Talks

1. **APTEKAREV Alexander** *Keldysh Institute of Applied Mathematics of Russian Academy of Sciences*

   Title: Random matrices ensembles and multiple orthogonal polynomials

   Abstract: Let $\mu(x) := (\mu_1(x), \dots, \mu_d(x))$ be a vector of positive measures. For a given multiindex $n = (n_1, \dots, n_d)$ we consider a polynomial $P_n(x)$ of degree $|n| := n_1 + \ldots + n_p$, which satisfies n_j orthogonality relations to the degrees of the scalar variable x with respect to the measure μ_j, $j = 1, \dots, p$. Such polynomials always exist and they are called multiple orthogonal polynomials. For $p = 1$ we have usual orthogonal polynomials. We discuss several examples of ensembles of random matrices related to the multiple orthogonal polynomials (namely: random matrix model with external source, two matrix model and normal matrix model). An application to the Brownian bridges will be highlighted.

   Time and Venue: Nov. 8 (Wed.) 9:30-10:20, Ding Shisun Lecture Theater

2. **BEZRODNYKH Sergei** *Federal Research Center "Computer Science and Control" of Russian Academy of Sciences*

   Title: Multiple hypergeometric functions and applications

   Abstract: A wide class of hypergeometric functions in several variables is defined with the help of the Horn series, which has the form:

   $$\Phi^{(N)}(\mathbf{z}) = \sum\nolimits_{\mathbf{k}\in\mathbb{Z}^N} \Lambda(\mathbf{k})\mathbf{z}^{\mathbf{k}},$$

   here $\mathbf{k} = (k_1, \dots, k_N)$ is the multi-indices, $\mathbf{z} = (z_1, \dots, z_N) \in \mathbb{C}^N$, $\mathbf{z}^{\mathbf{k}} := z_1^{k_1} \cdots z_N^{k_N}$, and the coefficients $\Lambda(\mathbf{k})$ are such that the ratio of any two adjacent is a rational function of the components of the summation index $k_1, \dots, k_N$. In other words, for all $j = \overline{1, N}$ the relations are fulfilled: $\Lambda(\mathbf{k} + \mathbf{e}_j)/\Lambda(\mathbf{k}) = P_j(\mathbf{k})/Q_j(\mathbf{k})$, $j = \overline{1, N}$, where P_j and Q_j are some polynomials in the N variables $k_1, \dots, k_N$ and $\mathbf{e}_j = (0, \dots, 1, \dots, 0)$ denote the vectors with jth component equal to 1 and the others equal to 0. The Lauricella function $F_D^{(N)}$, which occurs in numerous applications, is a vivid example of the multiple hypergeometric functions $\Phi^{(N)}$. Using the example of the function $F_D^{(N)}$, in the presentation we describe an approach to solving the analytic continuation problem of the Horn hypergeometric series.

   The Schwarz — Christoffel integral gives an analytical representation for a conformal mapping of a half–plane onto a simply connected domain bounded by a polygonal contour. The main difficulty for the practical application of the integral lies in the need to find unknown parameters entering the integrand. We demonstrate that the solution to the parameter problem of the Schwartz — Christoffel integral can be reduced to the issue of the efficient computation of the hypergeometric Lauricella function $F_D^{(N)}$, and propose an algorithm for such computation based on the obtained formulas of the analytic continuation of this function. We also provide examples of the conformal mapping computation of complex–shaped polygons that occur in applications.

   Time and Venue: Nov. 10 (Fri.) 10:50-11:40, Ding Shisun Lecture Theater

3. **BONDAL Alexey** *Steklov Mathematical Institute of Russian Academy of Sciences*

   Title: Derived categories of complex-analytic manifolds

   Abstract: We discuss how to define Chern and Bott-Chern classes of coherent sheaves on smooth compact complex-analytic manifolds. To this end we consider the derived categories of dbar-superconnections and state the theorem that the homotopy category of those is equivalent to the derived category of complexes of sheaves with coherent cohomology. We outline how this approach allows to look algebraically on the problem of describing complex-analytic manifolds which are not algebraic varieties.

   Time and Venue: Nov. 10 (Fri.) 11:50-12:40, Ding Shisun Lecture Theater

4. **BRAV Christopher** *Moscow Institute of Physics and Technology*

   Title: Adelic decompositions of quasi-coherent sheaves in solid algebraic geometry

   Abstract: We give an introduction to solid algebraic geometry, in the sense of Clausen-Scholze, a refinement of classical algebraic geometry built on spectra of solid rings, a certain category of "topological" rings including classical adic-like topological algebras. We show the additional locality afforded by working with a larger collection of test spectra leads to a new construction of adelic decompositions of quasi-coherent sheaves. This is joint work Grigory Konovalov.

