REPORT TO THE INTERNATIONAL ADVISORY BOARD

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Contents

1 Questionnaire

1.1 Best practices

Please, indicate what you think are good practices in the department.

1.2   Worst practices

Please, indicate what you think are bad practices in the department and require serious improvement.

1.3   Desired improvements

Please, indicate what can be contributed to improving the functioning of the Department by

- the Department authorities

- Faculty members

- the HSE authorities.

1.4   Quality of the present report

Please, indicate, whether the report contains necessary information in an appropriate amount.

1.5   Experts' estimates

Please, put a mark estimating the quality of the department among the top world departments.

	10	50	100	Not in the first 100
Research level				
Publication activity				
Curriculum level				
Teaching level				
Faculty level				
M.Sc. programs' level				
PhD programs' level				
Undergraduates' level				
M.Sc. students' level				
PhD students' level				
Term papers' level				
Educational results				
Administrative staff level				
Facilities and equipment				
International cooperation				
Web site quality				
As a whole				

2   General setting

2.1   Brief history

The department of mathematics was founded as a joint project of the Higher School of Economics and the Independent University of Moscow, initiated by the authorities of the HSE in 2007. The first faculty members were hired in early 2008. The main idea for organizing the department was to establish an institution inheriting the main positive features of the Independent University of Moscow, which are the mixing studies and research, teaching of modern mathematics, high level of both professors and students, and lacking the weak ones, which are no right to provide state diplomas, and, most seriously, having a small number of possessors of the IUM degree.

The first undergraduate students entered the Department in summer 2008, with classes starting in September. In 2010, a master program in *Mathematics* and a post-graduate studies program in *Mathematical logic, algebra and number theory* were started, with about 10 students at each level. All of the students accepted to the programs had graduated from universities different from the HSE. In 2011, it was decided to make the *Mathematics* master program an international one, with classes given in English, and to establish a new master program *Mathematical physics*, in Russian, headed by Igor Krichever (Columbia University, New York, USA).

In 2010, the HSE won a huge grant from the Russian ministry of science and education, and the research group *Laboratory of Algebraic geometry and its applications* was organized at the Department under the scientific guidance of Fedor Bogomolov (of the Courant Mathematical Institute). The laboratory hired various faculty members, as well as researchers from out of the Department, and also some students.

Three chairs (Algebra, Geometry and Topology, and Discrete Mathematics) had existed from the very first day of the Department, but were disbanded in 2011, making the administrative structure single level rather than a two-level one. Meanwhile, in 2011, under an agreement with the Steklov Mathematical institute of the Russian Academy of Sciences, the Steklov institute Chair was established at the Department. In 2012, a similar agreement was achieved with the RAS Kharkevich Institute for information transmission problems.

In 2009, the Scientific Council of the Department agreed to follow a Department development program. Founding of the International Advisory

Board was among the development stages stipulated by the Program. The International Advisory Board was organized in 2012, and the present Report is the first report to this Board.

2.2   The 2009 Development program

In 2009, the authorities of the Higher School of Economics initiated the working out of a Development program for each Department. The program for the Department of mathematics was accepted by the Scientific Council of the Department on October 05, 2009. It has been discussed and approved by several authorities' meetings at the university, but there has been no formal confirmation of its status from the University Scientific Council. Nevertheless, the Department follows this Development program and aims at achieving the main indicators stated in it.

Below, the indicators to be achieved in 2012 according to the Program, are given, both quantitative and qualitative, with descriptions of their current state.

Goals	Realizations, as in 2012
The main goal	
The Department should become a world renowned center of mathematical research and education	To be estimated by the International Advisory Board
Students and teaching	
1. 70 students to enter the bachelor program (of whom 50 study free of charge, and 20 pay for their studies).	55 students enter the bachelor program, 2 of them provide reduced payment.
2. 40 students to enter the Master programs (of whom 30 study free of charge, and 10 pay for their studies)	28 students enter the Master programs; 2 of them provide reduced payment.
3. 25 students to enter the PhD studies	There are 12 graduate students of the 2nd and 3rd year, and 12 more entered in November 2012
4. Up to 80% of Department graduates to enter Master programs of the HSE and other leading universities	9 out of the 24 students who got their bachelor degree in 2012 entered the Master programs of the Department, while 6 more entered other Master programs

Goals

5. The Math In Moscow program to be coordinated with the Department Master programs

6. There are 8 to 10 research preseminars and 5 to 7 research seminars at the department; each student takes part in at least one of the seminars.

Research

7. World leading research groups are formed in low-dimensional topology, mathematical physics, algebraic geometry, representation theory, and a couple of other directions

8. Research labs are formed, with student participation.

Realizations, as in 2012

The Mathematics Master program has been transformed into an international one; one of the former MiM students has entered the departmental program

19 research seminars and preseminars work weekly; the percentage of students attending at least one of the seminars regularly is about 60%.

Topologists: V. Vassiliev, Yu. Burman, M. Kazarian, S. Lando, S. Natanzon, O. Shvartsman, V. Timorin, A. Esterov; math. physicists: E. Akhmedov, A. Khoroshkin, A. Losev, A. Marshakov, T. Takebe, A. Zabrodin; algebraic geometers: M. Finkelberg, A. Rudakov, L. Positselskii, M. Verbitsky; representation theory specialists: B. Feigin, E. Feigin, G. Ol'shanskii, S. Loktev, L. Rybnikov; logicians: L. Beklemishev, V. Shekhtman; differential equations: Yu. Ilyashenko, A. Glutsyuk, V. Chepyzhov, A. Krasnosel'skii.

About 10 students and graduate students are regular members of the Laboratory of algebraic geometry and its applications; 6 students are members of the Research group under the guidance of L. Rybnikov and B. Feigin, to be transformed into a Research Lab.

Goals	Realizations, as in 2012
9. Students and graduate students publish their first research papers.	About 10 papers in peer reviewed journals have been published by students and graduate students.
10. The Department invites world leading scientists to give crash courses and distinguished lectures.	Crash courses were given by I. Krichever, R. Bezrukavnikov, N. Berkovits. Ya. Sinai, D. Zagier, J. Maldacena. S.-T. Yau, S. Smirnov, S. Fomin, Yu. Manin, J. Bernstein, G. Margulis, V. Voevodsky gave single lectures,
11. Standard curriculum programs are developed.	Done for the 1st and 2nd year.
12. At least 5 textbooks by the Dept professors are translated into English and published by foreign publishers.	The following textbooks are prepared (all in Russian): *Introduction to discrete mathematics* by S. Lando (MCCME, 2012), *Algebra* by A. Gorodentsev (MCCME, 2013), *Basic calculus* by S. Lvovski (HSE, 2013), *Geometry of Hamiltonian systems and partial* differential equations by V. Timorin (HSE, 2013).
13. Systematic video recording of the lectures given at the Dept is organized.	Special lectures are sometimes recorded, but not systematically.
14. Regular online-videoseminars are organized, with the participation of Kiev and St.-Petersburg phys-math clubs and the IUM.	Not done
15. The Moscow Mathematical Journal enters the list of top-50 impact factors.	Instead, the MMJ fell off the top-100 impact-factor list.
16. A Math Department is organized at one of the branches of the HSE.	Department at St.-Petersburg branch of the HSE failed due to the weakness of the scientific community.

2.3   Current state

Presently (as in September 2012), the Department of mathematics of the
National Research University Higher School of Economics (Moscow, Russia)
consists of

- 60 faculty members 29 of which are professors, and 31 docents (associate
  professors) 33 of these work full-time at the HSE and the other 27 are
  part-time

- 7 staff members all full time

- about 160 undergraduate students (with 53 freshmen)

- about 45 master students (10 of whom are 2012 graduates of the
  Department)

- 20 post-graduate students

25 faculty members hold the Russian Doctor of Science degree, while all
the others either are Candidates of Science or have PhD. 15 faculty members
have PhD from the best Western (including Japan) universities.

Some parts of the faculty form two RAS Institute chairs:

- the Steklov Mathematical institute chair headed by Victor Vassiliev
  (currently with 9 professors and docents);

- the Kharkevich Institute for Information Transmission Problems chair
  headed by Alexander Krasnosel'skii (currently with 12 professors and
  docents).

The Laboratory of algebraic geometry and its applications is a temporary
institution with guaranteed financing up to the end of 2012. Its head is Fedor
Bogomolov permanently working at the Courant Mathematical institute and
spending 4 months in Russia during each of the years 2011 and 2012.

The faculty occupies rooms in a building rented by the HSE at Vavilova
7, close to the metro station *Leninskii Prospekt* with about a dozen offices,
4 lecture halls and 2 smaller classrooms. In addition, the Department also
makes use of the offices belonging to the Laboratory of algebraic geometry
and its applications (10 rooms) as well as a small computer class and a lecture
hall. The computer class contains 16 computers and is used for classes during
the first half of the day.

Members of the faculty teach mathematical courses only at the Department of mathematics. There are a number of other structures in the Higher School of Economics where mathematics and computer science are taught:

- the Chair of higher mathematics at the Department of Economics (`http://economics.hse.ru/hmatec/`, transformed into an independent Department in 2012);

- the HSE Chair of higher mathematics (`http://www.hse.ru/org/hse/ouk/hmat`);

- the School of Applied Mathematics and Information Science of the Faculty of Business Informatics (`http://ami.hse.ru/index.html`);

- the School of Software Engineering (`http://ami.hse.ru/index.html`) of the Faculty of Business Informatics;

- several mathematical structures in the Institute of electronics and mathematics (`http://miem.hse.ru/`) incorporated into the HSE in 2012.

The Department of mathematics works in cooperation with the other mathematical institutions inside the HSE.

2.4   Plans for the future

Since the number of 50 freshmen each year is considered by the Scientific Council to be an optimal one, allowing both for high quality entrance conditions and for opportunities for further individual work, the Department has no plans for increasing the admittance to the bachelor program. Exclusions can be made for paid education (meaning up to 20 additional paying students per year). In contrast, the Master programs and the Graduate studies programs are expected to increase in student numbers, and to promote the opportunity for people coming from outside to enter these programs. An important expectation is that these programs will be internationalized, with up to 40% of participants coming from abroad.

The room facilities of the Vavilova 7 building are completely exhausted, and further enlarging of physical resources totally depends on the development of the University as a whole.

Here are the main directions for further development of the Department. Some of them are goals that failed to be achieved during the previous stage of the Dept's existence.

1. Develop the *Mathematics* Master program as an international master program. Increasing the number of foreign students entering the program to 20 by 2015. Increasing the number of Russian students entering the program to 25 by 2015.

2. Develop the *Mathematical physics* Master program. Increasing the number of students entering the program to 15 by 2015.

3. Improve the quality of PhD students, which would allow most of them to defend their PhD thesis after three years of post-graduate studies.

4. Develop technical support for distance learning; video-recording of all distinguished lectures and of some complete lecture courses, at the same time providing open access to those courses.

5. Improve the quality of the Moscow Mathematical Journal, and return it to the list of top journals.

6. Establish a Thesis defence Council at the Department.

7. Establish an International Mathematical Research Center in Moscow.

3   Organizational structure

The present section is devoted to a description of the current organizational structure of the Department. The Department is part of the Higher School of Economics, which in 2009 won the status of National Research University. The structure of the Department is determined by the statutes of the Higher School of Economics.

3.1   Administrative structure

The everyday life of the department is governed by the Executive Staff consisting of the Dean, and four Vice-Deans. The Dean is in charge of all events at the Department, as well as of the outer life. The Vice-Deans cover

- research

- teaching

- international relationships

- administration of the everyday life.

In accordance with HSE regulations, the Dean is elected by the Scientific Council of the faculty, with further confirmation by the HSE Rector. In practice, Sergei Lando was appointed Dean in 2008 when the Department was first organized, and no elections have taken place since then. The Vice-Deans are appointed by the Dean, with further confirmation by the HSE authorities.

3.2 Scientific Council

The Scientific Council of the Department is an organism which determines the development strategy of the Department, as well as makes decisions concerning the most important questions of the Department life, including hiring new faculty members. Principal decisions of the Scientific Council have to be further confirmed by the Scientific Council of the HSE.

The Scientific Council of the Department was re-elected in September 2011. It consists now of 15 members, 13 of whom are professors of the Department.

Sergei Lando (President of the Council); Yuri Burman (Council Secretary); Members: Igor Artamkin, Victor Vassiliev, Alexei Gorodentsev, Yulij Ilyashenko, Igor Krichever, Pavel Pyatov, Aleksei Rudakov, Vladlen Timorin, Boris Feigin, Mikhail Finkelberg, Sergei Khoroshkin, Mikhail Tsfasman, Ossip Shvartsman.

The Council meets around once per month during the school year. There were 10 meetings during the year 2008–2009, 8 meetings in 2009–2010, 10 meetings in 2010–2011, 7 meetings in 2011–2012. The decisions of the Council are published on the Department website (`http://math.hse.ru/protokol-US`). Among the most important decisions, leaving aside those of appointments, are

- accepting the Development program (2009)

- opening the Master programs in *Mathematics* (2009) and *Mathematical physics* (2012)

- disbanding the Chair structure (2010)

- establishing the Steklov Mathematical Institute Chair (2011) and the Kharkevich Institute for Information Transmission Chair (2012)

- establishing the International Advisory Board (2011).

3.3   Curriculum committee

The Curriculum committee of the Department of mathematics is in charge of the following activities:

- developing the structure of the obligatory curriculum during the first 2 years of study

- developing the list of courses offered as choices for the 3rd and the 4th years of study

- developing the minimal content for each lecture course that covers all essential notions of the subject as well as being necessary for compatibility of the courses with one another

- makes suggestions for the choice of lecturers and the list of optional courses.

The Curriculum committee is appointed by the Scientific Council of the Department of mathematics. Its Head is Professor Sergei Khoroshkin. The decisions of the Curriculum committee have to be confirmed by the Scientific Council of the department.

3.4   Research institutes' chairs

There are two RAS institutes chairs at the department, namely, that of the Steklov Mathematical Institute (established in 2011) and that of the Kharkevich Institute for Information transmission problems. Both institutions are known world-wide for their achievements in mathematics. The goal in the opening of these chairs was to establish close relationships

between the Department and these two leading institutions, which is expected to allow students to obtain research guidance of high-quality researchers, including in domains that are not well covered by those of the permanent faculty. Here the Steklov Institute represents pure mathematics, while the Kharkevich Institute (taking into account its numerous specializations, which include mathematical biology, information transmission, ...) is more on the applied side. It is assumed that researchers from an institute looking for PhD students will have opportunities to give lecture courses concerning their domain of research in order to attract students.

As an important byproduct, the Department benefits from basic lecture courses given by researchers from the RAS institutes. Currently these are

- Topology (Victor Vassiliev, Steklov);

- 1st year Mathematical logic (Lev Beklemishev, Steklov);

- 3rd year Differential geometry (Maxim Kazarian, Steklov);

- 3rd year Functional analysis (Armen Sergeev, Steklov);

- 2nd year Calculus (Alexander Krasnoselskii, Kharkevich);

- 3rd year Partial differential equations (Vladimir Chepyzhov, Kharkevich).

In addition, the Kharkevich institute is in the process of establishing a special Dobrushin professorship at the Chair, aimed at an honorable occupant of international renown.

3.5   Laboratory of Algebraic geometry and its applications

In 2010, the Russian Ministry of Science and Education announced several mammoth grants whose goal was to organize research laboratories in Russian universities. The laboratories were to be headed by prominent outside researchers, who promised to spend at least one third of each year at the lab. The application of the Higher School of Economics aimed at inviting Fedor Bogomolov (Courant Mathematical Institute of the New York University) was among the winners (the two other winners in mathematics are Stanislav Smirnov with the St. Petersburg State University, and Boris Dubrovin

with Moscow State University). 90 million roubles ($3 million) for 3 years (November 2010 — December 2012) were provided by the Government, and the Laboratory of Algebraic geometry and its applications was organized. The Laboratory is not formally a part of the Department, but the two work in close cooperation and share offices and classrooms.

For most members of the Lab, with few exceptions, this is a part-time job. There are three big groups in the Lab:

- Department members

- mature researchers from outside the Department (of whom a big group comes from the Steklov institute)

- young researchers, including Department students specializing in algebraic geometry, as well as young researchers from outside.

3.6 Computer facilities and the Department' web site

The HSE supplies the faculty with access to current issues of the most important research journals (including all journals published by Springer). Access to MathSciNet is also provided. Most of the offices are equipped with several computer work stations.

The Department has a Russian web page `http://math.hse.ru/` containing current information about faculty, students, curriculum. The English version `http://math.hse.ru/en/` of this page is less representative.

4 Faculty

At the moment, the Faculty consists of 60 persons, of whom

- 11 are full-time professors, 6 of whom have the Doctor of Science degree, have a Western PhD (including 2 given by Harvard), 2 have the Russian Candidate of Science degree

- 18 are part-time professors, 2 of whom have the Doctor of Science degree, 3 have a Western PhD, 2 have the Russian Candidate of Science degree; Victor Vassiliev is a member of the Russian Academy of Sciences, and Lev Beklemishev is a corresponding member

- 22 are full-time associate professors, 1 of whom has the Doctor of Science degree, 9 have a Western PhD (including 1 given by Harvard), 15 have the Russian Candidate of Science degree (some have both)

- 9 are part-time associate professors, 3 of whom have the Doctor of Science degree, 6 have the Russian Candidate of Science degree.

Five professors have given invited talks at International Mathematical Congresses: plenary talks were given by Boris Feigin (1990) and Victor Vassiliev (1994), and sectional talks by Alexei Rudakov (1994, Algebraic geometry), Yulij Ilyashenko (1978, Ordinary differential equations and Dynamical systems) and Sergei Lando (2010, Combinatorics).

4.1   Hiring policy

The hiring policy of the Department is aimed at hiring the best candidates available. Research achievements of the candidates and their ability to teach are considered as being most and also equally important. The Higher School of Economics offers positions having a number of features that make them attractive for the best Russian professionals in the field:

- a relatively low amount of classroom teaching (about four $1\frac{1}{2}$ hour lectures/seminars per week, for a full-time position), similar to that in Europe and the USA

- students with a very high level (in the case of mathematics, the level at HSE is possibly the highest in the world)

- a relatively high salary (a professor publishing in foreign journals gets around 90,000 roubles, that is \$3,000, per month).

The hiring practice is different for professor and associate professor positions. In 2008, an initial group of professors was hired, consisting of 10 persons.

