# Tianyuan Mathematics Research Center

Convex Geometric Analysis and Stochastic Geometry
Nov. 24 – Nov. 28, 2025

MEALS

*Breakfast (Buffet): 7:00-9:00 am, Dining Room, Monday-Friday
*Lunch (Buffet): 11:30 am-1:30 pm, Dining Room, Monday-Friday
*Dinner (Buffet): 5:30-7:30 pm, Dining Room, Sunday-Thursday
Coffee Breaks: As per daily schedule

MEETING ROOMS

All lectures will be held in the lecture hall in the Tuanyuan Mathematics Research Center (TYMC). An HD LED screen, notepads, pens and vertical sliding chalkboards are available for presentations.

SCHEDULE

| Date | Time | Speaker | Chair |
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| Nov. 23 | Check in (Front Desk – open 24 hours) | | |
| Nov. 24 | 8：45—9：00 | Introduction and Welcome | |
| | 9：00—9：50 | Andrea Colesanti | Ning Zhang |
| | 9：50—10：10 | Coffee break | |
| | 10：10—11：00 | Franz Schuster | Andrea Colesanti |
| | 11：05—11：55 | Fabian Mussnig | Franz Schuster |
| | Lunch | | |
| | 2：30—3：20 | Alexander Kolesnikov | Fabian Mussnig |
| | 3：20—3：40 | Coffee break | |
| | 3：40—4：30 | Jacopo Ulivelli | Alexander Kolesnikov |

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| | 4：35—5：25 | Dongbin Li | Jacopo Ulivelli |
| | Dinner | | |
| Nov. 25 | 9：00—9：50 | Jiazu Zhou | Baocheng Zhu |
| | 9：50—10：10 | Coffee break | |
| | 10：10—11：00 | Yao-Zhong Qiu | Jiazu Zhou |
| | 11：05—11：55 | Stephanie Mui | Chunna Zeng |
| | Lunch | | |
| | 2：30—3：20 | Baocheng Zhu | Stephanie Mui |
| | 3：20—3：40 | Coffee break | |
| | 3：40—4：30 | Leo Brauner | Lei Qin |
| | 4：35—5：25 | Xia Zhou | Leo Brauner |
| | Dinner | | |
| Nov. 26 | 9：00—9：50 | Paolo Salani | Yao-Zhong Qiu |
| | 9：50—10：10 | Coffee break | |
| | 10：10—11：00 | Dan Ma | Paolo Salani |
| | 11：05—11：55 | Yuanyuan Li | Jiaqian Liu |
| | Lunch | | |
| | Free Discussion | | |
| | Dinner | | |

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| Nov. 27 | 9：00—9：50 | Xu-Jia Wang | Dongmeng Xi |
| | 9：50—10：10 | Coffee break | |
| | 10：10—11：00 | Peng Wang | Xu-Jia Wang |
| | 11：05—11：55 | Xiaxing Cai | Peng Wang |
| | Lunch | | |
| | 2：30—3：20 | Jin Li | Xiaxing Cai |
| | 3：20—3：40 | Coffee break | |
| | 3：40—4：30 | Shuang Mou | Jin Li |
| | 4：35—5：25 | Free Discussion | |
| | Dinner | | |
| Nov. 28 | 9：00—9：50 | Deping Ye | Ben Li |
| | 9：50—10：10 | Coffee break | |
| | 10：10—11：00 | Weiru Liu | Deping Ye |
| | 11：05—11：55 | Qingdan Du | Weiru Liu |
| | Lunch | | |
| | Checkout | | |

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| Nov. 29 | Checkout |

TALKS (Alphabetical Order)

Speaker: Leo Brauner
Title: Mixed volumes and mixed area measures of bodies of revolution
Abstract: Sometimes, two mixed volume functionals with different reference bodies are in fact equal. For reference bodies that are symmetric around a common axis, we determine when this is the case, using mixed spherical projections and tools from valuation theory. We apply our findings to obtain new integral geometric formulas and isoperimetric type inequalities. Moreover, for convex bodies of revolution, we provide a complete solution to the mixed Christoffel-Minkowski problem. Joint work with Georg C. Hofstätter, Oscar Ortega-Moreno, and Franz Schuster.

Speaker: Xiaxing Cai
Title: Affine dual Minkowski problems
Abstract: In this work, affine “invariant” measures derived from the dual affine quermassintegrals are presented. Minkowski problems for the new affine-invariant measures are proposed and studied. The new variation formula derived here leads to new affine operators that map star bodies to star bodies. An affine isoperimetric inequality is obtained for new bi-dual intersection bodies.
(Joint work with Gangsong Leng, Yuchi Wu and Dongmeng Xi.)