   Time and Venue: Nov. 7 (Tue.) 17:05-17:50, Ding Shisun Lecture Theater

5. **DYNNIKOV Ivan** *Steklov Mathematical Institute of Russian Academy of Sciences*

   Title: Rectangular diagrams of links, surfaces and foliations

   Abstract: Rectangular diagrams are a specific way to represent one- and two-dimensional objects in the three-sphere. They appear to have a strong connection with contact topology, and nice combinatorial properties, which make them useful for solving algorithmic problems of knot theory. In particular, they allow to construct a particularly simple algorithm for recognizing the unknot and to solve the problem of algorithmic classification of Legendrian links. By using the formalism of rectangular diagrams one can represent explicitly such a complicated object as a taut finite depth foliation in a link complement. This sounds promising for further applications.

   Time and Venue: Nov. 9 (Thu.) 14:55-15:40, Ding Shisun Lecture Theater

6. **FANG Bohan** *Peking University*

   Title: Oscillatory integrals in mirror symmetry

   Abstract: I will describe, by examples, the oscillatory and period integrals on the B-side of mirror symmetry. They correspond to Gromov-Witten primary and descendant invariants of Gamma-modified twisted Chern classes of the mirror coherent sheaves. The cycles for integration correspond to these mirror sheaves by homological mirror symmetry, and one may obtain higher genus invariants if using correct higher genus B-model integrands. I will also describe some applications to Gamma conjectures.

   Time and Venue: Nov. 7 (Tue.) 14:00-14:45, Ding Shisun Lecture Theater

7. **FU Baohua** *Academy of Mathematics and Systems Science, Chinese Academy of Sciences*

   Title: Geometry of special nilpotent orbits

   Abstract: Special nilpotent orbits play a key role in representation theory, but their geometry is little understood. I'll first report a joint work with Yongbin Ruan and Yaoxiong Wenproposing a mirror symmetry conjecture for special nilpotent orbits and then a joint work with Daniel Juteau, Paul Levy and Eric Sommers on the proof ofsliced version of Lusztig's conjecture on special pieces.

   Time and Venue: Nov. 8 (Wed.) 10:50-11:40, Ding Shisun Lecture Theater

8. **GORCHINSKIY Sergey** *Steklov Mathematical Institute of Russian Academy of Sciences*

   Title: Higher-dimensional Contou-Carrère symbol

   Abstract: The talk is based on a series of common works with Denis Osipov. Contou-Carrère symbol in dimension n is a way to construct an invertible element of an arbitrary commutative ring A from $n+1$ Laurent series in n variables over A. This construction arises when considering families of n-dimensional algebraic varieties and chains of irreducible subvarieties on them. The higher-dimensional Contou-Carrère symbol possesses a number of fundamental properties, notably, a higher-dimensional reciprocity law, which implies basically all known reciprocity laws. In our survey, we will discuss these phenomena starting from the Weil reciprocity law on a curve.

   Time and Venue: Nov. 10 (Fri.) 16:10-16:55, Ding Shisun Lecture Theater

9. **JIANG Renjin** *Capital Normal University*

   Title: Riesz transform and elliptic boundary value problem on exterior domains

   Abstract: Riesz transform and elliptic boundary value problem on bounded domains have been well understood. However, not much has been known for the case of exterior domain. In this talk, we report some recent progress in this direction. Briefly speaking, we give an almost complete solution to this problem, which also confirms some conjectures in this direction.

   Time and Venue: Nov. 7 (Tue.) 14:00-14:45, Siyuan Lecture Hall

10. **KOROBKOV M.V.** *Fudan University, Sobolev Institute of Mathematics*

    Title: Classical Leray Problems on Steady–State Navier–Stokes system: recent advances and new perspectives

    Abstract: In recent years, using the geometric and real analysis methods, essential progress has been achieved in some classical Leray's problems on stationary motions of viscous incompressible fluid: the existence of solutions to a boundary value problem in a bounded plane and three-dimensional axisymmetric domains under the necessary and sufficient condition of zero total flux; the uniqueness of the solutions to the plane flow around an obstacle problem in the class of all D-solutions, the nontriviality of the Leray solutions (obtained by the "invading domains" method) and their convergence to a given limit at low Reynolds numbers; and, more generally, the existence and properties of D-solutions to the boundary

value problem in exterior domains in the plane and three-dimensional axisymmetric case, etc. A review of these advances and methods will be the focus of the talk. Most of the reviewed results were obtained in our joint articles with Konstantin Pileckas, Remigio Russo, Xiao Ren, and Julien Guillod, see, e.g., the recent survey paper http://dx.doi.org/10.1007/s00021-023-00792-w J. Math. Fluid Mech. **25** (55) (2023).