Since 2009, an international open advertising of the vacancies has been organized each year for associate professor positions. The advertising attracts a lot of attention, mostly from Russian applicants. In 2011 there were 63 applications for 6 positions, and 31 applications for 3 positions in 2012. The applications are considered by the Hiring Committee of the Department, which asks also for recommendation letters from specialists.

The final decision is made by the Scientific Council of the Department.

Applicants for professor positions apply throughout the year, and these applications are studied by the Scientific Council of the Department. The decision of the Council has to be confirmed by the HSE authorities.

Members of the Chairs of the RAS Institutes are suggested by the Institutes and approved by the Scientific Council of the Department.

4.2   Professors and associate professors

The first group of professors, consisting of I. Artamkin (algebraic geometry), Yu. Burman (topology and mathematical physics), B. Feigin (representation theory and topology), M. Finkelberg (algebra and mathematical physics), A. Gorodentsev (algebraic geometry), S. Lvovskii (algebraic geometry), S. Lando (combinatorics, topology, and moduli spaces), A. Rudakov (algebraic geometry), O. Shvartsman (geometry and algebra), V. Vassiliev (topology, singularity theory), was proposed by the Independent University of Moscow.

All the professors and associate professors have academic degrees of either Russian Doctor of Science, or Candidate of Science, or PhD s given by leading Western universities. We have 25 Candidates of Science, 27 Doctors of Science (which assumes the Candidate degree as well), and 19 PhD s (of whom 11 also possess the degree of Candidate or Doctor of Science).

Two associate professors (Misha Verbitsky and Vladlen Timorin) were nominated by the Scientific Council for positions of professor and were subsequently promoted in 2012.

4.3   Steklov Mathematical institute chair

The Steklov Mathematical institute chair was organized in 2011, and Victor Vassiliev, who had been working for the Department since it was first established in 2008, became the Head of the Chair, and V. Timorin became the Vice-Head. In the same year the Chair hired professors Alexander Bufetov (dynamical systems), Lev Beklemishev (mathematical logic), Maxim Kazarian (differential geometry, theory of singularities), and associate professor Alexei Klimenko (dynamical systems).

In 2012 professors Armen Sergeev (complex and functional analysis) and Andrei Pogrebkov (mathematical physics) joined the faculty.

Many other researchers from the Steklov institute are also involved in activites in the Department through being members of the Laboratory of Algebraic geometry and its applications. For example, Dmitrii Kaledin was the thesis advisor of the Master program student Eduard Balzin (now a graduate student).

4.4   Institute for Information Transmission Problems chair

The Institute for Information Transmission Problems chair is a newly established board. The Head of the Chair is Alexander Krasnosel'skii. The main part of the Faculty consists of those professors of the Department who were working already for the IITP.

The IITP also plans to establish the Dobrushin professorship at the Chair. This will be an honorary position with an ample stipend, intended for the hiring of an outstanding mathematician to teach at the Department for a period of 4 years.

4.5   Laboratory of Algebraic geometry and its applications

The Laboratory of algebraic geometry and its applications (`http://ag.hse.ru/en/`) was created in November 2010. It is an independent body of researchers and teachers, under the direction of Professor Fedor Bogomolov (Courant Institute), funded from a grant by the Ministry of Science of the Russian Federation.

The mission of the Laboratory of Algebraic Geometry is fivefold. It is

- To attract the best scientists working in algebraic geometry, both in Russia and in the West.

- To serve the wider community in disseminating knowledge; to organize conferences and workshops, to support the parent institutions of the HSE Department of Mathematics and the Independent University of Moscow.

- To create and to implement a new curriculum, following the demands of growth in science and technology.

- To nurture the creative side of high school education, through involvement in mathematical schools, summer camps, olympiads and by supporting the Moscow Center of Continuous Mathematical Education.

- (Of course, the most important mission) to carry out research; to stay at the bleeding edge of modern science — as every scientist should.

5 Research

All members of the faculty are active mathematical researchers. The research areas represented at the faculty cover almost all directions of modern mathematics and mathematical physics including

- mathematical logic

- number theory and arithmetic geometry

- homological algebra and non-commutative geometry

- algebraic, symplectic, complex analytic, and other aspects of geometry and topology

- singularity theory and low dimensional topology

- representation theory and the theory of invariants

- dynamics and integrable systems

- PDEs and functional analysis

- theory of probability, ergodic theory and optimal transportation

- statistical physics

- quantization and quantum field theories

- string theory and other modern branches of mathematical physics.

During the period $2008-2012$ faculty members have published more than 500 papers in peer-reviewed mathematical journals and several monographs. The total list of publications can be found in Appendix A.2.

Scientific collaborations at the faculty appear usually either at regular special scientific seminars[1] or within joint research teams supported by

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[1] see sec. 5.2 below

exterior scientific foundations[2].

At the same time, there are two autonomous research units organized at the faculty of mathematics and supported by special (temporary) grants of the government of the Russian Federation. The first is the Center for Scientific Education of the Department of mathematics (see sec. 5.3 below). It was organized in 2010 in collaboration with the Mathematical Physics Group of the Institute of Theoretical and Experimental Physics. The second is the Bogomolov Laboratory of Algebraic Geometry (see sec. 5.4 below). It was organized in 2011 under the supervision of prof. F. A. Bogomolov and incorporated researchers from several algebraic geometry centers in Moscow including the algebra section of the Steklov Mathematical Institute RAS and the algebra chair at the Department of mechanics and mathematics of Moscow State University.

More detailed information about all these research activities is presented below.

5.1 Review of new results obtained by faculty members

5.1.1 Algebraic, analytic, and arithmetic geometry

Ekaterina Amerik in 2010–2011 studied iterations of a rational endomorphism φ of algebraic variety over a number field. For some cases she has proved existence of points whose orbits do not intersect a given proper submanifold. Another result says that if φ is of infinite order, then there exists a point with an infinite orbit.

Misha Verbitsky proved the global Torelli theorem for hyperkähler manifolds and constructed formally Kähler structure on the space of knots in a G_2-manifold. Jointly with Markus Jardim, he developed theory of trisymplectic manifolds, and proved smoothness of the space of rank 2 instantons on $\mathbb{P}^3$.

Andrey Levin continues his studies of multiple elliptic polylogarithms. He and his students have constructed a system of generators of the algebra of homotopic invariant iterated integrals on elliptic curve and have given a geometrical interpretation of a rather mysterious dimension of the space of the cusp forms in the formula for defect of dimension of the space of multiple zeta-values of depth two.

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[2] such as Russian Foundation for Basic Research (RFBR) or Scientific Foundation of HSE (HSE SF), see sec. A.6 below

Sergey Lvovski extended to arbitrary characteristic the theorem saying that if $X \subset \mathbb{P}^n$ is a smooth projective variety which is not a linear subspace, then its normal bundle sequence is never split, even after restriction to an arbitrary subvariety of positive demension. His another result improves J. Landsberg's lower bound on the dimension of the second fundamental form for smooth projective varieties of small codimension.

Alexey Zykin developed a general asymptotic theory of ζ-functions over finite fields and studied concrete asymptotic properties of zeta and L-functions of global fields. The main results include the description of the asymptotic limit behavior of ζ-functions of global fields which generalizes and subsumes several previous results by Ihara, Tsfasman, Vladuts, and Lebacque.

5.1.2 Homological algebra, homotopic algebra, and categories

Leonid Positselski has got the possibility to write up and publish his most important results obtained after 1995. In 2011, he published a monograph on semi-infinite homological algebra, a memoir on derived Koszul duality and a long paper on Artin–Tate motives with finite coefficients, as well as a series of preprints on matrix factorizations, weakly curved A_∞-algebras, and contraherent cosheaves. The latter are developing various aspects of the subject of the derived categories of the second kind. The contraherent cosheaf idea is considered as especially significant and definitely will be developed in future.

Nikita Markaryan has interpreted the Atiyah class of a smooth projective variety X as a (homotopic) Lie algebra structure on the shifted tangent sheaf $\mathcal{T}_X[1]$ and has given an elegant interpretation of the Riemann–Roch theorem as a kind of expression for the standard (right) Lie algebra action on the functions on the corresponding Lie group in terms of exponential coordinates (i.e., as a version of the Campbell–Hausdorff formula). Also he simplifies the notion of manifoldic (co)homologies and gives a short conceptual definition for them and studied their basic properties.

Alexey Gorodentsev and Andrey Losev have constructed (over a field of characteristic zero) a strong deformation retraction between the simplicial chain complex $C(M)$ of the standard combinatorial simplex with vertex set M and the chain complex $C(B(M))$ of its barycentric subdivision $B(M)$ that is functorial w.r.t. inclusions of the vertex sets $M_1 \hookrightarrow M_2$. This retraction is unique up to an obvious rescaling. It allows one to transfer each functorial

in M A_∞ coproduct on $C(M)$ (defined by functoriality *for all* combinatorial chain complexes) from $C(B(M))$ back to $C(M)$. This produces an other functorial in M A_∞ coproduct on $C(M)$ called the barycentric subdivision of the original one. It was proven that there exists a unique functorial in M A_∞-coproduct on $C(M)$ invariant w.r.t. the barycentric subdivision.

5.1.3   Mathematical logic

Valentin Shehtman has constructed several solvable fragments of quantificational logic with only dyadic predicates and bounded quantifiers and only 3 variables used (it is known that the logic with one dyadic predicate without any restrictions on formulae is unsolvable). He also described (jointly with Andrey Kudinov) several modal logics with two modalities that appear from topological spaces, whose properties can be encoded by Boolean identities with two additional operations of the Cantorian derivative: in the original topology and in the weakest one. In particular, the solvability of these logics for $\mathbb{R}^n$, $n > 1$, and $\mathbb{Q}$.

5.1.4   Representation theory and theory of invariants

Evgeny Feigin has defined and studied degenerated flag varieties for simple Lie groups and PBW-filtrations on representations of simple Lie algebras.

Michael Finkelberg (jointly with Alexander Braverman) has discovered and studied double affine Grassmannian, which plays a crucial role in the geometric development of the theory of integrable representations of affine Lie algebras (similar to the role of ordinary Grassmannians in the representation theory of simple Lie algebras). The double affine Grassmannian has semi-infinite nature and is built from Uhlenbeck moduli spaces of instantons on the Klein singularity of type A (the number of the singularity corresponds to the level of the integrable representation).

Sergey Loktev has obtained a version of Bernstein–Gelfand–Gelfand duality for graded representations of Lie algebras of matrix-valued polynomials.

Leonid Rybnikov has constructed a Frobenius algebra structure on the space of an arbitrary finite dimensional irreducible representation of any semisimple Lie algebra. He also has described cohomology ring of the Laumon quasi-flag variety, has produced a conjecture on its small quantum cohomology, and has quantized the natural Poisson structure on the space of

based Laumon quasi-flags.

Evgeny Smirnov, Valentina Kiritchenko, and Vladlen Timorin have developed a new approach to the Schubert calculus on complete flag varieties using the volume polynomial associated with Gelfand–Zetlin polytopes. It allows one to compute the intersection products of Schubert cycles by intersecting faces of a polytope. Also, Evgeny Smirnov (jointly with N. Perrin) has studied the singularities of irreducible components of the Springer fiber over a nilpotent element with the zero square in Lie algebras of types A or D. They have proved that these irreducible components are normal, Cohen–Macaulay, and have rational singularities.

Ossip Schwarzman has described all pairs (Fuchsian group of finite volume, automorphism factor) whose algebra of automorphic forms is free.

Toshiro Kuwabara has studied representation theory of rational Cherednik algebras and W-algebras.

5.1.5 Low dimensional and combinatorial topology

Yurii Burman (jointly with Dmitry Zvonkine) has written an explicit formula for the Hurwitz function of cyclic permutations and an elegant formula that expresses the characteristic polynomial of a weighted sum of rank 1 operators via some discrete version of the path integration.

Alex Esterov has generalized the theory of Gelfand–Kapranov–Zelevinsky discriminants of multivariate polynomials to systems of polynomial equations and applied this generalization to the study of the topology of polynomial maps and the combinatorics of polytopes.

Maxim Kazarian constructed a smooth compactification of Hilbert schemes of disjoint points (a non-associative Hilbert scheme).

5.1.6 Ergodic theory and complex dynamics

Alexander Bufetov has proved a series of elegant theorems of completely new type for flows on flat surfaces. He also constructed infinite analogues of determinant measures on the configuration spaces.

Vladlen Timorin has proved a general result on the existence of partially defined semi-conjugacies between non-hyperbolic and hyperbolic rational functions on the Riemann sphere. From the viewpoint of topological dynamics, hyperbolic functions are stable and in many cases easy to understand. On the other hand, there are almost no general methods to

approach non-hyperbolic rational dynamics. It turns out that, if countably many suitably chosen cuts are made on the sphere, then the dynamics of a very general class of functions becomes topologically semi-conjugate to the dynamics of certain hyperbolic critically finite functions. This result gives a generalized version of the regluing surgery that has been proposed earlier by Vladlen Timorin.

5.1.7 Functional analysis

Alexei Pirkovskii has computed homological dimensions (the global one, the bidimension, and their weak analogues) for several classes of Fréchet algebras including the Köthe algebras and algebras satisfying the Van Den Bergh relations (in particular, for smooth and complex analytic quantum tori). He has introduced holomorphically finitely generated Fréchet algebras and has established an anti-equivalence between the category of these algebras and the category of Stein spaces of finite embedding dimension. He also constructed a series of explicit examples of non-commutative holomorphically finitely generated algebras, in particular, q-analogues of algebras of holomorphic functions on some classical domains.

5.1.8 Classical and quantum integrable systems

Anton Zabrodin has introduced the master T-operator, —which is a generating function for commuting transfer-matrices in integrable vertex models and associated quantum spin-chains. He has proved that it coincides with τ-function for classical soliton equations, i.e., satisfies the same bilinear Hirota equations. He also characterized the class of solutions of the Hirota equations that correspond to eigenvalues of the master T-operator and linked it with classical multi-particle integrable systems like Calogero–Moser and Ruijsenaars–Schneider ones.

Pavel Pyatov has developed the structure theory of the cotangent bundles over linear quantum groups $\mathrm{GL}_q(n)$ and $\mathrm{SL}_q(n)$. In particular, he has constructed 'spectral extension' for the algebra of q-difference operators on these groups.

Takashi Takebe has introduced a new recursive construction for solutions of $\hbar$-dependent integrable KP and Toda hierarchies reduced to dispersionless ones as $\hbar \to 0$. The recursion is based on a Riemann–Hilbert type problem for the pair of Lax and Orlov–Schulman operators.

5.2   Research seminars

In the current academic year we have 15 permanent weekly scientific seminars, see Sec. 6.5. Besides the permanent seminars, there are typically a couple non-permanent short-period seminars per term. They are organized on the occasion of a visitor or around some newly appearing mathematical result. There are also some scientific seminars joint with Independent University of Moscow (IUM): advised by M. S. Verbitsky, A. I. Zykin, and S. M. Natanzon.

All the seminars are open to students. One of key-points of the teaching strategy at the faculty is to drag the students into original research work as early as possible. To this aim we have several pro-seminars especially developed for the bachelor students of the first two years where we discuss interesting mathematical problems outside the standard basic courses.

5.3   Center for Scientific Education

The Center for Scientific Education (CSE) was established at the Department of mathematics following the signing of a contract N. 02.740.11.0608 with the Government of Russian Federation for the development of new methods to study integrable systems and moduli spaces in geometry, topology and mathematical physics during $2010 - 2012$.

The key idea of the center was to make research and education as close as possible. In particular, to include new scientific ideas into the teaching programs and to encourage students to do actual investigations.

The main research directions of the center were

- functorial A_∞-structures on the combinatorial simplicial chain complexes and their interaction with A_∞ structures of geometric nature coming from categories of sheaves and quantum field theories on a triangulated manifold ("how one can hear the shape of a manifold, and how to determine the sound that a manifold of a given shape will produce")

- characteristic classes of moduli spaces of curves and mappings, Hurwitz numbers, Witten's conjecture, string measures, asymptotic expansions of matrix integrals etc

- invariants of knots, links, and matroids

- dualities between gauge and string theories, AGT-correspondence

- geometric Langlands duality, geometry of double affine Grassmanians and zastava spaces, and their applications to classical and quantum integrable systems (Toda chains, Gaudin systems etc)

- non-symmetric orthogonal geometry of Mukai lattices and monodromies of Fuchsian differential equations on generating series for quantum cohomology

- stability data on triangulated categories and interactions between moduli of semistable objects and moduli of stabilities.

The research was carried out in close collaboration with members of the mathematical physics group from ITEP. Among senior researches there were members of our faculty (E. T. Akhmedov, I. V. Artamkin, A. I. Bufetov, Yu. M. Burman, M. V. Finkelberg, A. L. Gorodentsev, S. K. Lando, A. S. Losev, A. N. Rudakov, V. A. Timorin, B. L. Feigin, E. B. Feigin, S. M. Khoroshkin, V. A. Kirichenko, A. V. Marshakov, A. V. Klimenko, S. A. Loktev, A. Yu. Pirkovskii, L. E. Positselsky, P. N. Pyatov, G. L. Rybnikov, L. G. Rybnikov, E. Yu. Smirnov, O. V. Schwarzman, T. Takebe, M. S. Verbitsky, A. V. Zabrodin, A. I. Zykin), 11 invited researchers from ITEP (A. D. Mironov, D. V. Talalaev, L. O. Chekhov, N. Ya. Amburg, D. V. Vassiliev, S. M. Apenko, V. A.Poberezhny, A. A. Rosly, S. M. Kharchyov, G. I. Sharygin, Sh. R. Shakirov) and D. B. Kaledin from Steklov Mathematical Institute. About 50 undergraduates students of our faulty were involved into the project as well as around 30 graduates and undergraduates from MPTI (Fiz-Tech). Under partial financial support of the Center more than 60 of these students participated in more than 40 international scientific schools and workshops in Russia, US, Germany, France, Italy, Japan, and China.

During 2010 – 2012 members of the CSE gave more than 150 invited talks at scientific schools, workshops, and conferences (mostly at international ones) and published 119 peer-reviewed papers and monographs on the subject of the project; in addition 3 PhD theses and 3 doctoral theses were prepared.