Speaker: Andrea Colesanti
Title: Mixed Christoffel Problem
Abstract: In collaboration with Matteo Focardi, Pengfei Guan and Paolo Salani, we considered the problem of finding a convex body in the n-dimensional Euclidean space, with prescribed mixed area measure with (n-2) given convex bodies. We proved some existence results, transforming the problem into a PDE on the sphere, and using the constant rank method to prove that this equation admits a convex solution, which is the support function of the unknown body.

Speaker: Qingdan Du
Title: Orthogonal connectedness and staircase connectedness
Abstract: A polygonal path $P$ in $\mathbb{R}^d$ is called orthogonal if every edge of $P$ is parallel to one of the coordinate axes. An orthogonal path $P$ is called staircase, if all its parallel edges have the same direction. A set $M \subset \mathbb{R}^d$ is orthogonally (resp. staircase) connected if every two points $p, q \in M$ can be joined by an orthogonal (resp. staircase) path in $M$. In this talk, we'll introduce the definition of o-extreme points and investigate their properties. We also introduce some properties of Gamma-sets which are special orthogonal paths.

Speaker: Alexander Kolesnikov
Title: New results on Blaschke-Santalo and Brascamp-Lieb inequalities
Abstract: We discuss various generalizations of the functional Blaschke-Santalo inequality, including inequalities for multiple functions and inequalities with non-Gaussian extremizers. In particular, we highlight the relation to uniqueness problem for the spherical Monge-Ampere equation. We show that a strong version of the Brascamp-Lieb inequality for symmetric log-concave measure with homogeneous potential V is equivalent to a p-Brunn-Minkowski inequality for level sets of V. Exploiting these observations we prove new sufficient conditions for symmetric p-Brunn- Minkowski inequality with p < 1.
Based on joint works with Elisabeth Werner, Andrea Colesanti, Galyna Livshyts and Liran Rotem.

Speaker: Dongbin Li
Title: Entropic and functional forms of dimensional Brunn-Minkowski inequality in Gauss space
Abstract: The Gaussian measure on $\R^n$, when restricted to origin-symmetric convex bodies, satisfies $1/n$-concavity under Minkowski averages—a result of Eskenazis and Moschidis which confirms the Gardner–Zvavitch conjecture. In this talk, we view this geometric phenomena through the lens of entropy. Using mass transport techniques, we derive a more general formulation that not only strengthens the original geometric inequality but also naturally yields its functional forms.

Speaker: Jin Li
Title: Tensor valuations of small order
Abstract: Valuations are scissors congruence invariants that play fundamental roles in Hilbert's third problem. In this talk, I will present a complete classification of $SL(n)$ contravariant, p-order tensor valuations on convex polytopes in $\mathbb{R}^n$ for $n \geq p$ without imposing additional assumptions, particularly omitting any symmetry requirements on the tensors. Beyond recovering known symmetric tensor valuations, our classification reveals

asymmetric counterparts associated with the cross tensor and the Levi-Civita tensor. Additionally, some Minkowski type relations for these asymmetric tensor valuations will be represented, extending the classical Minkowski relation of surface area measures.

Speaker: Yuanyuan Li
Title: The Lp chord Minkowski problem for super-critical exponent
Abstract: In this talk, we consider the Lp chord Minkowski problem, proposed by Lutwak-Xi-Yang-Zhang [CPAM 2024]. We apply a nonlocal Gauss curvature flow introduced by Hu-Huang-Lu-Wang [Acta Math Sci 45 (2025)] and a topological argument developed by Guan-Li-Wang [J. Eur. Math. Soc. (2025)] to solve this problem for the super-critical exponents. Notably, we provide a simplified argument for the topological part. This is joint work with Shibing Chen (USTC) and Qirui Li (ZJU).

Speaker: Weiru Liu
Title: Uniqueness of solutions in the near-isotropic Lp dual Minkowski problem
Abstract: The Lp dual Minkowski problem is an important topic in convex geometry, unifying the Lp Minkowski problem and the dual Minkowski problem. This talk will present the uniqueness results for its solutions in the near-isotropic setting. The work is joint with Károly J. Böröczky, Shibing Chen, and Christos Saroglou.

Speaker: Dan Ma
Title: Fisher information tensors as valuations
Abstract: In this talk, we will present the recent extension of the characterization of the Fisher information matrix as valuations to the case of tensors of higher orders.