Time and Venue: Nov. 6 (Mon.) 17:05-17:50 Siyuan Lecture Hall

11. **KUDRYAVTSEVA Elena** *Lomonosov Moscow State University*

Title: Algebraic Morse functions and realizability of planar arrangements of ovals as algebraic curves

Abstract: The talk is devoted to a problem related to Hilbert's 16th oval problem. We show that any arrangement of ovals in the plane can be realized (up to isotopy) as an algebraic curve of degree 2ℓ, where ℓ is the number of ovals. Moreover, there exists a realizing polynomial of the form $|P|^2 - |Q|^2$, for some coprime polynomials $P, Q \in \mathbb{C}[z]$ of degrees $\ell = \deg P > \deg Q$, whose roots together form an ℓ-point configuration in the plane. Moreover, the degree 2ℓ of the curve is the best for polynomials of this form $|P|^2 - |Q|^2$, i.e., for any arrangement of ovals, it cannot be reduced while preserving this form of the realizing polynomial.

Thus, we get a 2ℓ-parameter family of algebraic functions $F = |P/Q|^2$ (parametrized by ℓ-point configuration in the plane) realizing the given arrangement of ℓ ovals as its level line $\{F = \text{const}\}$. Almost all of these functions are Morse. All these Morse functions are minimal in the sense that they have the minimal number of critical points (equal to 2ℓ) over all Morse functions on the 2-sphere realizing the given arrangement of ovals. We prove that this 2ℓ-parameter family has the same topology as the space of all minimal Morse functions on the 2-sphere realizing the given arrangement of ovals, equipped with C^∞-topology.

We also give a positive answer to a question by V.I. Arnold about realizability of Morse functions on the 2-sphere by algebraic functions. Moreover, we extend this to all smooth functions (not necessarily Morse). Namely, we prove that any smooth function F with k critical points on the 2-sphere is fibrewise equivalent to a function $|P/Q|^2$, where $\max\{1, k-2\} \geq \deg P > \deg Q$ and all critical values of P/Q are real and non-negative. If F has exactly 3 critical values (thus, F corresponds to a dessin d'enfant on S^2), then our function P/Q is a Belyi map (i.e., a non-constant holomorphic map $\overline{\mathbb{C}} \to \overline{\mathbb{C}}$ that is unramified away from $\{0, 1, \infty\}$) corresponding to this dessin d'enfant.

Time and Venue: Nov. 9 (Thu.) 17:05-17:50, Ding Shisun Lecture Theater

12. **LI Haigang** *Beijing Normal University*

Title: Babuska Problem in Composite Materials and Suspension Problem in Stokes Flow

Abstract: In high-contrast elastic composite media, when inclusions are spaced closely, the stress always concentrates in between inclusions and causes damage initiation. For Babuska problem in linear elasticity, we obtain the blow-up asymptotic expressions of the gradients of solutions to the Lame system with partially infinite coefficients in the narrow region when the distance between inclusions tends to zero.

An iteration method for the energy is developed for elliptic equations and systems. By using this method, the stress concentration problem between two convex adjacent rigid particles suspending in Stokes flow is recently solved in dimensions two and three.

Time and Venue: Nov. 6 (Mon.) 14:55-15:40, Siyuan Lecture Hall

13. **LI Qiongling** *Nankai University*

Title: Higgs bundles over non-compact hyperbolic surfaces

Abstract: For a Higgs bundle over a compact Riemann surface of genus at least 2, the Hitchin-Kobayashi correspondence says the existence of a harmonic metric is equivalent to the polystability of the Higgs bundle. In this talk, we discuss our recent progress on the existence and uniqueness of harmonic metrics on Higgs bundles over general non-compact hyperbolic Riemann surfaces. This is joint work with Takuro Mochizuki.

Time and Venue: Nov. 10 (Fri.) 14:55-15:40, Siyuan Lecture Hall

14. **LIN Jianfeng** *Tsinghua University*

Title: On moduli spaces of smooth 4-manifolds

Abstract: The moduli space of a smooth manifold is defined to be the classifying space of its diffeomorphism group. Understanding the homotopy type of this space helps us to classify families of manifolds (i.e., manifold bundles). In this talk, I will discuss some new properties of the moduli spaces of 4-manifolds. Some of them are special in dimension 4 (e.g. the homological instability phenomena), while some of them also appear in higher dimensions (e.g. a discrepancy between the moduli spaces in the smooth category and the topological category). The talk is based on a joint work with Hokuto Konno and a joint work with Yi Xie.

Time and Venue: Nov. 9 (Thu.) 16:10-16:55, Ding Shisun Lecture Theater

15. **LIU Yi** *Peking University*

Title: Profinite properties of 3-manifold groups

Abstract: In this talk, I will explain recent progress on profinite properties of closed or finite volume hyperbolic 3-manifold groups.