5.4 Laboratory of Algebraic geometry and its applications

The Laboratory of Algebraic geometry and its applications was created in November 2010. It is an independent body of researchers and teachers,

under the direction of Professor Fedor Bogomolov (Courant Institute of Mathematical Sciences, New York University), funded from a grant by the Ministry of Science of the Russian Federation. In spite of its independence, it works in close cooperation with the Department of mathematics, and the two bodies coordinate their research and organizational activities.

For most of the members of the Lab, with few exceptions, this is a part-time job. There are three big groups of members of the Lab:

- the Department faculty members;

- mature researchers from outside the Department of whom a big group comes from the Steklov Mathematical institute RAS (other researchers from outside the Department hold their principal positions at Moscow State University, Institute for Information Transmission Problems, Institute for Theoretical and Experimental Physics, Research Institute for System Analysis, etc.);

- young researchers, including students of the Department (both undergraduate and post-graduate) specializing in algebraic geometry, as well as young researchers from outside.

There are currently 50 researchers affiliated with the Laboratory. Out of these 13 are Doctors of Science (which assumes the Candidate degree as well), 23 are Candidates of Science, 11 members have PhD degrees of leading Western universities, 6 are post-graduate students and 5 are under-graduate students.

The Soviet school of algebraic geometry (founded by Shafarevich) was one of the most influential and illustrious of the time; it numbered amongst its members such major figures as Manin, Iskovskikh, Tyurin, Nikulin, Parshin, Kulikov, Bogomolov, Beilinson, Drinfeld. Since the 1990 s it dispersed through scientific emigration, and the importance of research originating from Russia diminished.

The Laboratory attracts leading experts in the field of algebraic geometry and related mathematical domains both from the Higher School of Economics and from other important Russian and foreign mathematical centers. The research directions of the members of the Laboratory are very broad and include birational geometry, complex algebraic geometry, arithmetic geometry, representation theory, derived algebraic geometry, etc. More information can be found at the laboratory web site `http://ag.hse.ru/research`.

The members of the Laboratory have a good publication record, the articles being published in journals of repute, the total number of publications by Laboratory members during the last three years being 130 (not including preprints).

One of the crucial goals of the Laboratory is to establish interactions between Russian and foreign researchers in algebraic geometry (including Russian scientists who emigrated in the 90 s). That is why mathematicians from the USA, France, Germany, Japan, Italy and other countries often come to give either a single lecture or a mini-course aimed at advanced under-graduate and post-graduate students. The list of visitors includes Yuri Manin, Shing-Tung Yau, Joseph Bernstein and many others.

More than 10 international mathematical conferences were organized and financially supported by the Laboratory. In addition to that the Laboratory organized 4 summer schools. One of the summer schools for advanced students, "Algebra and Geometry", is expected to become a regular event. It has already been held twice (in 2011, 2012) and it attracted more than 80 participants each year. The lectures were given by leading specialists in algebraic geometry and related topics, for the most part working abroad. More information about conferences and summer schools can be found at the Laboratory website `http://ag.hse.ru/conf-sem`.

A very important part of the activities of the Laboratory of Algebraic geometry is the initiation of students into academic research. A number of students of the Department have a Laboratory member as their supervisor. Students actively participate in conferences organized by the Laboratory and frequently give talks at Laboratory research seminars. Last but not least, the Laboratory has provided significant financial support for a number of master and post-graduate students (12000 and 15000 rubles per month, respectively).

The high research level of the members of the Laboratory was marked by a number of rewards in the last two years: Dmitry Orlov was elected a Corresponding member of the Russian Academy of Sciences, Vladlen Timorin, Vladimir Zhgun, Sergey Gorchinskiy received President's research grants, Alexey Zykin was awarded the Moscow Mathematical Society prize, Alexey Elagin, Alexander Efimov and Alexey Zykin were winners of the Dynasty foundation contest; Anton Fonarev and Alexander Efimov were winners of the Möbius contest; IUM-Simons foundation grants were awarded to Evgeny Smirnov, Leonid Positelsky, Michail Verbitsky, Alexander Kuznetsov, Alexey Zykin, Alexander Efimov, Igor Netay; one of the talks of the famous Bourbaki seminar ("A Global Torelli theorem for Hyperkähler

manifolds" given by D. Huybrechts in 2011) was based on the work of Mikhail Verbitsky.

5.5 Invited talks and events

During 2008 – 2012 several leading top-level scientists have given talks at the seminars of our faculty. Among them were I. Krichever, J. Maldacena, Yu. Manin, D. Zagier, V. Voevodsky, S. Smirnov.

There were also several short term visitors invited to the faculty for scientific collaboration and giving intensive lecture series. Among them were N. Berkovits, B. Shapiro, A. Mellit, P. Bressler, M. Polyak, V. Baranovsky.

5.6 International cooperation

Practically all faculty members do research in close cooperation with their foreign colleagues. The Department also has formal agreements with two institutions; the École Polytechnique, France and the Department of mathematics, University of Kyoto, Japan.

The agreement with the École Polytechnique established in 2010 assumes exchanges of Master programs and PhD students. The École Polytechnique is ready to accept each year up to 3 students for a period of 3-5 months, who will work under the guidance of ÉP professors, and a similar service is available for ÉP students coming to Moscow. In practice, the exchange started in 2012 with a month-long visit of our Master student Eduard Balzin to the École Polytechnique, where he worked under the guidance of Prof. Carlos Simpson (ÉP and Université de Nice) and Prof. Claude Sabbah. The Department plans to put mutual visits of students on a more solid ground.

The cooperation with the Department of mathematics of Kyoto University proceeds in the framework of the Agreement between Kyoto University and the Higher School of Economics (`http://math.hse.ru/partners`) signed in November 2011. In the course of realizing this Agreement, yearly a group of 5-7 Russian students goes to Kyoto for a period of three weeks (there have been two such visits so far, in July 2011 and in July 2012), and a group of 5-7 Japan students come to Moscow for the same period (so far one visit, in January 2012). During the visit, a series of lectures and seminars is given in English to the guests, to whom a group of students belonging to the host department is added. The next visit of Japanese students and professors is planned for January 2013.

6   Bachelor program

The Department runs a 4 year long bachelor program. The approach to teaching changes slightly from year to year, but aiming at doing research remains the main goal throughout the whole period of education.

Students are taught in a rather specific way. This is based on the use of "listki", invented by Nikolai Konstantinov in 1960, and now widely used in mathematical high schools throughout the country. In addition to ordinary lectures, students are given a large amount of problems which they are expected to solve. These problems are compiled in a way allowing the students to develop essential parts of theory on their own. The results and the questions arising are discussed with teachers (who are professors as well as teaching assistants) on a direct personal basis. As a result, a student may follow a course in the way which is most comfortable for him/her, and progress is marked on a weekly basis. Although professors have a lot of freedom in organizing lecture courses, most of them follow this scheme. The base scope of the problems is preserved from year to year, but each year the concrete realization is adapted to the specific knowledge and level of the students they are given to.

6.1   1st and 2nd year

During the first and second years of studies, the curriculum is rather strict. All the students have to pass through the same set of mathematical lecture courses, which are given in the table below.

Descriptions of the courses can be found in Appendix B.

The lecture courses include, in addition to ordinary lectures, a generous number of problem sessions, as well as homework. During a problem session, a number of tutors (about one per 8 students), who are faculty members as well as teaching assistants (graduate and master students), talk personally to the students discussing solutions and answering questions that arise in the process of solving the problems.

In addition to regular courses, the students are obliged to choose and attend weekly a research seminar and a special lecture course. Each year each student is obliged to write a short review paper concerning some mathematical subject.

	1st semester		2nd semester	
	Module 1	**Module 2**	**Module 3**	**Module 4**
1st year	Geometry			Introduction to topology
	Algebra			
	Calculus			
	Logic and algorithms		Introduction to discrete mathematics	
2nd year	Algebra			Computer computations
	Calculus			
	Dynamical systems			
	Introduction to topology		Functions of complex variable	

Tab. 2: Obligatory mathematical lecture courses for years 1 and 2

6.2 3rd and 4th year

In contrast to the first two years of study, during their third and fourth years the students have a lot of choice of lecture courses. They are obliged to pass exams for 4 lecture courses each year. At least 2 of these courses must be of a mathematical nature, while the others may be arbitrary. The choice of courses is made by each student under the guidance of her or his scientific advisor. If a lecture course is chosen by less than 15 students, then it is abandoned, although several exceptions are made each year to this rule.

There is no difference between the lecture courses allowed for choosing in the 3rd or 4th year, although certain courses have others as pre-requisites. The current list of mathematical lecture courses is given in the table below.

In addition to these courses, the students are obliged to choose and attend weekly a research seminar and an optional lecture course. The 3rd year students are obliged to write a short paper concerning some mathematical subject, while the 4th year students have to write a bachelor thesis, to be defended at the end of the academic year.

6.3 Optional mathematical lecture courses

The list of optional lecture courses varies from year to year. They are suggested by faculty members and must be approved by the Curriculum committee. There are one-semester as well as year-long optional lecture

1st semester	2nd semester
Differential geometry	
Functional analysis	
Probability theory	
Topology	
Sheaves and Homological algebra	Algebraic geometry
Representations of finite groups	Lie groups and Lie algebras
Applications of calculus	Partial differential equations
Mechanics and field theory	Calculus of variations and optimal control
	Dynamical systems and ergodic theory
Quantum mechanics	Statistical physics
	History of mathematics (in English)

Tab. 3: Mathematical lecture courses for years 3 and 4

courses.

In the 2012-13 academic year, these courses include

- *Algebraic curves: towards moduli spaces* by S. Lando;

- *Additional topics in dynamical systems* by K. Tolmachev;

- *Teichmüller spaces* by O. Shvartsman;

- *Number theory* by A. Zykin (given in IMU);

- *Perverse sheaves* by M. Finkelberg;

- *Gröbner basis theory* by T. Kuwabara;

- *Topics from discrete mathematics* by I. Artamkin;

- *Integrable models of statistical physics and field theory* by A. Zabrodin;

- *Hyperbolic groups after Mikhail Gromov* by M. Verbitsky;

- *Introduction to commutative algebra* by E. Amerik;

- *Special functions* by S. Khoroshkin;

- *Invariants and representations of classical groups* by A. Gorodentsev.

Two guest courses are

- *Problems in classical algebraic geometry* by A. Tikhomirov;

- *Elliptic pseudodifferential operators and spectral problems* by M. Agranovich.

6.4 Nonmathematical lecture courses

Nonmathematical courses are given mainly by professors who belong to the HSE faculty, but not to the Department of mathematics. These courses vary from year to year. In the 2012-13 academic year, the nonmathematical courses are

- *Sociology*;

- *History of philosophy*;

- *Macroeconomics*;

- *Topics in economics*;

- *Programming*;

- *Mathematical linguistics*;

- *Computer science* given by the Data analysis School of the Yandex company.

6.5 Research seminars

Research seminars work weekly, during the academic year. Normally a research seminar works for several years in a row. Seminars are informally divided into two subclasses: the ones aimed at attracting young students to research, and those oriented towards mature researchers.

In 2012-13, there are the following student research seminars:

- *Algebra and geometry* headed by A. Gorodentsev;

- *Singularities of differentiable mappings* headed by N. Tyurin and P. Pushkar';

- *Introduction to representation theory* headed by B. Feigin;

- *Introduction to theoretical physics* headed by E. Akhmedov, A. Marshakov;

- *Modular forms* headed by O. Shvartsman and A. Zykin;

- *Basic mathematical notions* headed by Yu.Burman and S. Lvovski;

- *Additional topics in mathematical logic* headed by L. Beklemishev and A. Kudinov;

- *Convex geometry* headed by V. Kirichenko and A. Esterov;

- *Combinatorics of Vassiliev invariants* headed by M. Kazarian and S. Lando;

- *Around asymptotic representation theory* headed by A. Bufetov and G. Olshanskii;

- *Problems in commutative algebra* headed by E. Amerik;

- *Probability theory: analytical and economical applications* headed by V. Konakov and A. Kolesnikov.

Research seminars are

- *Goresky–MacPherson Cohomology* headed by M. Finkelberg;

- *A_∞ structures in geometry and physics* headed by A. Gorodentsev, A. Losev, N. Markaryan;

- *Representation theory* headed by B. Feigin;

- *Quantum Algebra* headed by T. Takebe, T.Kuwabara;

- *Modern problems in mathematical physics* headed by A. Marshakov, A. Povolotskii;

- *Mathematical physics* headed by A. Marshakov, A. Zabrodin;

- *Characteristic classes and intersection theory* headed by M. Kazarian, S. Lando;

- Research seminar of the Laboratory of algebraic geometry and its applications.

6.6 Studying English

English is a subject of high importance at the HSE. During the first two years of education, classes are given twice a week, with lots of homework. After that, the students are expected to pass exams for an International certificate (IELTS). All graduates must write the introduction to their theses in English. Certain lecture courses (including those given on the *Mathematics* Master program) are given in English.

7 Bachelor students

The Department recruits 50 undergraduates each year (40 for the years 2008 and 2009). Education is free of charge. Students who pay for their studies are few and can be considered as exceptions. The same is true for all other mathematical departments in Russia: practically nobody is ready to pay for studying math.

7.1 Pre-entrance strategy

The Department tries to attract the best Russian high school students to enter. It was impossible to achieve this task in 2008, the first year of the Department's existence. However, already in 2009 the Department began to acquire excellent freshmen, who are continuing to show very good academic achievements; these will graduate in 2013. The 2011 and 2012 intake includes 8 winners of the All-Russia Mathematical olympiad entered the Department. Each year, one or two of the entries also possess medals of the International Mathematical Olympiad.

A lot of efforts are applied to contact high school students and their parents directly during the two academic years preceding the entrance year. These efforts are aimed first of all at the leading schools and centers teaching high level mathematics. They include Moscow schools 57, 179, 2, 1543, Kolmogorov Boarding school, the school "Intellektual", as well as various

lycees around the country (Chelyabinsk, Ufa, Ekaterinburg, Kazan', Omsk). Note that traditionally graduates of leading St.Petersburg high schools enter St.Petersburg's universities and do not move to other cities, including Moscow. During the first two years of entrance, there were successful students coming from Omsk and Irkutsk, and now their followers enter the Department each year.

The faculty members not only advertise the department, but also give mathematical lectures to high school students and discuss mathematics with them. Some members of the faculty give regular lessons in the best schools during the academic year.

In addition to these activities, the HSE and the Department arrange 3-4 Open Days throughout the academic year, where high school students and their parents can come and ask their questions.

Members of the faculty also take part in a variety of summer activities for school-children, including the Kirov summer school, Dubna *Modern mathematics* summer school, Ecological school at Pushchino.

7.2   Entrance

According to State regulations, there are two main ways for a high-school graduate to enter the Department. These are winning an Olympiad of sufficiently high level, or getting a sufficient amount of points at State examinations. The winners of the All-Russia Mathematical Olympiad (about 30 persons each year) have the right to enter any university they choose.

There are a number of olympiads approved by the Russian Olympiads Council. The olympiads are organized each year and after the results are collected, each olympiad gets its *level* depending on the number of participants and the quality of the problems given. There are three levels, and universities are allowed to make offers to olympiad winners depending on the level. In 2011, on the recommendation of the Department, the HSE allowed free entrance to all winners of the 1st and 2nd level olympiads, and 27 such winners were approved.

The result was found to be more than satisfactory, and the same procedure was applied in year 2012. As a result, 44 Olympiad winners were accepted, in addition to 5 accepted through the State examination; 2 more students have been accepted for health benefit, 2 others will pay for their studies, which make 53 first year students in total.

The main rivals of the Department in the entrance process are the

Moscow institute of physics and technology (fiztekh), and the Department of mathematics and mechanics of Moscow State University(mekhmat). Most of the graduates who make a final decision against entering the Department choose one of these two institutions.

In the process of studying at the Department, our students continue communications with their former classmates who made a different choice. This communication often happens at the Independent University of Moscow, Dubna summer school, and so on. Cases when these university students aimed at doing research decide to switch from the institutions where they study and join the Department of mathematics (after passing a reliable acceptance procedure) are numerous. As a result, the number of students at the Department increases from year to year rather than decreases due to those who leave it because of various reasons. The percentage of the latter does not exceed 15% during the whole period of studies.

In 2012, approximately half of the first year students came from Moscow, most of the others came from out of the Moscow region.

7.3   Mathematical olympiad

The current system of mathematical olympiads in Russia has two main lines. One of them is the State All-Russian Olympiad. This is a competition for grades 9–11 high school students. It consists of 4 to 5 stages. The winners of the final stage get a right to enter any Russian Department of the Olympiad profile without passing any additional exams (although passing State exams is necessary to complete school education). In mathematics, there are about 30-40 winners each year, and the preferences are applied to winners independently of the year they got their prize.

Another line of olympiads is organized independently by a variety of Russian universities. These olympiads are assigned levels (from 1 to 3) by the Russian Olympiads Council formed by Rectors of leading universities. In 2012, there were 26 such olympiads. University authorities can grant benefits to winners of these olympiads. Benefits include either automatic acceptance of the winners, or assigning them by default the highest mark for the entrance exam. In 2012, the Department of mathematics of the HSE granted free entrance to winners of all olympiads of the 1st and the 2nd levels (13 olympiads), and gave no benefits to winners of olympiads of the 3rd level.

Since 2010, the HSE has organized a mathematical olympiad of its own. This olympiad has 2 stages (the first one is computer-based, the second

requires personal participation). In 2012, there were 3360 participants of the first stage (of which 2200 were in the 11th grade). Both compiling the problems and checking the second stage solutions is done by the Department faculty. In 2011 and 2012 this olympiad was assigned the 2nd level.

7.4 Applicants

During the years 2008-2012, the university entrance rules have changed essentially each year, due to rules imposed by the Russian Ministry of education and science. It is not therefore an easy task to compare figures from different years. Thus, in 2011 there were 390 applications for the 50 positions, and the number was reduced to 350 in 2012. Presumably, the reduction can be explained by the following innovation in the entrance rules: in 2012, the Olympiad winners were allowed to use their privilege in just one single university, while previously there was no such restriction. It must be mentioned, however, that the applicants have very different motivations when applying, and many of them do not really plan to enter the Department, even if such an opportunity would be granted them: 70 applicants had State exam marks of 264 or higher, but only 6 of them approved the invitation to become students.

