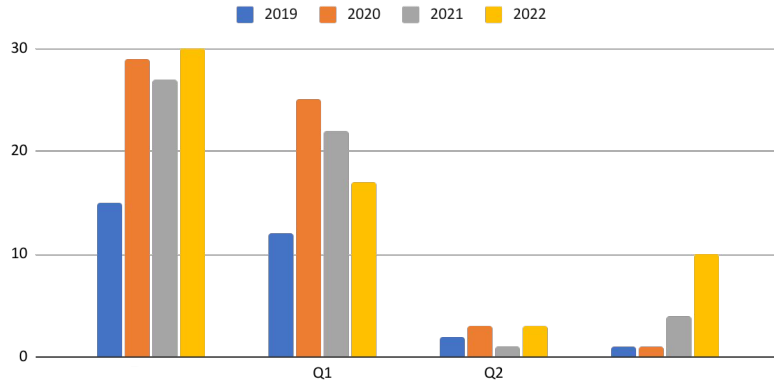
ITMP MSU is a platform for cooperation between students, PhD students, lecturers and researchers from the leading national and foreign research centers and universities.

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 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 (75 out of 101 published papers, other papers are in print).

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

27 seminars were held in 2022. The participants of the seminars include employees of Russian and foreign research centers: King's College London, Trinity College Dublin, Uppsala University and NORDITA, University of Mons, Harvard University, etc..

Seminars and presentations announcements are available here:

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

ITMP MSU EDUCATIONAL PROJECTS

- **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 «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)

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/>

Master's program co-supervisors:



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

Academic teaching staff

- 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 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 2021, 6 students successfully graduated the program.

All graduates continue to engage in postgraduate research at leading Russian and foreign research centers:

- Lebedev Physical Institute RAS- 4 students;
- Steklov Institute RAS- 1 student;
- University of Manchester- 1 student.

3 graduates are PhD students at ITMP MSU.

Number of students enrolled

Number of students enrolled in the program in 2019: 8 students, who graduated from the Faculty of Physics of MSU and MIPT.

Number of students enrolled in the program in 2020: 7 students, 2 of them graduated from MEPhI, and 1 student is a graduate of SPBU.

Number of students enrolled in the program in 2021: 7 students, who graduated from MSU.

Number of students enrolled in the program in 2022: 7 students, 3 of them graduated from MSU (including 1 international student), 1 student is a graduate of MEPhI and 3 students graduated from SPBU.

Some courses of the program are open to the students of MIPT and MEPhI.

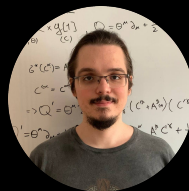
Master's program “Quantum gravity and mathematical physics”

In 2022, **4 students** successfully passed the qualification tests and defended their theses.

2 graduates continue their research careers, by enrolling in postgraduate programs of MSU and LPI RAS.



2022 graduates. ITMP MSU



**Rudinsky
Dmitry**

«I learned about the program in 2020 at ITMP Winter School. I was interested in the line of research of M.A. Grigoriev. The best advantage about the program is a large number of modern courses. We have a lot of great students in the group and they are really good at their fields of study. I would like to continue doing science in Russia after my graduation. I'm interested in participating in international conferences and giving some lectures, but I prefer to stay in national science».



**Adler
Sergei**

«I chose this program because of its courses that are highly requested today in modern science. The courses on conformal field theory especially caught my attention. The lecturers of the program are active researchers and we were able to discover some complicated things. There were many great students in my group. We are all studying different fields of science, and it gave me an opportunity to learn something new from them».

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 supervisor



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 2020/2021 academic year an experimental group consisting of 25 students was formed.

In 2022/2023 academic year there are 4 groups (1- 4 years) 70 students in total:

- 1 year - 25 students;
- 2 year - 21 students;
- 3 year - 15 students;
- 4 year – 9 students.

2022 Enrollment Geography: Moscow, St. Petersburg, Tatarstan, Krasnodar Territory, Primorsky Territory, Stavropol Territory, Volgograd Region, Kirov Region, Moscow Region, Nizhny Novgorod Region, Novosibirsk Region, Sverdlovsk Region, Yamalo-Nenets Autonomous Okrug.

Number of first year students enrolled

Year	Number of Students	FMMP Admission Score
2021	25	328
2022	25	343

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

Specialist Program «Fundamental Mathematics and Mathematical Physics»

2022 special courses list :

- **Theoretical foundations and methods for enabling neural networks**– PhD E.V. Burnaev (Skoltech)
- **Geometry and semiclassical asymptotics. Solving specific problems** – Dr. V.E. Nazaikinsky (MIPT, A.Yu. Ishlinsky Institute for Problems in Mechanics RAS)
- **Galois theory, algebraic groups and differential equations** – Dr. S.O. Gorchinsky (V.A. Steklov Institute of Mathematics RAS, National Research University Higher School of Economics)
- **Donaldson invariants of smooth structures on 4-manifolds** – Dr. N.A. Tyurin (JINR RAS)
- **Field theory**– PhD M.A. Grigoriev (ITMP MSU, LPI RAS)
- **Projective space: geometry and mechanics** - Dr. N.A. Tyurin (JINR RAS)
- **Additional chapters of differential geometry**– PhD G.I. Sharygin (faculty of mechanics and mathematics MSU)
- **Effective semiclassical asymptotics** - Dr. V.E. Nazaikinsky (MIPT, A.Yu. Ishlinsky Institute for Problems in Mechanics RAS)

Lecture course for school students and all comers

> 300 views
of lecture
videos in
2022.