Time and Venue: Nov. 9 (Thu.) 10:50-11:40, Ding Shisun Lecture Theater

16. **LOKUTSIEVSKIY Lev** *Steklov Mathematical Institute of Russian Academy of Sciences*

Title: Problem of Sub-Riemannian Geodesics Smoothnes

Abstract: The topic of the talk lies at the intersection of smooth manifold geometry and interpolation theory. The most intriguing object in sub-Riemannian geometry is abnormal geodesics. These geodesics determine the local structure of the metric but do not satisfy the analogue of the Christoffel symbols equation. Two main problems in sub-Riemannian geometry are associated with abnormal geodesics — the Sard's conjecture and the problem of their smoothness.

I will speak about a new approach to the problem: M.I. Zelikin and I have managed to show that the properties of smoothness and minimal length for a curve are in

duality from the perspective of convex geometry. This approach allows us to prove L_p-Hölder continuity of velocity on geodesics, which is the first result on the problem that has no a priori assumptions.

Time and Venue: Nov. 7 (Tue.) 14:55-15:40, Siyuan Lecture Hall

17. **OSIPOV Denis** *Steklov Mathematical Institute of Russian Academy of Sciences, NRU HSE, NUST "MISIS"*

Title: Local analog of the Deligne-Riemann-Roch isomorphism for line bundles on a family of curves

Abstract: I will speak about a local analog of the Deligne-Riemann-Roch theorem for line bundles on a family of smooth projective curves. First, I recall the Deligne-Riemann-Roch theorem for the family of curves, which generalizes the Grothendieck-Riemann-Roch theorem. Then I will speak about its local analog. The two parts for this local analog of the Deligne-Riemann-Roch theorem consist of the central extensions of the group (or, more exactly, the group ind-scheme) that is the semidirect product of the group of invertible functions on the formal punctured disc and the group of automorphisms of this disc. These central extensions are by the multiplicative group. The theorem is that these central extensions are equivalent over the ground field of rational numbers.

Time and Venue: Nov. 10 (Fri.) 14:00-14:45, Ding Shisun Lecture Theater

18. **PANOV Taras** *Lomonosov Moscow State University*

Title: SU-bordism: geometric representatives, operations, multiplications and projections

Abstract: The development of algebraic topology in the 1960s culminated in the description of the special unitary bordism ring. Most leading topologists of the time contributed to this result, which combined the classical geometric methods of Conner–Floyd, Wall and Stong with the Adams–Novikov spectral sequence and formal group law techniques that emerged after the fundamental 1967 work of Novikov. Thanks to toric topology, a new geometric approach to calculations with SU-bordism has emerged, which is based on representing generators of the SU-bordism ring and other important SU-bordism classes by quasitoric manifolds and Calabi–Yau hypersurfaces in toric varieties.

Both geometric and algebraic approaches to describing the structure of SU-bordism are based on the study of an intermediate theory between U- and SU-bordism, the c_1-spherical bordism W. We describe the algebra of SU-linear operations in the theory MU of complex bordism and prove that it is generated by the well-known geometric operations ∂_i. For the theory W of c_1-spherical bordism, we describe all SU-linear multiplications on W and projections $MU \to W$. We also analyse complex orientations on W and the corresponding formal group laws F_W. The relationship between the formal group laws F_W and the coefficient ring W_* of the W-theory was studied by Buchstaber in 1972. We extend his results by showing that for any SU-linear multiplication and orientation on W, the coefficients of the corresponding formal group law F_W do not generate the ring W_*, unlike the situation with complex bordism.

The talk is based on joint work with Zhi Lu, Ivan Limonchenko and Georgy Chernykh.

Time and Venue: Nov. 6 (Mon.) 16:10-16:55, Ding Shisun Lecture Theater

19. **PENSKOI Alexei** *Lomonosov Moscow State University, HSE University, Independent University of Moscow*

Title: Isoperimetric inequalities for eigenvalues of the Laplace-Beltrami operator on surfaces

Abstract: Lord Rayleigh asked in his famous book "Theory of Sound" (1877–1878) the following question: what shape of the drum membrane provides the lowest possible sound among all membranes of a given fixed area? The answer (the disc) was obtained by Lord Rayleigh using physical heuristics and rigorously proven later by Faber and Krahn in 1921.

The contemporary analogue of this problem in Riemannian geometry is the following one: given a compact surface without boundary and a natural number k, find the supremum of the k-th eigenvalue of the Laplace-Beltrami operator (depending on a Riemannian metric) over the space of all Riemannian metrics of given fixed area. This difficult problem turns out to be very rich and related to such classical domains as Differential and Algebraic Geometry, Geometric Analysis, PDEs, Topology etc.