8 Master programs

At the Higher School of Economics, the M.Sc. programs take two full years of study. The programs are considered to be a crucial intermediate step for non-HSE graduates, necessary for them to get important additional preparation for high-level post-graduate studies. On the other hand, graduates of the HSE Department are considered to be ready to do research on their own. For them, the two years of M.Sc. studies could be used as a time to be spent partly at other leading research and teaching centers.

8.1 Description of programs

All M.Sc. students complete their Individual Plans of Study (IPS). The IPS includes some mandatory items. However, most courses are student chosen (students can choose from a certain number of special topic courses and a certain number of research seminars). A course project must be completed

by the end of the first year. By the end of their course of study, students are required to submit a thesis. A presentation of the results of the thesis, in the form of a seminar, is required. Every M.Sc. student has a faculty adviser, who supervises the course project and the Master's thesis.

The Master of Science (M.Sc.) program in Mathematics was launched in 2010. The director of the program is Sergei Lando, the Dean. We now have the first graduates of this program. Only 8 M.Sc. students entered the program in 2010. Thus we could not fill all 15 government-funded positions provided to us (the RF government gives tuition-waivers but very little extra support). There were two main reasons why our program did not attract so many students: 1. the program was new, and many students did not know about it, 2. going to a different university for an M.Sc. program breaks a Russian tradition, according to which a student starts to work with an advisor during his/her Junior year, and continues all the way through: Master's and PhD. Students' advisors are generally not happy when students leave for M.Sc. studies to a different place.

Five M.Sc. students graduated in Spring 2012. Their Master's theses are based on original research. We expect that four of the five theses will soon lead to publications. We recommended all our M.Sc. graduates to continue their studies at the Ph.D. level. For the academic year of 2011-2012, we had 12 M.Sc. program freshmen (10 at the end of the year).

In 2012, our Master of Science program in Mathematics has been transformed into an international program (conducted in English), whilst a new Master of Science program in Mathematical Physics has been established. The director of the new program is Igor Krichever, a professor of Columbia University, NY. For the academic year 2012-13, we have 20 government-funded positions in Mathematics, and 15 government-funded positions in Mathematical Physics. Additionally, we can offer several tuition waivers (and free accommodation) to outstanding international applicants. A curriculum outline can be found at `http://math.hse.ru/en/matem/curriculum`.

8.2   Admission

Unfortunately, admission rules are different for domestic and international students. For citizens of the Russian Federation, admission rules are published at `http://ma.hse.ru/priem`. There are government funded positions ("free position") and regular fee-paying positions. Admission is

based on a written exam in Mathematics and a pass or fail test of English conducted in the third week of July. Citizens of former Soviet Union Republics can take the same admission tests as Russian citizens. International applicants (citizens of all countries other than Russian Federation, or Russian citizens, who live permanently abroad) can apply for international M.Sc. positions with a tuition waiver ("free positions") or for regular fee-paying positions. Applications are open from February 1 till March 15. The application package is described at `http://math.hse.ru/en/matem/package`.

This year, we offered M.Sc. positions to 7 international students. Although they accepted the offer, 4 of them changed their mind later. We made 2 more offers, and now have 5 international students who commenced their studies in Fall 2012. They come from the USA, Canada, Iran and Ukraine.

8.3   Student Olympiads and Winter Schools

The Student Olympiad is offered by the HSE every year in the Spring (it was late February in 2012). This year, we had two specializations of the Mathematical Olympiad, namely, Mathematics and Mathematical Physics. The Olympiad takes place simultaneously at about 30 places in Russia and in former republics of the Soviet Union (some of which are now part of the European Union). Students who wish to participate in the Olympiad must register online for one of the specializations. Winners of the Olympiad can enter the M.Sc. program of their choice without having to pass the entrance exams. The number of registered participants shows a steady growth: In 2010, about 30; in 2011, about 60; in 2012, about 120. This means that information about our department and its M.Sc. programs is spreading.

Winter Schools of the HSE invite students who may be interested to enter one of the M.Sc. programs offered by our university. The Mathematical Winter Schools normally take place in early February. They are organized by representatives of several M.Sc. programs of the HSE in Mathematical Sciences, in particular, Mathematics, Mathematical Physics, Applied Mathematics, Mathematical Modeling, and Theoretical Informatics. Experts answer students' questions and give lectures on contemporary problems in Mathematical Sciences and on applications of Mathematics in Physical and Social Sciences. Information on the HSE and its M.Sc. programs in Mathematical Sciences is given. The venue of the Winter School is usually a resort in the Moscow region. The HSE pays for the accommodation and

meals. It also provides a shuttle from Moscow to the School venue and back. Participation in Winter Schools requires registration.

8.4   Financial support

Unfortunately, the M.Sc. positions funded by the RF government do not include any substantial financial support other than the tuition waiver and accommodation at a university student residence. A typical scholarship is about 1500 rubles per month. The Laboratory of Algebraic Geometry is able to provide some financial support to M.Sc. and Ph.D. students. However, this support is very limited, and we cannot assume financial commitments based on it. For example we could not formally promise any financial support to future M.Sc. students: this was one reason why good students decided not to. We made a lot of effort advertising the program and selecting the applications but did not acquire as many as we might have done. There are competitions for Teaching Assistantships but although all our applications have been successful so far, the decision is not made by us, and TA funding is not something that we can rely on to promise to prospective students. Thus the financial issues are amongst the most serious ones preventing the desired development of our M.Sc. programs, and they should be discussed with the university government.

9   Graduate studies

The first Ph.D. program in Mathematics with specialization in Algebra, Logic and Number Theory was opened at the Department of Mathematics in 2010, and a new specialization in Geometry and Topology was added in 2012. Division into specializations is a formality (induced by Russian legislation in education), and the actual opportunities for graduate study and research in the department are available in most of the main fields of pure mathematics including analysis, differential equations, functional analysis, dynamical systems and mathematical physics. The Ph.D. program is tuition free for all students regardless of their citizenship. Students may choose thesis advisors from faculty members as well as from members of the Laboratory of algebraic geometry and its applications. There is a possibility to choose an advisor from other mathematical institutions in Moscow. Students may also study on joint Ph.D. programs (cotutelle) with non-Russian universities.

In 2012, most of the Ph.D. program in Mathematics was converted to the so-called "academic" or "full-time" Ph.D. program. The academic Ph.D. program has maximal research and educational opportunities compared to the regular Ph.D. programs in Russian universities. For this program, the HSE provides graduate scholarships worth 25 000 Rubles per month. This allows students to spend most of their time on research (the regular state-funded graduate scholarship of about 2000 Rubles per month does not give such an option). As a result, the number of applications has increased (from 10 applications in 2010 and 2011 to 17 applications in 2012). The quality of applications also increased significantly in 2012. Most of the applicants did their undergraduate studies at the Department of Mathematics of Moscow State University. In 2012, some of the best graduates of the MSU applied to the Ph.D. program of the Department of Mathematics of the HSE.

In October 2012, there were 12 graduate students at the department and 12 more were admitted in November. Six of the students combine their studies with Ph.D. programs in foreign universities and graduate schools such as Berlin Mathematical School, University of Cambridge, University of Nice, Bonn International Graduate School and the State University of Kiev. However, the Ph.D. program is not completely international (in contrast with the international M.Sc. program in Mathematics) as some knowledge of Russian language is expected from the applicants (according to Russian legislation, the Ph.D. thesis can only be written in Russian).

Admission requirements to the Ph.D. program include M.Sc. degree (this is required by Russian laws and cannot be replaced by B.Sc. degree), certificate of proficiency in English such as TOEFL/IELTS (this can be replaced by an oral examination at the HSE) and two letters of reference (these are only required for the academic Ph.D. program). The prospective students have to pass an oral examination in Philosophy (this is again required by law) and a written examination in Mathematics. The final decision is made after prospective students are interviewed by faculty members. During interview students are expected to talk about their past research and future plans.

The duration of the Ph.D. program is 3 years and this cannot be extended. During this time students have to pass three oral qualifying exams (English, Philosophy and Mathematics), write a thesis and publish all results of their thesis before the defense. All these requirements are imposed by VAK (the Higher Attestation Commission) and cannot be changed by individual universities. Students are also expected to teach 50 hours per year during

their first and second year as a teaching practice. In doing this they have an option of applying for the HSE teaching assistantships (approximately 40 000 Rubles per term). Students enrolled into the academic Ph.D. program are also requested to take 3-4 topics courses per year. They may choose from the variety of topics courses offered by the department to master and advanced bachelor students. Students may also participate in research projects of the department funded by external grants. In 2011-2012 most of the Ph.D. students were part-time employed in the Laboratory of algebraic geometry and its applications with an average salary of 15 000 Rubles per month.

10   Cooperation with the Independent University of Moscow

The Department of mathematics of the Higher School of Economics is a joint project of the HSE and the Independent University of Moscow. The first 10 members of the Department were chosen by the IUM. The Rector and one of the Vice-Rectors of the IUM are simultaneously professors at the Department, another IUM Vice-Rector is a member of the Scientific Council. Hence, the relationship between the two institutions is very close.

10.1   Teaching

The curriculum of the Department is very close in style to that at the IUM, from which it originates. Thus, it is rather strict during the first two years of bachelor studies, and flexible, with a number of lecture courses to be chosen during the 3rd and the 4th year. Many of the lecture courses given at the Department were first tried at the IUM. The main differences between the two curricula are due to the following circumstances:

- the Department curriculum contains many optional courses in non-mathematical areas, including sociology, philosophy, linguistics, computer programming, economics, due to its being a part of an Economics school

- practically all IUM students are simultaneously studying at other universities as well, and the courses given by the IUM professors assume knowledge that students get from other places.

At present, many Department professors continue giving courses and conducting seminars at the IUM (in the fall semester 2012 these include Evgeny Feigin, Vladlen Timorin, Evgeny Smirnov, Misha Verbitsky, Alexander Bufetov, Alexey Zykin). Some students from the Department (about one fourth of each year) also attend IUM courses. As a result, a lot of students studying at the IUM know about the Department directly from its professors and students, and a number of them apply in the course of study, to switch to the Department from their home universities.

10.2   Moscow Mathematical Journal

The Moscow Mathematical journal (`http://www.ams.org/distribution/mmj/`) is an international research quarterly established by the IUM in 2001. MMJ presents research and research-expository papers in mathematics from all over the world. The journal is published in English. During the years 2005-2010 it had the highest ISI impact-factor among Russian mathematical journals, and was in the list of top-100 journals in the world. However, in 2011 it lost its position, due to the small number of citations in that year.

The journal is distributed by the American Mathematical Society.

A number of faculty members of the Department are also members of the Editorial board of the MMJ. Since 2012 the journal became a joint project of the Independent University of Moscow and the Higher School of Economics. The HSE finances operating costs of the journal, and the editorial staff of the journal is a part of the Department.

10.3   Math in Moscow program

The Math in Moscow program (`http://www.mccme.ru/mathinmoscow/`) is a program inviting foreign students to study mathematics at the Independent University of Moscow for one semester. It started in 2000. The participants have to pay for their studies and lodging. The program is oriented mainly towards North American students, since American students are used to paying for their studies at their home universities. The National Science Foundations of the USA and Canada supply stipends for winners of a competition. The competition for stipends is arranged by the Mathematical Societies of the two countries.

Around 15 students take part in the program each half a year, and approximately 300 students have graduated from it overall. The credits

for the program courses are transferrable to the USA and Canada home universities.

Since 2010, the program became a joint program of the IUM and the HSE. The HSE supplies the participants of the program with lodging at the HSE dormitory inside Moscow, and professors of the Department of mathematics are among those who give the lecture courses. In 2012, part of the MiM courses became considered part of the Department of mathematics master program given in English.

One of the international students accepted by the Department in 2012 for the MSc program is a former MiM participant (Austin Mack).

11   The Department in the media

Russian people are not all that much interested in mathematical science and education, whence not many journals publish information about development of mathematical departments. However, the faculty has established close relationship with the scientific department of the one of the most popular Internet resources `http://www.polit.ru` and the weekly Troitsky variant `http://trv-science.ru/`. These two have published two interviews with Sergei Lando: a two-part one in 2008 when the Department was established `http://www.polit.ru/article/2008/01/23/lando1/`, `http://www.polit.ru/article/2008/01/23/lando2/`, and a second interview three years after, in 2011 `http://trv-science.ru/2011/09/27/bez-proryva-my-obrecheny -na-dalnejshee-otstavanie/#more-12565`, `http://www.polit.ru/article/2011/09/27/math_in_hse`. The latter was supplied with short interviews with other faculty members.

A number of other publications are mainly due to Victor Vassiliev (e.g., `http://www.afisha.ru/article/viktor-vasiliev-matematik/`), and concern high school mathematical education, as well as general approaches to developing science and education in Russia.

A Faculty members

A.1 Fields of interests

Below is the complete list of the professors of the Department of mathematics, including their field of interests and citation data, is given. For mathematicians, the citation data is given according to MathSciNet, as on October 1, 2012, and for physicists, according to the InSpire database `http://inspirehep.net/`.

Professors

	Name	Research interests	MSN	IS
1	I. Artamkin	Algebraic geometry, combinatorics, graphs, QFT	42	
2	L. Beklemishev	Mathematical logic, proof theory, formal arithmetic, provability logic, modal logic	82	
3	A. Bufetov	Measure-preserving actions of infinite-dimensional groups and ergodic properties of translation flows on flat surfaces of higher genus.	39	
4	V. Chepyzhov	Nonlinear partial differential equations, infinite-dimensional dynamical systems, global and trajectory attractors, epsilon-entropy and dimension of attractors, inertial manifolds, non-autonomous dynamical systems, non-autonomous PDEs	826	
5	B. Feigin	Representation of toroidal algebras, combinatorics of plain partitions	1759	1410
6	M. Finkelberg	Algebraic Geometry, Representation Theory	182	
7	A. Glutsyuk	Dynamical systems, complex analysis, foliations by Riemann surfaces, uniformization, subgroups in Lie groups, billiards.	73	
8	A. Gorodentsev	Algebraic and symplectic geometry, homological algebra, mathematical physics	98	
9	Yu. Ilyashenko	Differential equations, dynamical systems	821	
10	M. Kazarian	Topology, geometry, singularity theory, characteristic classes, moduli spaces	135	
11	S. Khoroshkin	Representation theory of Lie groups and infinite-dimensional algebras with applications to classical and quantum integrable systems	303	186
12	A. Krasnose'lskii	Nonlinear analysis, differential equations, bifurcations	98	
13	A. Levin	Algebraic Geometry: algebraic curves and Hodge theory, especially intersections with Math. Physics (conformal theories and Hitchin systems) and Number Theory (Polylogarithms and Modular Forms)	92	

Professors

	Name	Research interests	MSN	IS
14	S. Lando	Singularity theory, low-dimensional topology, algebraic geometry, combinatorics	340	
15	V. Losiakov	Mathematical physics, magnetic monopoles, superconductivity, phase transitions, critical phenomena		15
16	A. Marshakov	Mathematical physics, integrable systems, gauge theory, comformal theory, matrix models		3307
17	S. Natanzon	Moduli spaces, integrable systems, real algebraic geometry, low-dimension topology and topological field theory	215	82
18	G. Olshanskii	Representation theory (mainly of infinite-dimensional groups) and related topics in algebraic combinatorics (theory of symmetric functions) and probability (random partitions, random point processes).	1160	
19	A. Pogrebkov	Mathematical methods of physics. Classical and quantum integrable systems. Multidimensional and discrete integrable systems. Inverse scattring transform. Theory of solitons.		409
20	M. Rovinskii	Algebra and its interactions with other scientific domains	32	

Professors

	Name	Research interests	MSN	IS
21	A. Rudakov	Homological methods in Algebraic Geometry, in particular the derived categories of the coherent sheaves on a variety and its structure.	244	
22	A. Sergeev	Complex analysis, mathematical physics	39	
23	O. Shwartzman	Discrete subgroups of Lie groups, reflection groups,hyperbolic geometry.	85	
24	V. Shehtman	Mathematical logic, with the emphasis to nonclassical logics, and their applications to universal algebra, topology and computer science	63	
25	T. Takebe	Integrable systems; classical integrable systems like the KP hierarchy, the Toda lattice hierarchy and their dispersionless limits; quantum integrable systems like solvable lattice models (in particular, those related to elliptic R matrices), conformal field theories	173	281
26	V. Timorin	Geometry (convex polytopes, toric varieties, projective differential geometry, classical geometric structures), dynamics (rational functions, surgery, invariant laminations), quadratic forms	38	
27	V. Vassiliev	Singularity Theory, Topology, Integral Geometry, Monodromy Theory, Combinatorics, Computational Complexity.	551	
28	M. Verbitsky	Algebraic geometry, differential geometry, hyperkahler geometry, calibrations on manifolds, quaternionic structures, locally conformally Kaehler manifolds, Yang-Mills theory, Hodge theory.	284	
29	A. Zabrodin	Theory of Integrable systems, integrable models of classical and quantum physics, theory of random matrices and its applications, conformal field theory, mathematical models of growth processes and pattern formation		1854

Associate professors

	Name	Research interests	MSN	IS
30	E. Amerik	Algebraic geometry and its interactions with dynamics; arithmetical dynamics; birational geometry; holomorphic symplectic manifolds and their fibrations.	53	
31	E. Akhmedov	Quantum fields in curved space-time, black hole thermodynamics, holography, holographic renormalization group		758
32	Yu. Burman	Topology, combinatorics, mathematical physics	17	
33	A. Esterov	Algebraic, convex and tropical geometry, singularity theory, algebraic combinatorics, topology of algebraic varieties and analytic singularities, pseudoperiodic topology.	20	
34	E. Feigin	Representation theory, algebraic geometry, combinatorics, mathematical physics	43	
35	A. Gorinov	Topology of complex algebraic varieties, in particular configuration spaces, discriminant complements and moduli spaces; Hodge theory; low-dimensional topology and geometric structures on manifolds.	5	
36	V. Kiritchenko	Algebraic geometry (group actions, spherical varieties, theory of Newton polytopes and Newton Okoun'kov bodies, Schubert calculus, algebraic cobordisms	10	
37	A. Klimenko	Ergodic theory of group actions, asymptotics of time averages for translation flows and similar systems.	1	