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
1 мая 2022 18:00

Линейная алгебра и задачи квантования в математике и физике

Лектор: А.В. Зотов, д.ф.-м.н.,
Математический институт им. В.А. Стеклова РАН,
ИТМФ МГУ, НИУ ВШЭ

На простейших примерах мы обсудим задачи квантования в математике и физике. Для этого будем пользоваться элементарными понятиями линейной алгебры, такими как матричное и тензорное умножение. Уже на этом уровне можно продемонстрировать многие понятия квантовой физики, включая, например, квантовую запутанность. На обзорном уровне мы также коснемся более сложных математических задач и методов, включая деформационное квантование и квантовые группы.

Регистрация

Лекторий будет читаться на платформе Zoom
Идентификатор конференции: 830 2456 7220
Код доступа: 084117

English-taught Master's program "Geometry and Quantum Fields"

The first English-taught 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/mscgeometry>

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 from RAS institutes and other Russian and foreign research centers, including ITMP MSU research fellows

English-taught Master's program “Geometry and Quantum Fields”



The first international enrollmen



The program interested many international students: **43 applications** were submitted from **7 regions** (South and North America, South, East and Southwest Asia, Africa, CIS).

8 students enrolled in 2022 - **2 from Russia** and **6 foreign students** (citizens of China, Colombia, Mexico and India).



English-taught Master's program “Geometry and Quantum Fields”



Due to a new educational program and an increase in the number of students, ITMP has equipped an additional lecture hall for classes and a co-working room for students.



Education

Elective Courses

During the past 4 years ITMP offered 22 elective courses

External Lecturers Were Involved To Read The Courses :

- **Infrared modifications of gravity** - Ph.D. Eugeny O. Babichev (Paris-Saclay University and University of Paris)
- **Quantum Field Theory in Cosmology** – PhD Viktor Gorbenko (Stanford University)
- **Selected topics in the theory of condensed matter. Parts 1-2** – Prof. Alexey N. Rubtsov (RQC & Faculty of Physics MSU), PhD. Evgeny A. Polyakov (RQC)
- **Classical integrable systems: algebraic approach** – Dr. Andrei V.Zotov (Steklov Mathematical Institute of RAS)
- **Lie groups and algebras and classical integrable systems** – Dr. Khazret S. Nirov (INR RAS & NRU HSE)
- **Hamiltonian approach to general relativity and its applications in modern models of gravity** – Dr. Andrey O. Barvinsky (LPI RAS)
- **Seminar on mathematical physics for junior students** – PhD A.S.Anokhina (NRC "Kurchatov Institute")

VIDEO LECTURES :

See video lectures here:

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

- «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 AT 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

ITMP Winter School on theoretical and mathematical physics for bachelor students.

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



ИТМФ МГУ
Институт теоретической и математической физики МГУ

ЗИМНЯЯ ШКОЛА ИТМФ МГУ

29 января – 6 февраля 2022
Московская область

Для студентов 3-4 курсов
интересующихся теоретической и математической физикой.

ФИЗИКА ЧЕРНЫХ ДЫР
Дмитрий ГТееков

**КАЛИБРОВОЧНЫЕ ПОЛЯ,
СВЯЗНОСТИ И СУПЕРГЕОМЕТРИЯ**
Максим Григорьев

**КОНФОРМНАЯ ТЕОРИЯ ПОЛЯ:
ОТ ФАЗОВЫХ ПЕРЕХОДОВ ВТОРОГО РОДА
ДО КВАНТОВОЙ ТРАВИТАЦИИ**
Евгений Скворцов

МОНОПОЛИ И ДИОНЫ
Егор Зенкевич, Сергей Миронов

первая волна подачи заявок
до 25 декабря 2021

вторая волна подачи заявок
до 13 января 2022

отбор участников школы
до 20 января 2022

Для участия в школе необходимо:
Подготовить конспект доклада по одной из тем из курсов или решить несколько задач по одному из курсов (около 2 стр. в LaTeX). Эти материалы необходимо приложить к заявке на участие в школе. Темы и задачи доступны по адресу: <https://itmp.msu.ru/winter-school/program>
Занятия школы будут проходить очно - в формате студенческих докладов, семинаров и лекций.

При поддержке

Расходы на проезд, проживание и питание отобранных участников будут оплачены организаторами.
Проезд участникам будет оплачен, если заявка подана **до 25 декабря 2021 года.**

Подробнее на сайте ИТМФ



BASIS

2021 (online):

- 33 students applied
- 14 students gave talks
- 5 lecturers

2022:

- 50 students applied
- 25 participants
- 5 lecturers

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

The logo for BASIS features the word "BASIS" in a bold, sans-serif font. The letter "A" is replaced by a stylized orange triangle with a white outline.