Time and Venue: Nov. 9 (Thu.) 14:55-15:40, Siyuan Lecture Hall

20. **POLEKHIN Ivan** *Steklov Mathematical Institute of Russian Academy of Sciences*

Title: On the dynamics and integrability of circulatory systems

Abstract: We will give a short overview of circulatory systems, which differ from Hamiltonian systems in that they contain additional non-potential positional forces. Our main attention will be paid to the consideration of a specific circulatory system, the so-called Ziegler pendulum. We prove that the Ziegler pendulum — a double pendulum with a follower force — can be integrable, provided that the stiffness of the elastic spring located at the pivot point of the pendulum is zero and there is no friction in the system. We show that the integrability of the system follows from the existence of two-parameter families of periodic solutions. We explain the mechanism for the transition from integrable to irregular dynamics and show that this mechanism is significantly different from the typical phenomena observed in conservative Hamiltonian systems.

Time and Venue: Nov. 7 (Tue.) 17:05-17:50, Siyuan Lecture Hall

21. **POPOV Vladimir** *Steklov Mathematical Institute of Russian Academy of Sciences*

Title: Multiple-transitive algebraic group actions and tensor product decompositions

Abstract: The talk is aimed to discuss the link between the classical problem of representation theory on the decompositions of tensor products of representations into irreducibles and the geometric problems of describing generically multiple-transitive algebraic group actions and finding some fine numerical characteristic of the geometry of root systems.

Time and Venue: Nov. 7 (Tue.) 10:50-11:40, Ding Shisun Lecture Theater

22. **PROKHOROV Yuri** *Steklov Mathematical Institute of Russian Academy of Sciences, Lomonosov Moscow State University, NRU HSE*

Title: Rationality problem for conic bundles

Abstract: A conic bundle is a morphism $f : X \to Z$ of algebraic varieties whose fibers are plane conics. I will discuss the problem of rationality of algebraic varieties having conic bundle structures. First, I recall almost classical results on birational properties of surface conic bundles over non-closed fields. Then I concentrate on the three-dimensional case.

Time and Venue: Nov. 9 (Thu.) 11:50-12:40, Ding Shisun Lecture Theater

23. **PRZYJALKOWSKI Victor** *Steklov Mathematical Institute of Russian Academy of Sciences, Lomonosov Moscow State University, NRU HSE*

Title: Geometry of Landau–Ginzburg models

Abstract: Mirror symmetry conjectures predict the correspondence between smooth Fano varieties and Landau–Ginzburg models, that is certain families of varieties whose algebraic and symplectic properties are equivalent to symplectic and algebraic properties of Fano varieties, correspondingly. We consider algebro-geometric aspects of the mirror correspondence and discuss how numberical invariants of Landau–Ginzburg models translates to invariants of Fano varieties.

Time and Venue: Nov. 7 (Tue.) 14:55-15:40, Ding Shisun Lecture Theater

24. **SERGEEV Armen** *Steklov Mathematical Institute of Russian Academy of Sciences*

Title: On Mathematical Problems in the Theory of Topological Insulators

Abstract: The talk is devoted to the theory of topological insulators. Apart from its importance for theoretical physics this theory is closely related to various mathematical disciplines such as homotopy theory and K-theory, Clifford algebras and noncommutative geometry. Topological insulators are characterized by having wide energy gap, stable under small deformations, which motivates the usage of topological methods for their study.

A key role in this study is played by the symmetry groups of these objects. The description of possible symmetry types goes back to Kitaev who proposed a classification of topological insulators based on the investigation of the symmetry groups and their representations.

In our talk we pay main attention to the topological insulators invariant under time reversion. We introduce the involutive spaces being the mathematical equivalent of the momentum spaces of insulators invariant under time reversion. An example of such systems is given by the quantum spin Hall insulator which has a non-trivial topological $\mathbb{Z}_2$-invariant introduced by Kane and Mele.

Time and Venue: Nov. 6 (Mon.) 14:00-14:45, Siyuan Lecture Hall

25. **SHAFAREVICH Andrei** *Lomonosov Moscow State University*

Title: Geometrical Asymptotics for Equations with Singularities

Abstract: The theory of geometric asymptotics is well developed for a wide class of differential and pseudodifferential equations with smooth coefficients. This theory is

based on the construction allowing to associate asymptotic solutions of evolutionary and spectral problems to geometric objects - Lagrangian surfaces or complex vector bundles over isotropic surfaces. Generalizations of these constructions for the case of equations with singularities are known only in individual cases; at the same time, such equations are interesting as both theoretically and due to numerous applications. In the talk we first remind the main ideas of the theory for the case of smooth coefficients. Then a number of examples are discussed in which it is possible to construct geometric asymptotics of solutions to equations with singularities and in particular, to describe the restructuring of the corresponding geometric objects at the points of the support of the singularity of the coefficients.