Associate professors

	Name	Research interests	MSN	IS
38	A. Kolesnikov	Optimal transportation theory, Monge-Ampere equation, Sobolev spaces, isoperimetric inequalities, infinite dimensional analysis, convex geometry, geometric flows, elliptic and parabolic PDE's, analysis on Riemannian manifolds, Gaussian measures, stochastics	72	
39	T. Kuwabara	Representation theory of a certain infinite dimensional associative algebra, so called rational Cherednik algebras, and other algebras related with them. Microlocal aspects of it and relationship to quantum algebras such as quantum enveloping algebras and Hecke algebras.	2	
40	A. Kudinov	Modal logic, hybrid logic, spatial reasoning, algorithmic complexity, epistemic logic	3	
41	S. Loktev	Representation theory, mathematical physics	132	
42	A. Losev	String theory, M-theory, Topological theories, mathematical aspects of Quantum Field Theory		884
43	S. Lvovski	Algebraic geometry of projective varieties	19	
44	N. Markaryan	Algebraic geometry; Hochschild homology, characteristic classes. Questions connected with topological chiral homology	17	
45	I. Marshall	Mathematical Physics, Poisson geometry and symmetries	173	
46	A. Pirkovskii	Locally convex (in particular, Banach) algebras and modules. Homological algebra in categories of topological modules: homological dimensions, Hochschild (co)homology of topological algebras etc. Topological algebras in noncommutative geometry and in quantum group theory.	54	

Associate professors

	Name	Research interests	MSN	IS
47	A. Povolotsky	Statistical physics	111	
48	L. Positselski	Homological algebra: 1) derived categories of the second kind and 2) mixed motives with finite coefficients.	117	
49	P. Pushkar	Symplectic/Contact Geometry/Topology, Morse theory.	36	
50	P. Pyatov	Differential geometry of the quantum groups. Structure theory and representations of the quantum matrix algebras. Integrable models. Braid group and its finite dimensional quotient algebras		248
51	G. Rybnikov	Combinatorics and topology of hyperplane arrangements; operadic methods in algebraic topology.	20	
52	L. Rybnikov	Representation theory, Lie theory, integrable systems	33	30
53	P. Saponov	Quantum groups, non-commutative geometry, classical and quantum integrable models		95
54	D. Shamkanov	Proof theory, nonclassical logics, combinatory logic		
55	V. Shevshishin	Symplectic geometry, pseudoholomorhic curves, mapping class groups, complex geometry	88	
56	E. Smirnov	Equivariant algebraic geometry, representation theory, algebraic combinatorics		
57	N. Tyurin	Lagrangian geometry of Fano varieties, its applications in Geometric quantization and Homological Mirror symmetry, gauge theories and symplectic topology.	17	
58	I. Vyugin	Inverse monodromy problems for linear differential equations (Riemann-Hilbert problem), isomonodromic deformations, Painlevé equations, irregular singular points, differential and difference equations with meromorphic coefficients, applications of linear differential equations to number theory, differential Galois theory.	13	
59	V. Zhgoon	Algebraic geometry, Geometric invariant theory, actions of affine algebraic groups, spherical varieties, flag varieties, Hamiltonian varieties, Coxter groups	7	
60	A. Zykin	Zeta-functions and L-functions (modularity, special values, behaviour in families, Brauer–Siegel type results, distribution of zeroes) Algebraic geometry over finite fields (points on curves and varieties over finite fields, zeta functions, relations to coding theory) Families of fields and varieties, asymptotic theory, Abelian varieties and Elliptic Curves	8	

A.2   List of research papers and books; years 2008–2012

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  2. I.Artamkin Colored graphs and matrix integrals, Proceedings of the Steklov Institute of Mathematics, 2009. V. 264. N 1. C. 2-19

  3. I.V. Artamkin, Левицкая Ю.А., Шабат Г.Б., Examples of Families of Strebel Differentials on Hyperelliptic Curves, Functional Analysis and Its Applications, 2009. V. 43. N 2. C. 140-142

  4. Артамкин И.В., Шехтман В.Б. (ред.), Теория моделей и алгебраическая геометрия. Сборник статей под редакцией Э.Бускаран, Москва, МЦНМО, 2008

- Beklemishev Lev

  1. Beklemishev, L. and Gurevich, Y.: Propositional primal logic with disjunction. Journal of Logic and Computation, published online May 2012, doi:10.1093/logcom/exs018.

  2. L. Beklemishev (2012): Calibrating provability logic: from modal logic to reflection calculus. In T. Bolander, T. Braüner, S. Ghilardi, L. Moss, eds. Advances in Modal Logic, v. 9, College Publications, London, 2012, pp. 89-94.

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  4. L.D. Beklemishev, Ordinal completeness of bimodal provability logic GLB, In: N. Bezhanishvili et al., eds. Logic, Language, and Computation, TbiLLC 2009. Springer, Lecture Notes in Artificial Intelligence, v. 6618, 2011. C. 1-15

  5. L.D. Beklemishev, Gurevich Y., Propositional primal logic with disjunction, Microsoft Research Technical Report N MSR-TR-2011-35

6. Ред.: S.Adian, L.D. Beklemishev, Visser A., Special Issue: Logical Models of Reasoning and Computation, Oxford: Oxford University Press. Journal of Logic and Computation, 2011. Т. 21 (4). 172 c.

7. Gabelaia D., L.D. Beklemishev, Topological completeness of the provability logic GLP, arXiv:1106.5693v1, 2011. -26 c.

8. Ред.: Мищенко Е.Ф., Беклемишев Л.Д., Алгоритмические вопросы алгебры и логики: Сборник статей. К 80-летию со дня рождения академика С.И. Адяна, Москва: МАИК "Наука/Интерпериодика Труды МИАН, 2011. Т. 274. 352 c.

9. Беклемишев Л.Д., Упрощенное доказательство теоремы об арифметической полноте для логики доказуемости GLP, Труды Математического института им. В.А. Стеклова РАН, 2011. Т. 274. С. 32-40

10. Ред.: L.D. Beklemishev, Goranko V., V.B. Shehtman, Advances in Modal Logic, v. 8, London: College Publications, 2010. 513 c.

11. L.D. Beklemishev, Kripke semantics for provability logic GLP, Annals of Pure and Applied Logic, 2010. Т. 161. N 6. C. 756-774

12. L.D. Beklemishev, On the Craig interpolation and the fixed point properties of GLP, В кн.: Proofs, Categories and Computations. Essays in honor of G.E. Mints. London: College Publications, 2010

13. L.D. Beklemishev, G.Bezhanishvili, Icard T., On toplogical models of GLP, In: R. Schindler, ed. Ways of Proof Theory. Ontos Verlag, Frankfurt, 2010. C. 133-153

14. Беклемишев Л.Д., Теоремы Геделя о неполноте и границы их применимости, Успехи математических наук, 2010. N 5 (т.65). С. 61-104

- Bufetov Alexander

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2. Клименко А.В., Буфетов А.И. Максимальное неравенство и эргодические теоремы для марковских групп, Труды МИАН, 2012. Т. 277. С. 23-48

3. M.Khristoforov, Bufetov A., Klimenko A., Cesáro Convergence of Spherical Averages for Measure-Preserving Actions of Markov Semigroups and Groups, International Mathematics Research Notices, 2012

4. B.Solomyak, Буфетов А.И., Limit theorems for self-similar tilings, arXiv:1201.6092, 01/2012. -33 c.

5. Bufetov A., Klimenko A., On Markov Operators and Ergodic Theorems for Group Actions, European Journal of Combinatorics, 2012. , 2012 33(7) 1427-1443

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7. V.Araujo, Буфетов А.И., A large deviations bound for the Teichmueller flow, Ergodic Theory an Dynamical Systems, 2011. T. 31. N 04. C. 1043-1071

8. Series C., Буфетов А.И., A pointwise ergodic theorem for Fuchsian groups, Mathematical Proceedings of the Cambridge Philosophical Society, 2011. T. 151. N 01. C. 145-159

9. M.Khristoforov, Клименко А.В., Буфетов А.И., Cesaro convergence of spherical averages for measure-preserving actions of Markov semigroups and groups, arXiv: 1101.5459, 01/2011. -32 c.

10. Буфетов А.И., Ergodic Decomposition for Measures Quasi-Invariant Under Borel Actions of Inductively Compact Groups, arXiv: 1105:0664, 05/2011. -30 c.

11. B.M.Gurevich, Буфетов А.И., Existence and Uniqueness of the Measure of Maximal Entropy for the Teichmueller Flow on the Moduli Space of Abelian Differentials, Математический Сборник РАН, 2011. T. 202. N 7. C. 3-42

12. Буфетов А.И., Finiteness of Ergodic Unitarily Invariant Measures on Spaces of Infinite Matrices, 08/2011.

13. Буфетов А.И., Forni G., Limit Theorems for Horocycle Flows, arXiv: 1104.4502, 04/2011. -52 c.

14. Буфетов А.И., On the Vershik-Kerov Conjecture Concerning the Shannon-McMillan-Breiman Theorem for the Plancherel Family of

Measures on the Space of Young Diagrams, Geometric And Functional Analysis, 2011. Т. принято в печать. С. 1-37

15. Клименко А.В., Христофоров М., Буфетов А.И. , Сходимость по Чезаро сферических средних для сохраняющих меру действий марковских групп и полугрупп, Успехи математических наук, 2011. Т. 66. N 3. С. 203-204

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17. Буфетов А.И., Hoelder cocycles and ergodic integrals for translation flows on flat surfaces, Electronic Research Announcements, 2010. N 17 (3442)

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19. Буфетов А.И., On the Vershik-Kerov Conjecture Concerning the entropy of the Plancherel measure, Russian Mathematical Surveys, 2010. N 65 (1). С. 175-176

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23. Буфетов А.И., Гуревич В.М., On a measure with maximum entropy for the Teichmueller flow on the moduli space of abelian differentials, Functional Analysis and Its Applications, 2008. N 42 (3). С. 75-77

- Chepyzhov Vladimir

1. V.V.Chepyzhov, M.I.Vishik. Trajectory attractors for dissipative 2d Euler and Navier-Stokes equations.Russian Journal of Mathematical Physics. V.15. 2008. N.2. P.156-170.

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1. Тиморин В.А., Хованский А.Г., Многогранники и уравнения, Математическое просвещение. Сер. 3, 2010. N 14. С. 30-57

2. Тиморин В.А., Табачников С., Прямая Сильвестра, Квант, 2009. N 5 и 6. С. 2-6 и 6-9

3. Тиморин В.А., Арифметические треугольники, Квант, 2008. Т. 6

- Vassiliev Victor

1. Васильев В.А., Законы природы неподкупны, Бюллетень РАН "В защиту науки", 2010. Т. 7

2. Васильев В.А., Об учебниках для начальной школы, 11/2010.

- Lvovski Sergey

1. Львовский С.М., Гельфанд И.М., Тоом А.Л., Тригонометрия, Москва: МЦНМО, 2008

A.4 RFBR grants

Below is the list of the Russian Foundation for Basic Research grants held by the faculty members in 2008–2012.

1. RFBR 07-01-00051-a $(2007-2009)$ participant A. I. Zykin

2. RFBR 07-01-92211-a $(2007-2009)$ participant A. I. Zykin

3. RFBR 07-01-00526-a $(2007-2009)$ "Homological methods to study the moduli spaces in geometry and quantum physics", leader A. L. Gorodentsev, participant A. N. Rudakov

4. RFBR 08-01-00110-a $(2008-2010)$ "Geometry and combinatorics of the mapping spaces of real and complex curves", leader S. K. Lando, , participant Yu. M. Burman

5. RFBR 08-01-00392-a $(2008-2010)$ "New algebraic methods in quantum physics", participant P. N. Pyatov

6. RFBR 08-01-00667-a "Algebraic geometry and representation theory in applications to integrable systems" $(2008-2010)$, participant A. M. Levin

7. RFBR 08-02-00287-a $(2008-2010)$ "Integrability in physics of non-equilibrium processes, quantum field theory and statistical physics", leader A. V. Zabrodin

8. RFBR 08-07-92495-a $(2008-2010)$, participant A. I. Zykin

9. RFBR 09-01-00242-a $(2009-2011)$ "Geometry and combinatorics of double affine grassmannian" leader M. V. Finkelberg, , participants L. G. Rybnikov, M. S. Verbitsky

10. RFBR 09-01-12170$(2009-2011)$ participant A. I. Zykin

11. RFBR 09-01-12185 "Combinatorial aspects of integrable models in mathematical physics" $(2009-2010)$ leader I. V. Artamkin, participants A. L. Gorodentsev, S. K. Lando, P. N. Pyatov, G. L. Rybnikov

12. RFBR 09-01-93106-a $(2009-2011)$ "Mathematical problems in integrable systems", participant A. V. Zabrodin

13. RFBR 09-02-00393-a "Modern methods in gauge and topological theories and in in the string theory" (2009 – 2011), participant A. M. Levin

14. RFBR 09-02-91005-a "Dualities in modern string theory and their applications" (2009 – 2011), participant A. L. Gorodentsev

15. RFBR 10-01-00518-a, "Differential properties of measures and non-linear transformations", participant A. V. Kolesnikov

16. RFBR 10-01-00709-a "Families of geometric structures on Riemann surfaces" (2010 – 2012), participant I. V. Artamkin

17. RFBR 10-01-00836-Рѳ (2010 – 2012) "Homological methods to study the moduli spaces in geometry and quantum physics", leader A. L. Gorodentsev, participants I. V. Netai, Ya. V. Abramov

18. RFBR 10-01-92104 "Integrable systems, random matrices, algebraic geometry and geometric invariants" (2010 – 2012), participant S. K. Lando, A. V. Zabrodin

19. RFBR 10-01-93113-a, "Homological methods in geometry"(2010 – 2012), participant M. S. Verbitsky

20. RFBR 10-02-92109 (2010 – 2011) "Integrability synthesis in the framework of dualities between strings and gauge theories", participant A. V. Zabrodin

21. RFBR 11-01-90436 "Applications of algebraic geometry and representation theory to quantum integrable systems", participant A. L. Gorodentsev

22. RFBR 11-02-01220-a (2011 – 2013) "Integrability in physics of non-equilibrium processes, quantum field theory and statistical physics", leader A. V. Zabrodin

23. RFBR 12-02-91052-a (2012 – 2014) "Hidden dispersion amplitude structures in gauge field theories and quantum gravity", participant A. V. Zabrodin

24. RFBR 12-02-92108-a (2012 – 2014) "Further development of the integrability synthesis in the framework of dualities between strings and gauge theories", participant A. V. Zabrodin

25. 10-01-93112-a (2010 – 2012) "Geometric and topological methods in studying bifurcations of complex systems", head A. M. Krasnosel'skii

26. RFBR 08-01-00867. Homology theory for classical and quantum algebras of Functional Analysis (2008–2010). Participant A. Yu. Pirkovskii

27. RFBR 12-01-00577. Topological homology and operator K-theory (2012–2014). Participant A. Yu. Pirkovskii

A.5   Personal awards

Personal grants of President of Russian Federation won by members of the faculty are

- 764.2008.1 (A. V. Kolesnikov)

- 1173.2009.1 (A. Yu. Pirkovskii)

Several members of the faculty won the All-Russian Contest for young mathematicians established in 2005 by Pierre Deligne and then, from 2007, taken over[3] by Dmitri Zimin's "Dynasty" foundation:

- L. G. Rybnikov won the 2007 Pierre Deligne competition

- L. E. Positselski won the 2008 Pierre Deligne competition

- E. B. Feigin won the 2008 Pierre Deligne competition

- V. A. Timorin won the 2009 Pierre Deligne competition

- V. A. Kirichenko won the 2009 Dynasty foundation competition

- V. S. Zhgun won the 2010 Dynasty foundation competition

- A. I. Zykin won the 2010 Dynasty foundation competition

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[3] during 2007 – 2009 it was the joint Deligne – Dynasty contest, see details at `http://www.mccme.ru/pdc/index.html`

- E. B. Feigin won the 2010 Dynasty foundation competition

- A. I. Esterov won the 2011 Dynasty foundation competition

- A. I. Bufetov won the 2011 Dynasty foundation competition

The members of faculty also won more than a dozen individual research grants of the Scientific Foundation of the Higher School of economics.

A.6   Grants and research groups

During the period 2008 – 2012 the members of the faculty organize and participate in more than a dozen research teams supported by several Russian and International scientific foundations. Below is a (non-complete) list of these projects.

1. CNRS project "Combinatorial algebraic and geometric methods for investigations of the integrable systems", participant P. N. Pyatov

2. CRDF project RUM1-2895-MO-07 "Rational Cherednik algebras, inverse Macaulay systems, and complete integrability", participant Yu. M. Burman

3. DFG project 436 RUS 113/909/0-1(R) "New models of integrable stochastic many-particle systems", participant P. N. Pyatov

4. DFG project 36 RUS 113/343/0(R), participant A. V. Kolesnikov

5. FAPESP grant 2009/12576-9, participant M. S. Verbitsky

6. joint RFBR-CNRS project 09-01-93107-a "Algebraic, combinatorial and geometric methods in investigation of integrable systems", participant P. N. Pyatov

7. joint RFBR-CNRS project 07-01-92214-a, leader B. L. Feigin, participants L. G. Rybnikov, E. Yu. Smirnov

8. joint project of RFBR and Consortium E.I.N.S.T.E.IN (Italy) 09-01-92437 "Classical and quantum integrable and exactly solvable many particle systems and their integrable discretizations"

B   Minimal content of the 1st and 2nd year lecture courses

1st year lecture courses

- **Geometry:** Linear Euclidean geometry: angles, distances, oriented volume, Gram matrix, orthogonal projection. Orthogonal group, reflections. Convex geometry and topology of $\mathbb{R}^N$. Linear projective geometry. Quadrics.

- **Introduction to topology:** Basic general topology (compactness, separability, standard topologies on products and spaces of mappings). Fundamental group, coverings, bundles.

- **Algebra:** Commutative rings, fields, complex numbers, polynomials, rational functions, formal power series. Vector spaces, systems of linear equations, determinants, Hamilton–Cayley identity. Notion of a group, cyclic groups, symmetric groups. Lagrange theorem, action of a group on a set. Modules over commutative rings, structure of finitely generated commutative groups. Spaces endowed with a bilinear form. Polylinear mappings and tensors.

- **Calculus:** Construction of real numbers. Complex numbers. Sequences and series. Functions of one variable: elementary functions, properties of continuous functions. Calculus of functions of one variable and investigation of graphs (given explicitly, implicitly, and parametric form). Taylor series. Topology of $\mathbb{R}^N$, equivalence of different norms. Calculus of several variables. Integrals of functions of one variable.

- **Logic and algorithms:** Algebra of logic and Boolean operations on sets. Propositions. Relations and functions. Cardinality of a set. Formulas and theories of the first order. Models and validity. Axiom of Choice and Zorn's lemma. Turing's machines. Computable functions. Enumerability and solvability.

- **Introduction to discrete mathematics:** Combinatorics of symmetric groups, enumerative combinatorics and generating functions. Graphs, their enumeration and invariants. Formal languages, finite automata and formal grammars.

2nd year lecture courses

- **Algebra:** Symmetric functions. Modules over noncommutative rings. Representation theory. Categories and functors. Galois theory. Basic commutative algebra.

- **Computer computations:** Mathematical experiments with the help of *Mathematica* computer system.

- **Calculus:** Integrals of functions of several variables. Green–Gauss–Ostrogradskii–Stokes formula. Functional series. Fourier series and integral. Distributions and special functions.

- **Dynamical systems:** Differential equations of the 1st order. Existence and uniqueness theorem for solutions; analytical dependence on initial values. Linear differential equations and systems. Stability theory. Autonomous differential equations and vector fields. Hypergeometric equation. Configurational and phase spaces of a mechanical system. Lagrangian mechanics: Newton laws, conservation laws, d'Alambert principle, least action principle. Differentiable manifold. Tangent space. Mappings of manifolds and tangent spaces. Vector fields, Lie derivative.

- **Introduction to topology:** Classification of triangulated surfaces. Homology, cohomology, Euler characteristic. Homology of manifolds.

- **Functions of complex variable:** Cauchy integral. Laurent series. Residues and their applications. Analytic continuation. Conformal mappings. Entire and meromorphic functions. Variational principle. Special (in particular, elliptic) functions.

C   Post-graduate students' thesis subjects

Since the graduate studies program started in 2010, the students still work on their theses. Below is the list of the students, their thesis advisors and the subjects they are working on.

Ph.D. thesis themes of the current graduate students

	Name	Year of admission	Thesis advisor	Ph.D. thesis theme
1	B. Bychkov	2011	S. Lando	Stratification of the space of functions on complex curves
2	M. Gumin	2011	E. Feigin	Higher spin gauge theories
3	R. Devyatov	2011	S. Loktev	Deformation of varieties with a torus action of complexity two
4	S. Korobitsyna	2011	M. Verbitsky	Geometric structures on K3-surfaces
5	A. Kravets	2011	D. Orlov	Higher structures on triangulated categories of geometric origin
6	S. Slobodyanyuk	2011	L. Beklemishev	Topological semantics of non-provability logic
7	A. Soldatenkov	2011	M. Verbitsky	Geometry of hyperkähler manifolds
8	Y. Abramov	2010	A. Gorodentsev	Properties and constructions of geometric quotients of reductive group representations
9	G. Mutafyan	2010	B. Feigin	Quantum W-algebras and their representations
10	I. Netay	2010	A. Gorodentsev	Syzygies of Grassmannians
11	N. Netrusova	2010	S. Lando	Construction of knot invariants using graph invariants
12	V. Sharich	2010	S. Lando	Statistic models of graph invariants generating knot invariants

D   Laboratory of Algebraic geometry and its applications

D.1   Conferences organized by the Lab

Here is the list of conferences and schools organized with participation of the Laboratory.

- *Instantons in Complex Geometry,* (Algebraic Geometry, Mathematical Physics), Moscow, Russia 14.03.2011-18.03.2011 `http://ag.hse.ru/instantons`

- *Summer School in Algebraic Geometry and Complex Geometry for young scientists,* (Algebraic Geometry, Complex Geometry), Yaroslavl, Russia 23.05.2011-28.05.2011 `http://ag.hse.ru/Yaroslavl`

- *Integrable Systems,* (Mathematical Physics, Partial Differential Equations), Moscow, Russia 20.09.2011-30.09.2011 `http://ag.hse.ru/sent.visit_1`

- *First summer school "Algebra and Geometry",* (Algebra, Geometry, Algebraic Geometry, Number Theory), Yaroslavl, Russia 01.08.2011-07.08.2011 `http://ag.hse.ru/stud-ag`

- *School of Algebra and Algebraic Geometry,* (Algebra, Algebraic geometry, Representation Theory,) Yekaterinburg, Russia 15.08.2011-21.08.2011 `http://ag.hse.ru/stud-ekat`

- *Conference in honor of Fedor Bogomolov's 65th birthday,* (Algebraic Geometry, Arithmetic Geometry), Moscow, Russia 01.04.2011-04.09.2011 `http://ag.hse.ru/konf-bogom`

- *Derived Categories in Algebraic Geometry,* (Algebraic Geometry, Homological Algebra) Moscow, Russia 05.09.2011-09.09.2011 `http://ag.hse.ru/konf-sept`

- *Geometric Structures on Complex Manifolds,* (Algebraic Geometry, Complex Geometry) Moscow, Russia 03.10.2011-07.10.2011 `http://ag.hse.ru/geom-oct`

- *Zeta-functions of Arithmetic Surfaces,* (Number theory, Arithmetic Geometry), Moscow, Russia 03.04.2012-20.04.2012 `http://ag.hse.ru/fesenko`

- *Arithmetic Days,* (Number theory, Arithmetic Geometry) Moscow, Russia 05.04.2012-06.04.2012 `http://ag.hse.ru/arithmetic`

- *Birational and Affine Geometry,* (Algebraic Geometry), Moscow, Russia 23.04.2012-27.04.2012 `http://ag.hse.ru/birational`

- *Algebra and Geometry (dedicated to the 65th anniversary of Askold G.Khovansky)*, (Algebra, Geometry, Number Theory, Represantation Theory), Moscow, Russia 04.06.2012-09.06.2012 `http://ag.hse.ru/askoldfest`

- *Hecke Algebras,* (Algebra, Representation Theory), Moscow, Russia 26.06.2012- 03.07.2012 `http://ag.hse.ru/braverman`

- *Second Summer School "Algebra and Geometry",* (Algebra, Geometry, Algebraic Geometry, Number Theory), Yaroslavl, Russia 25.07.2012-31.07.2012 `http://ag.hse.ru/stud-ag2`

- *Relation of String Theory to Gauge Theories and Moduli Problems of Branes,* (Mathematical Physics), Moscow, Russia 10.09.2012-14.09.2012 `http://ag.hse.ru/mostok`

- *Complex Geometry and Foliations,* (Algebraic Geometry, Complex Geometry), Moscow, Russia 17.09.2012-21.09.2012 `http://ag.hse.ru/brunella`

- *Elliptic curves and Serre's "big image" theorem,* (Arithmetic Geometry, Number Theory), Moscow, Russia 29.10.2012-30.11.2012 `http://ag.hse.ru/galateau`

- *Algebraic and Differential Geometry of Andrey Tyurin,* (Algebraic Geometry, Differential Geometry), Moscow, Russia 24.10.2012-26.10.2012 `http://ag.hse.ru/a_n_tyurin`

D.2 Talks at international conferences 2010–2012 given by Lab members

- *XVI Escola de Geometria Diferencial,* Universidade de Sao Paulo, Brasil, 12.07.2010 - 16.07.2010 Verbitsky M.S. *Global Torelli theorem for hyperkähler manifolds*

- *Workshop on Mirror Symmetry, Symplectic Geometry, and Related Topics,* Massachusetts Institute of Technology, Boston, USA 19.07.2010 - 23.07.2010 Efimov A.I. *HMS for P - 3 points*

- *Workshop on Moduli and Birational Geometry*, POSTECH, Pohang, Korea 05.08.2010 - 08.08.2010, Prokhorov Yu.G. *Fano 3-folds and finite subgroups of the Cremona group of rank 3*, Shramov K.A. *Exceptional quotient singularities*

- *14th International Conference in Representations of Algebras (ICRA XIV)*, Tokio, Japan, 05.08.2010 - 16/08/2010. Smirnov E.Yu. *Schubert calculus and Gelfand-Zetlin polytopes*

- *Conference on Complex Geometry, Group actions and Moduli spaces*, University of Hyderabad, Hyderabad, India 12.08.2010 - 16.08.2010 Kiritchenko V.A. *Schubert calculus and Gelfand-Zetlin polytopes*

- *Komplexe Analysis*, Mathematisches Forschungsinstitut Oberwolfach, 29.08.2010 - 04/09.2010 Verbitsky M.S. *Global Torelli theorem for hyperkahler manifolds*

- *POMI 70th anniversary conference*, Sankt-Petersburg branch of the Steklov Mathematical Institute, Russia 13.09.2010 - 17.09. 2010 Kaledin D.B. *Non-commutative Witt vectors*

- *Complex dynamics around Thurston's theorem*, Roskilde, Denmark 27.09.2010 - 01.10.2010 Timorin V.A. *Partial holomorphic semiconjugacies between rational functions*

- *Miniworkshop on holomorphic symplectic geometry*, Republic of Corea, Seoul, KIAS 29.09.2010 - 30.10.2010 Verbitsky M.S. *Global Torelli theorem for hyperkahler manifolds*

- *Workshop dedicated memory of Andrey Tyurin*, MI RAS, Moscow, Russia 26.10.2010 N.A.Tyurin *Торы типа Чеканова на торических многообразиях Фано, Tori of the Chekanov type on toric manifolds*, Prokhorov Yu.G. *Singular 3-dimensional Fano G-manifolds*

- *RIMS International Conference on Noncommutative Geometry and Physics and Hayashibara forum on Symplectic Geometry, Noncommutative Geometry and Physics*, Kyoto, RIMS 1.11.2010 -12.11 2010 Kaledin D.B. *Witt vectors as a polynomial functor*

- *Международная конфенреция посвященная 80 летию кафедры алгебры мехмата МГУ (International Conference in Honor of the 80th*

Anniversary of the Chair of Algebra of the Faculty of Mechanics and Mathematics of the MSU), Moscow State University , Russia 16.11.2010-18.11.2010 Tyurin N.A. *On lagrangian fibrations of the flag variety F3*, Prokhorov Yu.G. *О конечных подгруппах групп Кремоны (Finite subgroups of the Cremona group)*

- *Instantons and Rationality of Moduli Spaces*, Freie Universität Berlin, Germany 29.11.2010 - 03.12.2010 Prokhorov Yu.G. *E.Noether's problem*

- *Birational geometry conference in honour of V.V. Shokurov*, The International Centre for Mathematical Sciences (ICMS), Edinburgh, UK 06.12.2010- 10.12.2010 Prokhorov Yu.G. *On the classification of singular Fano threefolds*

- *Second Latin Congress on Symmetries in Geometry and Physics*, Universidade Federal do Parana, Curitiba, Brazil 13.12.2010 - 17.12.2010 Efimov A.I. *Counter-examples to King's conjecture for toric Fano varieties*

- *Геометрия и интегрируемые системы. К 60-летию И.М.Кричевера (Geometry and Integrable Systems. In Honor of the 60th Birthday of I. M. Krichever)*, MI RAS, Moscow, Russia 26.12.2010 -30.12.2010 Levin A.M. *What is the configuration space of the elliptic Calogero system*

- *Derived Categories*, Japan, Tokyo, Graduate School of Mathematical Sciences, University of Tokyo 24.01.2011 - 28.01.2011 Bondal A.I. *Derived categories of coherent sheaves*, Kaledin D.B. *Homology of infinite loop spaces, Non-commutative Witt vectors and de Rham-Witt complex*, Kuznetsov A.G. *Exceptional collections on homogeneous varieties*

- *International Workshop on Classical and Quantum Integrable Systems CQIS-2011*, Protvino, RF, Institute for High Energy Physics 24.01.2011 - 27.01.2011 Artamkin I.V. *Colored graphs, Gaussian integrals and stable graph polynomials*, Gorodentsev A.L. *On functorial A_∞-coproduct of combinatorial simplicial chains transferred to itself under barycentric subdivision*, Tyurin N.A. *Специальные лагранжевы сло-ения многообразий Фано и псевдоторические структуры (Special Lagrangian Fibrations of Fano Varieties and Pseudotoric Structures)*,

Feigin E.B. *Systems of correlation functions, coinvariants and the Verlinde algebra*

- *Workshop on Homological Mirror Symmetry and Related Topics*, USA, University of Miami 24.01.2011 - 29.01.2011 Orlov D.O. *D-branes in LG-models, matrix factorizations, and triangulated categories of singularities: properties and relations*

- *Вторая школа-конференция "Алгебры Ли, алгебраические группы и теория инвариантов"(Second School/Conference "Lie Algebras, Algebraic Groups and Invariant Theory")*, Moscow State University, Russia 31.01.2011 - 5.02.2011 Smirnov E.Yu. *Исчисление Шуберта и многогранник Гельфанда-Цетлина (Schubert Calculus and the Gelfand-Zetlin Polytopes)*, Trepalin A.S. *Рациональность фактора проективной плоскости по конечной подгруппе автоморфизмов над полем характеристики 0. (Rationality of the Quotient of the Projective Plane over a Finite Subgroup of Automorphisms over a Field of Characteristic 0)*

- *Complex and Riemannian Geometry Extremal metrics: evolution equations and stability*, Marseille (France). CIRM, Luminy campus 7.02.2011 - 11.02.2011 Verbitsky M.S. *Extremal metrics in quternionic geometry*

- *Frontiers in Complex Dynamics (Celebrating John Milnor's 80th birthday)*, Canada, Banff. The Banff International Research Station 20.02.2011 - 25.02.2011 Timorin V.A. *Partial semiconjugacies between rational functions*

- *Complex and Riemannian Geometry Non-Kahlerian aspects of complex geometry*, Marseille (France). CIRM, Luminy campus 21.02.2011 - 25.02.2011 Verbitsky M.S. *Generalization of Inoue surfaces by Oeljeklaus-Toma and number theory*

- *Instantons in Complex Geometry*, MI RAS, Laboratory of Algebraic Geometry, Moscow, Russia 14.03.2011 - 18.03.2011 Bondal A.I. *Coherent sheaves on minuscule varieties*, Gorchinsky S.O. *Polar Homology*, Kuznetsov A.G. *Instanton bundles on Fano threefolds*, Finkelberg M.V. *Parabolic bundles on P^2, Quiver varieties, and Quantization*

- *Texas Ergodic Theory Workshop*, USA, University of Houston 22.03.2011 - 23.03.2011 Timorin V.A. *Topological cubic polynomials*

- *Ahlfors-Bers Colloquium 2011*, USA, Rice University, TX, Houston 24.03.2011 - 27.03.2011 Timorin V.A. *Partial holomorphic semiconjugacies between rational functions*

- *Homotopy and Non-Commutative Geometry*, Tbilisi, Tbilisi Centre for Mathematical Sciences 28.03.2011 - 1.04.2011 Kaledin D.B. *Topological cyclic homology of an algebra over a finite field*

- *Moduli Spaces (Derived Categories)*, UK, Isaac Newton Institute, Cambridge 4.04.2011 - 15.04.2011 Bondal A.I. *Микровесовые многообразия и их вырождения (Microweight manifolds and their degeneracies)*, Kuznetsov A.G. *Exceptional collections on Grassmannians of classical groups*

- *Geometry of Projective Varieties*, Korea, Korean Institute of Advanced Studies 5.04.2011 - 7.04.2011 Cheltsov I.A. *What we know and what we do not know about Cremona groups?*

- *Международная научная конференция "Ломоносов 2011"(International Research Conference "Lomonosov 2011")*, Moscow State University, Russia 1.04.2011 - 15.04.2011 Trepalin A.S. *Рациональность фактора рациональных поверхностей по конечным группам простого порядка над полем характеристики 0 (Rationality of Quotients of Rational Surfaces over Finite Groups of Prime Order over a Field of Characteristic 0)*

- *Matrix Factorizations*, Germany, University of Bielefeld 6.05.2011 - 8.05.2011 Efimov A.I. *Reconstruction of hypersurface singularity from its triangulated category of singularities*

- *Journées de Géométrie Affine*, Grenoble France, Institute Fourier, Grenoble 9.05.2011 - 10.05.2011 Prokhorov Yu.G. *On finite subgroups of Cremona Group*

- *Two Weeks of Classical Algebraic Geometry*, Italy, Padova, University of Padova 16.05.2011 - 27.05.2011 Kulokov V.S. *On the number of irreducible components of Hurwitz spaces of marked coverings of $\mathbb{P}^1$ On classical Plücker's formulae*

- *Летняя школа-конференция по алгебраической геометрии и комплексному анализу для молодых ученых России (Summer School/Conference in Algebraic Geometry and Complex Analysis for Young Scientists of Russia)* RF, Yaroslavl, YSPU 23.05.2011 - 28/05/2011 Bogomolov F.A. *Универсальные пространства в бирациональной геометрии (Universal Spaces in Birational Geometry)*, Budylin R.Ya. *Рациональный адельный комплекс на поверхности (A Rational Adelic Complex on a Surface)*, Gorchinsky S.O. *Параметрические расширения Пикара-Вессио (Parametric Picard-Vessiot Extensions)*, Elagin A.D. *Эквивариантные векторные расслоения на P^1 и представления колчанов. (Equivariant Vector Bundles on P^1 and Representations of Quivers)* Универсальные пространства в бирациональной геометрии. (Universal Spaces in Birational Geometry) Kuznetsov A.G. *Производные категории в алгебраической геометрии (Derived Categories in Algebraic Geometry)*, Netai I.V. *Алгебры сизигий вложений Сегре (Algebras of Syzygies of Segre Embeddings)*, Soldatenkov S.O. *Гиперкомплексные структуры на группах Ли и голономия связности Обаты на SU(3). (Hypercomplex Structures on Lie groups and Holonomy of the Obata Connection on SU(3))*, Trepalin A.S. *Рациональность фактора поверхностей Дель Пеццо степени 3 и выше по циклическим группам простого порядка над полем характеристики 0. (Rationality of Quotients of Del Pezzo Surfaces of Degree 3 and more over Cyclic Groups of Prime Order over a Field of Characteristic 0)*, Tyurin N.A. *Специальные лагранжевы слоения многообразий Фано и псевдоторические структуры (Special Lagrangian Fibrations of Fano Varieties and Pseudotoric Structures)*, Shramov K.A. *Конечные погруппы в группе Кремоны (Finite Subgroups of the Cremona Group)*

- *Eighteenth Gokova Geometry/Topology Conference*, Turkey, Gokova , National Science Foundation 30.05.2011 - 4.06.2011 Cheltsov I.A. *Subgroups of Cremona groups*