Time and Venue: Nov. 9 (Thu.) 9:30-10:20, Ding Shisun Lecture Theater

26. **SKRIPCHENKO Alexandra** *Faculty of Mathematics, National Research University Higher School of Economics*

Title: Systems of isometries and their relatives

Abstract: Systems of partial isometries of the interval represent a simple combinatorial object which appears in topology in connection with measured foliations on a surface (orientable or non-orientable), in dynamics as a nice model to study billiards in rational polygons and in geometric group theory as a way to describe actions of free groups on $\mathbb{R}$-trees.

We will discuss several classes of systems of isometries, including interval exchange transformations, interval exchange transformations with flips, interval translation mappings and band complexes. We try to compare their key dynamical properties, such as minimality, ergodicity, invariant measures, and outline the most challenging open questions.

Time and Venue: Nov. 9 (Thu.) 16:10-16:55, Siyuan Lecture Hall

27. **TIAN Gang** *Beijing International Center for Mathematical Research*

Title: Progress on analytic MMP

Abstract: The analytic minimal model program aims at classifying Kahler manifolds, particularly, projective manifolds, through Ricci flow. Since it was proposed more than 15 years ago, there have been many progresses. In this talk, I will start with a brief introduction to the analytic MMP, then I will discuss some of its recent progress.

Time and Venue: Nov. 6 (Mon.) 11:20-12:10, Ding Shisun Lecture Theater

28. **TRESCHEV Dmitry** *Steklov Mathematical Institute of Russian Academy of Sciences*

Title: Normalization flow

Abstract: I propose a new approach to the theory of normal forms for Hamiltonian ODE systems near a non-degenerate equilibrium position. The traditional normalization procedure is performed step-by-step: non-resonant terms in the expansion of the Hamiltonian function are removed first in the lowest degree, then in the next one and so on. I consider the space of all Hamiltonian functions with equilibrium position at the origin and construct a differential equation in this space. Solutions of this equation move Hamiltonian functions towards their normal forms. Shifts

along the flow of this equation correspond to canonical coordinate changes. So, we have a continuous normalization procedure. The formal aspect of the theory presents no difficulties. The analytic aspect and the problems of convergence of series, as usual, non-trivial.

Time and Venue: Nov. 6 (Mon.) 10:20-11:10, Ding Shisun Lecture Theater

29. **VATUTIN Vladimir** *Steklov Mathematical Institute of Russian Academy of Sciences*

Title: Critical branching processes in extremely non-favorable random environment

Abstract: Let $\mathcal{Z} = \{Z_n,\ n = 0, 1, 2, ...\}$ be a critical branching process evolving in a random environment generated by a sequence $\{F_n(s), \quad s \in [0, 1], n = 1, 2, ...\}$ of i.i.d. probability generating functions. Denote $X_i = \log F_i'(1), i = 1, 2, ...$ and introduce a random walk

$$S_0 = 0, \quad S_n = X_1 + ... + X_n,\ n \geq 1.$$

We impose the following restrictions on the properties of the random environment.

Assumption B1 $\{S_n, n \geq 0\}$ is a random walk whose i.i.d. increments belong without centering to the domain of attraction of an α-stable law $\{Y_t, t \geq 0\}$, i.e. $S_{nt}/a_n \Rightarrow Y_t, t \geq 0$, for some scaling constants a_n, and the distribution of X_1 is non-lattice.

Assumption B2. There is an $\varepsilon > 0$ such that

$$\mathbf{E}\left(\log^+ \frac{F_1''(1)}{(F_1'(1))^2}\right)^{\alpha+\varepsilon} < \infty.$$

Given Assumptions B1-B2 we study the asymptotic behavior, as $n \to \infty$ of the probability

$$\mathbf{P}\left(Z_n > 0, S_n \leq h(n)\right),$$

where $h(n)$ is either a constant or $h(n) \to -\infty$ as $n \to \infty$ in such a way that $h(n) = o(a_n)$.

Time and Venue: Nov. 10 (Fri.) 14:00-14:45, Siyuan Lecture Hall

30. **WANG Guozhen** *Fudan University*

Title: Computations in topological cyclic homology

Abstract: Topological cyclic homology is introduced in the 1990s by Bkstedt-Hsiang-Madsen to study topological problems like the classifications of manifolds. The work of Dundas-Goodwillie-McCarthy makes topological cyclic homology an important tool in algebraic K-theory computations. Recently work by Bhatt-Morrow-Scholze has shed new light on the theory of topological cyclic homology and p-adic cohomology. Influenced by this, we will show how to use relative topological Hochschild homology to study topological cyclic homology for locally complete intersections. We will also give the basic properties of the resulting cohomology theory arising from the stack defined by the descent spectral sequence. This is joint work with Jingbang Guo and Ruochuan Liu.

Time and Venue: Nov. 7 (Tue.) 9:30-10:20, Ding Shisun Lecture Theater

31. **WANG Shicheng** *Peking University*

Title: Some connections between topology and number theory

Abstract: We will discuss some connections between topology and number theory inspired by the studies of mapping degrees and achirality of manifolds.

Time and Venue: Nov. 8 (Wed.) 11:50-12:40, Ding Shisun Lecture Theater

32. **WEI Qiaoling** *Capital Normal University*

Title: Inverse spectral problem of convex planar domains

Abstract: This talk is related to the famous question "Can you hear the shape of drum?" by M.Kac in 1966. That is, whether a planar domain Ω can be uniquely determined by its Laplace spectrum consisting of eigenvalues of a Dirichlet problem. Meanwhile, from dynamical aspect, there is length spectrum consisting of perimeters of all periodic orbits of a billiard problem inside Ω. The Laplace and length spectra are closely related. During the talk, we will show some recent progress with dynamical approach on this old topic.

Time and Venue: Nov. 9 (Thu.) 17:05-17:50, Siyuan Lecture Hall

33. **XIANG Shengquan** *Peking University*

Title: Quantitative rapid stabilization of some fluid models

Abstract: The control of equations is about asking oneself: if I can act on a system, what can I make it do? One of the main branches of this theory is about understanding how to act on a system as a function of what we measure. Given an unstable system, how can we act to enhance its stability? This is called stabilization. We will talk about some recent progress on this topic based on Navier-Stokes equations, the linearised water wave equations and others.

Time and Venue: Nov. 7 (Tue.) 16:10-16:55, Siyuan Lecture Hall

34. **XIAO Liang** *Peking University*

Title: Slopes of modular forms and the geometry of eigencurves

Abstract: In the seminal paper by Coleman and Mazur, they introduced the p-adic eigencurves which parametrize the p-adic overconvergent modular forms in family. This has become a central mathematical object in modern number theory, and an important tool to study the p-adic aspect of Langlands program. In this talk, I will explain a recent joint work with Ruochuan Liu, Truong Nha, and Bin Zhao, in which we determine the slopes of overconvergent modular forms on this eigencurve under some technical conditions, and therefore prove that this eigencurve has finitely many irreducible components. This answers several open conjectures in this area. One key component in our work is to prove a recent conjecture, called the ghost conjecture proposed by Bergdall and Pollack, which essentially summarized all the aforementioned conjectures.

Time and Venue: Nov. 7 (Tue.) 11:50-12:40, Ding Shisun Lecture Theater

35. **XIE Junyi** *Peking University*

Title: The multiplier spectrum is generically injective

Abstract: The talk is based on a joint work with Zhuchao Ji. We consider the multiplier spectrum of periodic points, which is a natural morphism defined on the moduli space of rational maps on the projective line. A celebrated theorem of McMullen asserts that aside from the well-understood flexible Latts family, the multiplier spectrum morphism is quasi-finite. In this paper, we strengthen McMullen's theorem by showing that the multiplier spectrum morphism is generically injective. This answers a question of Poonen.

Time and Venue: Nov. 10 (Fri.) 9:30-10:20, Ding Shisun Lecture Theater

36. **YANG Enlin** *Peking University*

Title: Cohomological Milnor formula for constructible etale sheaves

Abstract: In this talk, we will sketch the construction of non-acyclicity classes for constructible etale sheaves on (not necessarily smooth) varieties, which is defined in a recent joint work with Yigeng Zhao. This cohomological class is supported on the non-locally acyclicity locus. As applications, we show that the Milnor formula and Bloch's conductor formula can be reformulated in terms of the functorial properties of non-acyclicity classes. Based on this formalism, we propose a Milnor type formula for non-isolated singularities.

Time and Venue: Nov. 10 (Fri.) 14:55-15:40, Ding Shisun Lecture Theater

37. **YANG Wenyuan** *Peking University*

Title: Generic 3-manifolds are hyperbolic

Abstract: In this talk, we first introduce various models to study what a generic 3-manifold looks like. We then focus on the Heegaard splitting model of 3-manifolds, equipped with geometric complexity using Teichmuller metric. The main result is that the Hempel distance of a generic Heegaard splitting goes linearly to the infinity. In particular, generic 3-manifolds are hyperbolic in this model. This represents the joint work with Suzhen Han and Yanqing Zou.