- *Loop spaces, loop groups and loop algebras 2011*, France, Luminy, CIRM. 30.05.2011 - 3.06.2011 Kaledin D.B. *Loop spaces and cyclic K-theory*, Markarian N.S. *Spherical homology of BV and Hycomm algebras*

- *Holomorphic symplectic varieties*, USA, New-York University, Courant Institute 4.06.2011 - 5.06.2011 Verbitsky M.S. *Global Torelli theorem*

for hyperkähler manifolds. Subtwistor metric on the moduli of hyperkähler manifolds and its applications

- *Polynomial Matings*, France, Touoluse, Institut de Mathematiques de Toulouse 8.06.2011 - 11.06.2011 Timorin V.A. *Matings, captures and regluings*

- *Equivariant coherent sheaves and their derived categories*, Poland, Miedzybrodzie Bialskie 13.06.2011 - 17.06.2011 Bondal A.I. *Когерентно-конструктивное соответствие (The Coherent-Constructive Correspondence)*, Elagin A.D. *Equivariant coherent sheaves and their derived categories*

- *Minimal models and extremal rays*, Japan, RIMS, Kyoto University 20.06.2011 - 24.06.2011 Prokhorov Yu.G. *On the classification of singular Fano threefolds*

- *Workshop on moduli of curves and Gromov- Witten Invariants*, France, Grenoble. 20.06.2011 - 8.07.2011 Budylin R.Ya. *Moduli of irreducible representations*

- *Memorial Conference for Maximilian Kreuzer*, Austria, Vienna, Erwin Schrödinger Institute for Mathematical Physics 25.06.2011 - 28.06.2011 Bogomolov F.A. *Strong form of the case*, Efimov A.I. *Quantum cluster algebras and motivic Hall algebras*, Orlov D.O. *D-branes in LG models, matrix factorizations and triangulated categories of singularities: properties and relations*, Przhijalkovskii V.V. *D-branes in LG models, matrix factorizations and triangulated categories of singularities: properties and relations; Why Laurent polynomials*

- *Новые достижения в алгебре и их приложения (Progress in Algebra and Its Applications)*, Schotland, Skai 26.06.2011 - 2.07.2011 Bondal A.I. *Несмешанные базисы и ортогональные разложения алгебры Ли специальных линейных матриц (Unmixed Bases and Orthogonal Decompositions of Lie Algebras of Special Linear Matrices)*

- *Oberseminar Algebraische und Arithmetische Geometrie* Germany, Hanover, Inst. für Algebraische Geometrie 24.03.2011 -04.04.2011 Verbitsky M.S. *An intrinsic volume functional on almost complex*

6-manifolds and nearly Kähler geometry Global Torelli theorem for hyperkähler manifolds and the mapping class group

- *Algebres de Hecke Affines*, France, CIRM 20.06.2011 - 1.07.2011 Finkelberg M.V. *Wreath Macdonald polynomials*

- *Дни арифметики в Москве ("Arithmetic Days"in Moscow)*, Moscow State University, RF 13.06.2011 - 17.06.2011 Zykin A.I. *Asymptotic properties of zeta functions*, Rybakov S.Yu. *Constructible modules over de Rham algebra*

- *Strings and categories*, Austria, Vienna, 28.06.2011 - 1.07.2011 Przhiyalkovsky V. *Landau-Ginzburg models*

- *Seminar of Algebraic Geometry*, Italy, University of Trento 22.06.2011 - 22.06.2011 Cheltsov I.A. *Quotient singularities and Bordiga varieties*

- *The Seventh Congress of Romanian Mathematicians Romania*, Institute of Mathematics, Brashov 29.06.2011 - 5.07.2011 Verbitsky M.S. *Instanton bundles on $\mathbb{C}P^3$ and special holonomies*

- *Mirror Symmetry and Tropical Geometry*, Italy, Chetraro, Austria, University of Vienna Bogomolov F.A. *On rationality of the fields of invariants of linear actions for connected nonsemisimple algebraic groups*, Efimov A.I. *Cohomological Hall algebra and Kac conjecture*, Orlov D.O. *Mirror symmetry, B-branes and strange Arnold duality*

- *4th Workshop on Geometric Methods in Theoretical Physics*, Italy, Triest, SISSA 6.07.2011 - 12.07.2011 Gorodentsev A.L. *Functorial A_∞-coproduct of combinatorial simplicial chains that induces itself under barycentric subdivision*

- *French-Romanian Workshop on Complex Geometry*, Romania, CNRS 7.07.2011 - 9.07.2011 Verbitsky M.S. *Global Torelli theorem for hyperkähler manifolds and the mapping class group*

- *Homological Mirror Symmetry and Category Theory*, Croatia, Split, Austria University of Vienna 11.07.2011 - 15.07.2011 Bogomolov F.A. *Section Conjecture*, Bondal A.I. *Mirror symmetry in toric geometry*, Przhijalkovskii V.V. *Landau-Ginzburg models*, Efimov A.I. *Quantum cluster algebras and motivic Hall algebras*, Verbitsky M.S. *Global Torelli*

theorem for hyperkähler manifolds, Kuznetsov A.G. *Enriques surfaces and Artin-Mumford quartic double solids*, Orlov D.O. *Does full imply faithful?*, Kaledin D.B. *Hochschild-Witt complex*

- *Motives, periods and transcendence*, Austria, ETH Zurich 13.07.2011 - 19.07.2011 Gorchinsky S.O. *Rigidity, torsors and more*

- *3rd Summer Workshop on Algebraic Geometry*, Germany, Tubingen, University of Tubingen 21.07.2011 - 22.07.2011 Cheltsov I.A. *What are higher-dimentional analogies of $D_n, E_6, E_7,$ and E_8 singularities*, Kujumzhijan K.G. *Infinite transitivity and flexibility for affine toric varieties*, Prokhorov Yu.G. *On the classification of singular Fano threefolds*

- *Lie groups and algebraic groups* Germany, Bielefeld, 21.07.2011 - 22.07.2011 Zhgoon V.S. *On complexity of Lagrangian subvarieties in Hamiltonian varieties*

- *50 лет ИППИ РАН (50 Years of IITP RAS)*, Россия, Москва ИППИ РАН 25.07.2011 - 29.07.2011 Timorin V.A., Kiritchenko V.A., Smirnov E.Yu. *Gelfand-Zetlin polytopes and Demazure characters*

- *Finite Dimensional Integrable Systems in Geometry and Mathematical Physics*, Germany, Jena, 26.07.2011 - 29.07.2011 Shevchishin V. *Superitegrable surface metrics admitting one linear and one cubic integral*

- *36th National Conference on Theoretical Physics*, Vietnam, Academy of Sciences 1.08.2011 - 4.08.2011 Tyurin N.A. *Abelian Lagrangian Algebraic Geometry: from Geometric Quantization to Mirror Symmetry*

- *Categories and spectra*, Austria, Vienna 15.08.2011 - 21.08.2011 Przhijalkovskii V.V. *Clusters*

- *Oberwolfach mini-workshop on Newton-Okounkov bodies*, Germany, Obefwolfach Mathematisches Forschungsinstitut Oberwolfach 21.08.2011 - 27.08.2011 Kiritchenko V.A., Timorin V.A. *Convex chains for Schubert varieties*

- *Международная конференция по алгебре и геометрии (International Conference on Algebra and Geometry)*, Russia,

Ekaterinburg, Institute of Mathematic and Mechanic 15.08.2011 - 21.08.2011 Bogomolov F.A. *Замкнутые симметрические дифференциалы на поверхностях; Обратная задача Римана (Closed Symmetric Differentials on Surfaces; The Inverse Riemann Problem)*, Efimov A.I. *Cohomological Hall algebra and Kac conjecture*, Netai I.V. *Алгебры сизигий вложений Сегре (Algebras of Syzygies of Segre Embeddings)*, Trepalin A.S. *On quotients of rational surfaces*, Abramov Ya.V. *Системы результантов (Systems of Resultants)*, Kulikov V.S. *Разложения на множители в конечных группах (Factorizations in finite groups)*, Positselskii L.E. *Абсолютные группы Галуа и их свойства (Absolute Galois Groups and their Quotients)*, Kujumzhijan K.G. *Infinite transitivity of automorphisms groups actions on varieties*, Smirnov E.Yu. *Группы отражений (Groups of reflections)*

- *Seminar on Algebraic Geometry*, USA, Boston, MIT 29.08.2011 - 29.08.2011 Cheltsov I.A. *What are higher-dimensional analogues of $D_n, E_6, E_7,$ and E_8 singularities?*

- *Международная конференция, посвященная 65-летию Ф.А.Богомолова (International Conference in Honor of the 65th Birthday of Fedor Bogomolov)*, Russia, Moscow, MI RAS, Laboratory of Algebraic Geometry 1.09.2011 - 4.09.2011 Amerik E.Yu. *On iteration of algebraic points under a rational self-map*, Verbitsky M.S. *Global Torelli theorem for hyperkähler manifolds*, Kaledin D.B. *Cyclic K-theory*

- *Derived Categories in Algebraic Geometry*, Russia, Moscow, MI RAS, Laboratory of Algebraic Geometry 4.09.2011 - 9.09.2011 Bondal A.I. *Orthogonal decompositions of $sl(n)$ and mutually unbiased bases*, Positselskii L.E. *Matrix factorizations and exotic derived categories Toric Topology and Automorphic Functions*, Russia, Khabarovsk, Institute of Applied Mathematics 5.09.2011 - 10.09.2011 Cheltsov I.A. *Weakly-exceptional quotient singularities*

- *GEOQUANT - 2011*, China, Tianjin, Chern Mathematical Institute 9.09.2011 - 16.09.2011 Gorodentsev A.L. *A_∞-structures and A_∞-coproducts of combinatorial simplicial chains*, Tyurin N.A. *Pseudotoric Structures and Chekanov Tori*

- *Seminar on Algebraic Geometry*, Germany, Free University, Berlin 15.09.2011 Cheltsov I.A. *Cremona groups and the icosahedron*

- *Geometric structures in mathematical physics*, Bulgaria, Sofia University 19.09.2011 - 26.09.2011 Przhijalkovskii V.V. *Laurent polynomials in Mirror Symmetry*, Kaledin D.B.*Cyclic K-theory*

- *Geometric structures on complex manifolds*, Russia, Moscow, MI RAS, Laboratory of algebraic geometry 3.10.2011 - 7.10.2011 Timorin V.A. *Maps that take lines to conics*

- *Moduli spaces and automorphic forms*, France, Lumini, CIRM 10.10.2011 - 14.10.2011 Verbitsky M.S. *Any component of moduli of polarized hyperkähler manifolds is dense in its deformation space*, Kuznetsov A.G. *Enriques surfaces and Artin-Mumford quartic double solids*

- *Complex geometry and uniformisation*, France, Lumini, CIRM 17.10.2011 - 21.10.2011 Verbitsky M.S. *Morse-Novikov cohomology and Kodaira-type embedding theorem for locally conformally Kähler manifolds* ,

- *Глобальные поля (Global Fields)* Russia, Moscow, Poncelet Laboratory 25.10.2011 - 28.10.2011 Budilyn R.Ya. *Adelic Construction of the Chern Class*, Rovinsky M.Z. *Reconstruction of fields from quotients of their absolute Galois groups (after Bogomolov–Tschinkel)*, Amerik E.Yu. *Iteration of algebraic points under a rational self-map*, Rybakov S.Yu. *The groups of points on abelian surfaces over finite fields*

- *Ежегодная мемориальная конференция памяти А.Н.Тюрина (Annual Conference in Memory of A. N. Tyurin)*, Russia, Moscow, MI RAS 25.10.2011 Kulikov V.S. *Полугруппы накрытий (Semigroups of Coverings)*, Markarian N.S. *Многообразные гомологии инварианты гладких многообразий (Homology Manifolds and Invariants of Smooth Manifolds)*

- *Curves and categories in geometry and physics*, Japan, Tokio, IPMU 1.11.2011 - 15.11.2011 Shramov K.A. *On tetragonal construction of R.Donaldi*

- *Algebraic geometry conference*, Thailand, Bangkok, Chulalongkorn University 19.12.2011 - 23.12.2011 Verbitsky M.S. *Global Torelli theorem for hyperkähler manifolds*

- *Automorphisms of algebraic varieties – Dynamics and Arithmetic*, Japan, Nagoya Univ. 19.12.2011 - 23.12.2011 Amerik E.Yu. *Iterations of algebraic points under a rational self-map*

- *Однодневная конференция, посвященная памяти В. А. Исковских (One-day Conference in Honor of V. A. Iskovskih)*, Russia, Moscow, MI RAS 29.12.2011 Cheltsov I.A. *Перестройки и зеркальная двойственность (Rearrangements and Mirror Symmetry)*

- *American Math Society Meeting, Special Session on Rational points on varieties*, USA, Boston 04.01.2012 - 07.01.2012 Bogomolov F.A. *Elliptic division and unramified correspondence*

- *Christmas meetings with Pierre Deligne, Рождественские встречи фонда "Династия"Независимому Московскому университету 20 лет*, Russia, Moscow, Independent University 08.01.2012 - 10.01.2012 Kujumzhijan K.G. *Varieties with infinitely transitive action of the group of Special Automorphisms*, Elagin A.D. *Descent constructions for derived categories*, Zhgoon V.S. *On the complexity of invariant Lagrangian subvarieties in symplectic varieties with reductive group action*, Feigin E.B. *Вырожденные представления и многообразия флагов типа A (Degenerate Representations and Flag Varieties of Type A)*, Timorin V.A. *Matings, captures and regluings*, Kiritchenko V.A. *Divided difference operators on polytopes*, Efimov A.I. *Квантовые кластерные переменные и исчезающие циклы (Quantum Cluster Variables and Vanishing Cycles)*, Positselskii L.E. *Exotic derived categories of matrix factorizations*, Zhgoon V.S. *On the complexity of invariant Lagrangian subvarieties in symplectic varieties with reductive group action*

- *MS Seminar (Mathematics - String Theory)*, Japan, Tokyo, 19.01.2012 - 24.01.2012 Verbitsky M.S. *Trihyperkähler reduction, Twistor correspondence for hyperkaehler manifolds and the space of instantons, Trisymplectic manifolds*

- *Special Seminar IPMU*, Japan, Tokyo, University Tokyo 20.01.2012 - 20.01.2012 Verbitsky M.S. *Global Torelli theorem for hyperkähler manifolds*

- *Conference on Homological Mirror Symmetry*, USA, Miami, Miami University 23.01.2012 - 27.01.2012 Przhijalkovskii V.V. *Weak Landau-Ginzburg models, toric degenerations and multi-potentials*, Kaledin D.B. *Cyclic K-theory*, Kuznetsov A.G. *Categorical resolutions of singularities*

- *Classical and Quantum Integrable Systems*, Russia, Dubna, Joint Institute for Nuclear Research 23.01.2012 - 27.01.2012 Feigin E.B. *Abelianized representations of simple Lie algebras*

- *International School on TQFT, Langlands and Mirror Symmetry*, Mexico, Huatulko 31.01.2012- 04.02.2012 Kujumzhijan K.G. *Varieties with infinitely transitive action of the group of Special Automorphisms*, Przhijalkovskii V.V. *Sarkisov flow*

- *Swiss-French workshop on algebraic geometry*, Switzerland, Bazel University 20.02.2012-24.02.2012 Kuyumzhiyan K. *Varieties with infinitely transitive action of the group of Special Automorphisms*

- *Геометрическая теория представлений, Russian-British winter school on Mc Kay Correspondence*, Great Britain, Worvik University 20.02.2012-25.02.2012 Smirnov E.Yu. *Schubert calculus and Gelfand-Zetlin polytopes*

- *Российско-германская конференция по многомерному комплексному анализу (Russian-German Conference on Multivariable Complex Analysis)*, Russia, Moscow, MI RAS 27.02.2012- 02.03.2012 Verbitsky M.S. *Trisympletic manifolds*, Gorchinsky S.O. *Polar homology*

- *Affine Algebraic Geometry Meeting*, March 1-4, 2012, Osaka, Japan Prokhorov Yu.G. *Subgroups of Cremona groups*

- *Enveloping algebras and geometric representation theory*, Germany, Oberwolfah 04.03.2012-10.03.2012 Feigin E.B., Finkelberg M.V. *Degenerate flag varieties*

- *Workshop on Cluster Algebras and Combinatorics*, Austria, Gras 08.03.2012-10.03.2012 Smirnov E.Yu. *Shubert polynomials and related combinatorial objects*

- *Advances in hyperkähler and holomorphic symplectic geometry*, Canada, Alberta, BIRS 13.03.2012- 17.03.2012 Verbitsky M.S. *Trisympletic manifolds*

- *Noncommutative Algebraic Geometry and its Applications to Physics*, Netherlands, Leiden, Lorenz Centre 19.03.2012- 23.03.2012 Kaledin D.B. *Hochschild-Witt complex*, Kuznetsov A.G. *Categorical resolutions of singularities*

- *Motivic structures on quantum cohomology: progress reports*, Germany, Bonn 23.03.2012-28.03.2012 Przhijalkovskii V.V. *Mirror symmetry for Fano threefolds,*

- *Арифметические дни (Days of Arithmetic)*, Russia, Moscow, Laboratoty of Algebraic Geometry 05.04.2012-06.04.2012 Budylin R.Ya. *Adelic Bloch formula for Chern classes*

- *Интегрируемость в топологической теории поля (Intergrability in Topological Field Theory)*, Germany, Bonn, Institute Hausdorff 16.04.2012-20.04.2012 Bondal A.I. *Стандартная модель теории поля и зеркальная симметрия для микровесовых многообразий (Standard Model of Field Theory and Mirror Symmetry for Microweight Manifolds)*

- *Birational and affine geometry*, Moscow, Russia, MI RAS, Laboratory of Algebraic Geometry 23.04.2012-27.04.2012 Amerik E.Yu. *Remarks on self-maps with fixed points over a number field*, Kuznetsov A.G. *Categorical resolutions of singularities*

- *Lie Theory and quantum analogues*, France, Marseille, CIRM 23.04.2012-27.04.2012 Feigin E.B. *PBW degeneration*

- *Homologie des foncteurs et applications*, France, Nant University 23.04.2012-27.04.2012 Kaledin D.B. *Hochschild-Witt complex*

- *ACC for minimal log discrepancies and termination of flips*, USA, California, Paolo Alto, American Mathematics Institute 14.05.2012-18.05.2012 Prokhorov Yu.G. *BAB and subgroups of Cremona groups*