Time and Venue: Nov. 9 (Thu.) 14:00-14:45, Ding Shisun Lecture Theater

38. **YIN Qizheng** *Peking University*

Title: Perverse filtrations and Fourier transforms

Abstract: The perverse filtration captures interesting topological information of an algebraic map. Recently using Fourier-Mukai transforms, we find a way to approach the perverse filtration for certain abelian fibrations. As a result, we obtain a new, geometric proof of the $P = W$ conjecture for GL_n. Joint work with Davesh Maulik and Junliang Shen.

Time and Venue: Nov. 6 (Mon.) 14:55-15:40, Ding Shisun Lecture Theater

39. **ZAPOROZHETS Dmitry** *St. Petersburg Department of Steklov Mathematical Institute of Russian Academy of Sciences*

Title: Random Walks

Abstract: A random walk on a line is one of the central concepts of probability theory. Despite the simplicity of its construction, it serves as a basic example for various models of both theoretical and applied nature.

We will begin by examining several classic results of an extremely general nature, where the distribution of the walk's step plays only a secondary role. After that, we will discuss how these results can be generalized to the multidimensional case.

Time and Venue: Nov. 6 (Mon.) 16:10-16:55, Siyuan Lecture Hall

40. **ZHANG Zhenlei** *Capital Normal University*

Title: Complex Monge-Ampere equation in Orlicz Space

Abstract: We shall discuss the regularity of solutions to the complex Monge-Ampere equation on a compact Kahler manifold when the measure belongs to certain Orlicz space. The aprior L^∞ estimate under an integrability condition has been proved by Kolodziej. The stability as well as more regularity of the solution relies on a stronger integrablity condition. Some application to the geometric estimates of Kahler metircs will also be discussed.

Time and Venue: Nov. 9 (Thu.) 14:00-14:45, Siyuan Lecture Hall

41. **ZHEGLOV Alexander** *Lomonosov Moscow State University*

Title: Some new applications of the Schur-Sato theory

Abstract: The Schur-Sato theory, which will be discussed in the talk, is a generalization of a well-known theory in dimension one, where it describes rings of ordinary differential operators in terms of points of the big cell of Sato grassmanian. This theory was developed for a wide class of so-called quasi-elliptic rings in arbitrary dimension in the work https://arxiv.org/abs/2205.06790. Such rings have been defined in order to classify a wide class of commutative rings of operators appeared in the theory of (quantum) integrable systems (such as, for example, rings of commuting differential, difference, differential-difference and etc. operators). The theory was applied to get classification of quasi-elliptic rings in terms of some subspaces (generalized Schur pairs). I'll talk about a new application of the theory: a convenient description of the moduli space of spectral sheaves of quasi-elliptic rings. This moduli space is an open set of the moduli space of torsion free sheaves with fixed Hilbert polynomial on the spectral variety.

Time and Venue: Nov. 6 (Mon.) 14:00-14:45, Ding Shisun Lecture Theater

42. **ZHENG Weizhe** *Academy of Mathematics and Systems Science, Chinese Academy of Sciences*

Title: Ultraproduct cohomology and the decomposition theorem

Abstract: Ultraproducts of tale cohomology provide a large family of Weil cohomology theories for algebraic varieties. Their properties are closely related to questions of l-independence and torsion-freeness of l-adic cohomology. I will present recent progress in ultraproduct cohomology with coefficients, such as the decomposition theorem. This talk is based on joint work with Anna Cadoret.

Time and Venue: Nov. 7 (Tue.) 16:10-16:55, Ding Shisun Lecture Theater

43. **ZHOU Xiangyu** *Academy of Mathematics and Systems Science, Chinese Academy of Sciences*

Title: Multiplier submodule sheaves and a criteria of vector bundles being Nakano positivity

Abstract: First we'll recall some recent results on multiplier ideal sheaves and converse L^2 theory, then we'll explain some new results on multiplier submodule sheaves associated to singular hermitian metric on holomorphic vector bundles, including a criteria of holomorphic vector bundles being Nakano semipositivity and a solution of Lempert's problem on Nakano semipositivity.

Time and Venue: Nov. 6 (Mon.) 9:00-9:50, Ding Shisun Lecture Theater

44. **ZOTOV Andrei** *Steklov Mathematical Institute of Russian Academy of Sciences*

Title: Interacting integrable tops and their quantization

Abstract: We begin with a brief review of classical elliptic integrable systems. Interacting tops is the model which generalizes both – relativistic Ruijsenaars-Schneider many-body system and a family of integrable tops of Euler-Arnold type. Next, we discuss quantization of these models as well as a construction of new q-deformed integrable long-range spin chains.

Time and Venue: Nov. 10 (Fri.) 16:10-16:55, Siyuan Lecture Hall