- *Spring School on Algebraic Microlocal Analysis*, Math Department of Nord-East University 14.05.2012-26.05.2012 Kaledin D.B. *Hochschild-Witt complex*

- *Cluster Algebras, Knots, and Topological Recursion, 3rd Workshop on Combinatorics of Moduli Spaces* Moscow, Russia, HSE 28.05.2012-02.06.2012 Smirnov E.Yu. *Schubert polynomials, plane partitions and associahedra*, Bondal A.I. *Noncommutative blow-downs, representation theory and perverse sheaves*

- *Characteristic p and p-adic geometry*, Germany, Mainz, Mainz University 04.06.2012-08.06.2012 Kaledin D.B. *Hochschild-Witt complex*

- *Algebra and Geometry (Askoldfest)*, Russia, Moscow, Independent University, Laboratory of Algebraic Geometry 04.06.2012-09.06.2012 Abramov Ya.V. *Systems of resultants*, Feigin E.B. *Degenerate flag varieties*, Kujumzhijan K.G. *Simple G-modules with normal closures of maximal torus orbits*, Smirnov E.Yu. *Schubert polynomials and Catalan-Hankel determinants*

- *Holomophic foliations and complex dynamics*, Russia, Moscow, Independent University 11/06/2012-15/06/2012 Verbitsky M.S. *Stable bundles on non-Kähler manifolds with transversally Kähler foliations*, Timorin V.A. *Matings, captures and regluings*

- *Summer School and Workshop on Lie Theory and Representation Theory*, China, Shanghai, University of Shanghai 09.06.2012-29.06.2012 Finkelberg M.V. *Degenerate flag varieties*

- *International Conference on Essential Dimension and Cremona Groups*, China, Tianjin 11.06.2012 - 15.06.2012 Przhijalkovskii V.V. *Mirror symmetry for Fano threefolds: toric degenerations, uniqueness and non-uniqueness*, Smirnov E.Yu. *Schubert calculus and Gelfand-Zetlin polytopes*, Prokhorov Yu.G. *On elements of order two in the space Cremona group*

- *Géométrie Algébrique en Liberté*, France, Grenoble, University Grenoble I 18.06.2012 - 22.06.2012 Zykin A.I. *Propriétés asymptotiques des fonctions zéta* 1

- *Algebraic Geometry day*, China, Peking 16.06.2012 - 19.06.2012 Przhijalkovskii V.V. *Projecting Fanos in the Mirror*

- *Integrable systems and quantum symmetries - XX*, Czech Republic, Prague 17.06.2012 - 23.06.2012 Tyurin N.A. *Pseudotoric structures and exotic Chekanov tori,*

- *Birational Geometry day*, Korea, Pohang 23.06.2012 - 28.06.2012 Przhijalkovskii V.V. *Projecting Fanos in the Mirror*

- *Алгебры Ли, алгебраические группы и теория инвариантов (Lie Algebras, Algebraic Groups and Invariant Theory)*, Russia, Tolyatti, Tolyatti University 25.06.2012 - 29.06.2012 Kuyumzhijan K. *Нормальность замыканий орбит максимального тора в неприводимых представлениях простых алгебраических групп (On Normality of Closures of Maximal Torus Orbits in Irreducible Representations of Simple Algebraic Groups)*, Netai I.V. *A_∞-алгебры сизигий вложений Сегре (A_∞-algebras of Syzygies of Segre Embeddings)*, Trepalin A.S. *Об унирациональности расслоений на коники. (On unirationality of conic bundles)*, Smirnov E.Yu. *Исчисление Шуберта, модули Демазюра и многогранники Гельфанда-Цетлина (Schubert Calculus, Demazure Modules and Gelfand-Zetlin Polytopes)*

- *Symmetric spaces and their generalizations - II*, Italy, Leviko Term, University of Trento 25.06.2012 - 29.06.2012 Zhgoon V.S. *On the complexity of the invariant Lagrangian subvarieties in the symplectic varieties*, Feigin E.B. *Degenerate flag varieties and quiver Grassmannians*

- *Interactions of Birational Geometry with other fields*, Great Britain, Durham, London Mathematical Associates 02.07.2012 - 06.07.2012 Amerik E.Yu. *Iteration of algebraic points under a rational self-map*, Prokhorov Yu.G. *Subgroups of Cremona groups and Fano varieties*, Bondal A.I. *Noncommutative blow-down representation theory*

- *Algebraic geometry and higher categorical structures*, CIRM, Universite de Marseille II, Luminy, France 02.07.2012 - 06.07.2012 Kaledin D.B. *Hochschild-Witt homology*

- *Interactions of birational geometry with other fields*, London Mathematical Society, Durham, UK 02.07.2012-07.07.2012 Prokhorov Yu. G. *Subgroups of Cremona groups and Fano varieties*

- *5th Workshop on Geometric Methods in Theoretical Physics*, Italy, Triest, SISSA, 03.07.2012 - 07.07.2012 Gorodentsev A.L. *Mukai lattices in geometry, in arithmetics and in integrable systems*

- *Геометрические методы в физике и теории управления (Geometrical Methods in Physics and Control Theory)*, Odessa Ukrain 15.07.2012 - 25.07.2012 Rosly A.A. *Полярные гомологии и проективная геометрия (Polar homology and projective geometry*

- *Schubert calculus*, Osaka, Japan Osaka University 16.07.2012-27.07.2012 Kuyumzhiyan K.G. *Simple G-modules with normal closures of maximal torus orbits*

- *The eighteenth International Conference on Difference Equations and Applications*, Spain, Barselona 22.07.2012 - 26.07.2012 Timorin V.A. *Regluing and topological models of rational functions*

- *Lie Groups and Algebraic Groups*, Germany, Bielefeld 23.07.2012 - 25.07. 2012 Zhgoon V.S. *On generation of the little Weyl group by reflections and products of orthogonal reflections*

- *Schubert calculus*, Osaka City University, Japan 23.07.2012-27.07.2012 Kiritchenko V.A. *Convex geometric Demazure operators*

- *Birational Geometry and Derived Categories*, Vienna, Austria 01.08.2012 - 06.08.2012 Prokhorov Yu.G. *Subgroups of Cremona groups and Fano varieties*, Orlov D.O. *Uniqueness of enhancements of triangulated categories*, Przhijalkovskii V.V. *Projecting Fanos in the mirror*, Efimov A.I. *Homotopy finiteness for derived categories of coherent sheaves and categories of matrix factorizations*, Cheltsov I.A. *Projecting Fanos in a nutshell*

- *7th Pacific Rim Complex Geometry Conference*, Japan, Kyoto 6.08.2012 - 10.08.2012 Verbitsky M.S. *Global Torelli theorem for hyperkähler manifolds*

- *Workshop and International Conference of Representations of Algebras*, Bielefeld University, Germany 08.08.2012 - 17.08.2012 Orlov D.O. *Landau-Ginzburg Models, B-branes and Mirror Symmetry*, 3 lectures

- *Seminar of the Department of Mathematics and Statistics*, USA, Miami 24.08.2012 - 24.08.2012 Verbitsky M.S. *Holomorphic connections on the space of quasilines*

- *INdAM Conference New Trends in Holomorphic Dynamics*, Italy, Cortona 2.09.2012 - 7.09.2012 Timorin V.A. *The main cubioid*

- *Komplexe Analysis*, 2.09.2012 - 8.09.2012 Germany, Oberwolfach Verbitsky M.S. *Rational curves on non-Kahler manifolds*

- *Seminar on Algebra, Geometry and Physics*, 9.10.2012 - 9.10.2012 Germany, Bonn Verbitsky M.S. *Trisymplectic manifolds and the moduli of instantons*

- *Relation of String Theory to Gauge Theories and Moduli Problems of Branes*, MI RAS , Moscow, Russia Laboratory of Algebraic Geometry 10.09.2012 - 14.09.2012 Kuznetsov A.G. *Homological Projective Duality*, Efimov A.I. *Homotopy finiteness of the derived categories of coherent sheaves*, Fonarev A.V. *Minimal Lefschetz decompositions for Grassmannians*

- *Комплексная геометрия и голоморфные слоения (Complex Geometry and Holomorphic Bundles)*, Russia, Moscow, HSE, Laboratory of Algebraic Geometry, 17.09.2012-21.09.2012 Amerik E.Yu. *Бирациональная геометрия слоений (Birational Geometry of Fiber Bundles)*, Vedrbitsky M.S. *Locally conformally Kähler metrics on Kato surfaces, A characterization of Inoue surfaces*, Soldatenkov A.O. *Codimension one foliations on complex tori (after Marco Brunella); KAHLER MANIFOLDS WITH SPLIT TANGENT BUNDLE*

- *Lie algebras, torsors and cohomological invariants*, Banff International Research Station, Canada 29.09.2012 - 07.10.2012 Kiritchenko V.A. *Schubert calculus for equivariant algebraic cobordism*

- *Homological Projective Duality and Noncommutative Geometry*, Warwick University, UK 08.10.2012 - 13.10.2012 Kaledin D.B. *Hochschild-Witt complex* (at Oxford University), Trepalin A.S. *Rationality of the quotient of* Pro^2 *by finite group of automorphisms over arbitrary field of characteristic zero*, Efimov A.I. *Homotopy finiteness of DG categories from algebraic geometry*, Kuznetsov A.G. *Categorical resolutions of singularities*, Netai I.V. *On* A_∞ *algebras of highest weight orbits*

- *Chinese-Russian conference on Number Theory*, Moscow, MI RAS, Laboratory of Algebraic Geometry, 08.10.2012 - 12.10.2012 Kulikov V.S. *Covering semigroups and irreducible components of Hurwitz spaces*

- *Четвертое российско-армянское совещание по математической физике, комплексному анализу и смежным вопросам (Fourth Russian-Armenian Conference on Mathematical Physics, Complex Analysis and Related Questions)*, Siberian Federal University, Krasnoyarsk, Russia 10.10.2012-16.10.2012 Kulikov V.S. *Полугруппы накрытий (Semigroups of Coverings)*

- *Feuilletages et équations différentielles complexes*, France, Lumini, CIRM 15.10.2012 -19.10. 2012 Amerik E.Yu. *Remarks on lagrangian fibrations of holomorphic symplectic manifolds*

- *Algebraic and Differential Geometry of Andrei Tyurin*, Moscow, MI RAS, Laboratory of Algebraic Geometry, 24.10.2012 - 26.10.2012 Prokhorov Yu.G. *On elements of finite order in the three-dimensional Cremona group*, Rosly A.A. *Усложним и запутаем (Some like it complex and knotted)*, Kuznetsov A.G. *Heights of exceptional collections and Hochschild cohomology of quasiphantoms"("Высоты исключительных наборов и гогомологии Хохшильда квазифантомов")*, Gorchinsky S.O. *Фантомные категории и теорема Меркурьева-Суслина (Phantom Categories and the Merkuriev-Suslin Theorem)*

- *Hyper-Kähler Geometry*, Simons Center for Geometry and Physics State University of New York, Stony Brook, NY, USA, 29.10.2012 - 02.11.2012 Kaledin D.B. *A canonical hyperkähler metric on the cotangent bundle*

- *Groups of Automorphisms in Birational and Affine Geometry,* 28.10.2012—03.11.2012 Shramov K.A. *Jordan property for Cremona groups*

- *Birational and Affine Geometry,* CIRM, Italy 29.10.2012-03.11.2012 Kuyumzhiyan K.G. *Unirationality and existence of infinitely transitive models*

E   Olympiad problems

Below, samples of the 2012 school and student olympiad problems are given.

E.1   First stage

At the first stage, each grade gets ten problems, and only the answer is required to be given. The answers are checked automatically.

1. An ant goes from a point on the surface of a regular octahedron with edge 2 to the opposite point. What is the possible minimal distance?

   Answer: 7

2. How many non self-intersecting broken lines can be formed out of the edges of an octahedron?

   Answer: 75

3. What is the minimal number of plumbum balls (not necessarily of the same radius) sufficient to totally obstruct emanation from a point source?

   Answer: 4

4. A closed broken line consists of 203 segments no two of which belong to the same straight line. What is the maximal possible points of self-intersection of this broken line?

   Answer: 20300

5. Find the maximal number of consistent inequalities among the following 6:

$$x < y^2 - z^2, \quad -x < y^2 - z^2,$$
$$y < z^2 - x^2, \quad -y < z^2 - x^2,$$
$$z < x^2 - y^2, \quad -z < x^2 - y^2.$$

Answer: 4

6. For each of the numbers $a_n = 19 \cdot 8^n + 17$, $n = 1, 2, \ldots$, one writes out its minimal prime factor. What is the maximal number written?

Answer: 13

7. Find the side of the minimal integral square whose vertices can be posed on two circles of integral radii touching one another internally.

Answer: 6; the radii of the circles are 3 and 5, respectively

8. Each boy in a class is friendly to 3 girls, while each girl is friendly to 2 boys. There are 12 two-person tables in the class and 16 A-grade students. How many students are there in the class?

Answer: 20

9. Andrei runs faster than Stepa, but slower than Dima. The three started to run together from the same point of a circular running path in the same direction and stopped at the moment when all three were at the same point. During this time, Dima outran Stepa 13 times. What is the total number of times one of them outran another one (not taking the first and the last moment into account)?

Answer: 25

10. A parabola on the plane is the graph of a quadratic function in some coordinate system. What is the maximal number of parts into which 2 parabolas split the plane?

Answer: 7

E.2 Second stage

Six problems were given to each grade at the second stage of the olympiad, with complete solutions required to be written down. The works are collected and checked by the faculty.

1. Find all the pairs of relatively prime positive integer numbers a, b such that $2a^2 + 3b^2$ is divisible by $2a + 3b$.

2. Find the maximal number of parts into which 10 graphs of quadratic functions $y = ax^2 + bx + c$, $a \neq 0$ can split the plane.

3. For which value of the parameter a the graph of the polynomial $x^4 - 6x^3 + 12x^2 + ax$ is symmetric with respect to the line $x = c$ for some value of the constant c?

4. Four points not belonging to the same plane, all of whose coordinates are divisible by 3 are chosen. What is the minimal number of integral points with all even coordinates contained in the tetrahedron with vertices at the chosen points? (Here "contained" means "belonging to either the interior, or the faces, or the edges, or the vertices".)

5. The diagonal AC splits a circumscribed quadrangle $ABCD$ into two similar, but not equal triangles. What can be the length of AC provided the edge AB has length 5, and the edge CD has length 10?

6. One of the vertices of a regular $2n$-gon is marked with 1. For a given marking of the rest vertices with the numbers $2, 3, \ldots, 2n$, put $+$ on an edge of the $2n$-gon if the number at the end of the edge (in the clockwise direction) is greater than that in the beginning, and put $-$ otherwise. Prove that the absolute value of the number of markings of the vertices of the $2n$-gon with the numbers $2, 3, \ldots, 2n$ having even number of pluses on the edges and those having odd number of pluses coincides with the number of markings with alternating pluses and minuses (a) for $n = 3$; (b) for $n = 4$; (c) for arbitrary n.

E.3 Student olympiad problems 2012

1. Let us define a sequence of polynomials $g_n(x)$ in the following way. Set $g_0(x) = 1$, and define the polynomial $g_{n+1}(x)$ as the expression

$(x + x^{-1})g_n(x)$, in which the term with x^{-1} is omitted. For example, $g_1(x) = x$, $g_2(x) = 1 + x^2$ etc. Find $g_{15}(0)$ and $g_{16}(0)$.

2. Compute the integral

$$\int e^{x^2+y^2-u^2-v^2}\,dx\,dy\,du\,dv.$$

over the ball of radius R centered at 0 in the space $\mathbb{R}^4$.

3. Find the smallest number $k > 1$ with the following property: every group acting non-trivially on a set with four elements contains a normal subgroup of index $\leq k$. A group action is said to be *non-trivial* if not all elements of the group act as the identity transformation.

4. Find the smallest number of proper subspaces of the space $\mathbb{F}_2^3$, whose union coincides with the entire space. Here $\mathbb{F}_2$ denotes the field with two elements.

5. Find at least one polynomial $u(x, y)$ with the following properties:

$$u_x + 2xu_y = 0, \quad u(0,0) = 1, \quad u(0,1) = u(0,2) = u(0,3) = 0.$$

6. Given two convex polygons in the plane, is it always true that any homeomorphism between their interiors extends to a homeomorphism of the closed polygons? Rigorously justify your answer.

7. A point of mass m slides with zero initial speed along a frictionless inclined plane, starting at height h. The inclined plane connects to a vertical loop of radius R. 1) What is the smallest value h_0 of the initial height, for which the point can hold on the loop i.e. do not drop from it? 2) The same question in the case, where there is friction. The friction coefficient is equal to μ.

F   Written Ph.D. admission examination 2012

Below, the reader will find the list of the problems given in the entrance exam to the PhD program (exam duration 5 hours) in 2012. The exams is aimed at checking the general mathematical background of the applicant. More specific questions are asked during the oral examination.

1: Let f be a continuous function on the ray $[0, +\infty)$ such that f is differentiable on $(0, +\infty)$, its derivative strictly increases, and $f(0) = 0$. Prove that $g = f(x)/x$ also strictly increases on $(0, +\infty)$.

2: For which n does there exist an $n \times n$ matrix A with real coefficients satisfying the equation
$$A^2 + A + 7E = 0?$$
Here E denotes the identity $n \times n$ matrix.

3: Find the sum of the series
$$\sum_{n=1}^{\infty} \frac{\sin n}{n}.$$

4: How many automorphisms does the group $\mathbb{Z}/5\mathbb{Z} \oplus \mathbb{Z}/5\mathbb{Z}$ have?

5: A function is continuous in the closed unit disk $\{|z| \leq 1\}$ and is holomorphic in the interior of the disk. Can the image of the boundary of the disk be equal to the union of the unit circle $\{|z| = 1\}$ with the interval $[1, 2]$?

6: Show that there are no simple groups of order 30.

7: (a) Let X denote the union of two disjoint circles, and $\mathbb{T}$ a two-dimensional torus (i.e. the direct product of two circles). Show that there are no continuous maps $f : X \to \mathbb{T}$ and $g : \mathbb{T} \to X$ such that $g \circ f$ is the identity map on X.

(b) Will the statement of part (a) remain true if the union of two disjoint circles is replaced by the figure 8 (i.e. by the union of two circles intersecting at one point)?