Speaker: Shuang Mou

Title: Continuity of the solution to the normalized $L_p$ Minkowski problem

Abstract: In this talk, we address the continuity of the solution to the Minkowski problem. This problem was initially investigated by Zhu [2017, Proc. Amer. Math. Soc., 379-386], who showed that if the $L_p$ surface area measures $S_p(K_i, \cdot)$ converge weakly to $S_p(K, \cdot)$, then the corresponding convex bodies $K_i$ converge to $K$ for all $p > 1$ with $p \neq n$. Our aim is to extend this result to all $p > 1$. In this work, we establish the continuity of solution to the normalized $L_p$ Minkowski problem. Moreover, we prove the continuity of the solution with respect to the parameter $p$. This is joint work with Tuo Wang.

Speaker: Stephanie Mui
Title: On log-concave isotropic random matrices
Abstract: I will discuss some concentration inequalities on the largest and smallest singular values of log-concave isotropic random matrices. Results are from joint works with Manuel Fernandez, Galyna Livshyts, and Santosh Vempala.

Speaker: Fabian Mussnig
Title: Christoffel-Minkowski problems and Hessian equations under rotational symmetries
Abstract: We present an explicit solution to the Christoffel-Minkowski problem for convex bodies of revolution. Our approach relies on constructing convex solutions to mixed Monge-Ampere equations on Rn under the assumption of radial symmetry.
Joint work with Jacopo Ulivelli.

Speaker: Yao-Zhong Qiu
Title: Isoperimetric inequalities for sub-Riemannian analogues of the gaussian measure
Abstract: We discuss isoperimetric inequalities for three analogues of the Euclidean gaussian measure on the Heisenberg group, namely the heat kernel of the sub-Laplacian, or the gaussian with the Euclidean norm replaced either by the Carnot-Caratheodory metric or the Koranyi-Folland gauge. We discuss also the structure of isoperimetric sets and conclude with generalizations to other spaces and related questions.

Speaker: Paolo Salani
Title: Geometric properties and inequalities for eigenvalues problems in the Gauss space
Abstract: This talk is based on a joint work with A. Colesanti and L. Qin.
We prove a Brunn-Minkowski type inequality for the first (nontrivial) Dirichlet eigenvalue of the $p$-Ornstein-Uhlenbeck operator

$$-\Delta_{p,\gamma}u = -\Delta_p u + \langle x, \nabla u\rangle |\nabla u|^{p-2},$$

Where $p > 1$, in the class of bounded Lipschitz domains in $\mathbb{R}^n$. We also prove that any corresponding positive eigenfunction is log-concave if the domain is convex.

Speaker: Franz Schuster
Title: Radon Transforms of Projection Functions and Aleksandrov-Fenchel Inequalities
Abstract: The Radon transforms on Grassmannians define a family of geometric maps on convex bodies when applied to their projection functions. These operators coincide on origin-symmetric bodies with the mean section operators introduced in the 1990s by Goodey and Weil and are dual, via the

Alesker-Fourier transform, to Minkowski's family of projection body maps. Over the past two decades various results, including sharp isoperimetric type inequalities, established for projection body maps towards the end of the previous century were shown to also hold for the mean section operators. However, a dual to Lutwak's family of Brunn-Minkowski type inequalities for the intrinsic volumes of the projection body maps remained open for mean section operators in full generality with several partial results being proved since the early 2000s. In this talk, we present new Alesksandrov-Fenchel inequalities for certain averages of mixed volumes that are the key to show that also all the intrinsic volumes of the Radon transforms of projection functions are indeed log-concave.

Speaker: Jacopo Ulivelli
Title: Geometric inequalities for convex functions
Abstract: Geometric inequalities for convex bodies are often strongly related to functionals that can be classified as sufficiently regular valuations. In the functional setting, the same intuition fails, as we will show in this talk. Nonetheless, it is still possible to identify cones of convex functions where inequalities can be recovered, leading to a unified geometric perspective and reinterpretation of results in the previous literature. Based on joint works with Mussnig and Knoerr.

Speaker: Peng Wang
Title: Minimal immersions of flat n-tori into spheres
Abstract: In this talk, we will discuss the following results: Firstly, we will give a classification of conformally flat minimal 3-tori and 4-tori in spheres immersed by their first eigenfunctions. Secondly, we prove that every flat rational n-torus admits a minimal immersion into some sphere, extending a theorem of Bryant on flat 2-tori. Finally, we show that every minimal flat n-torus in a sphere can be minimally and isometrically immersed in S^{n(n+1)-1}. In particular, every minimal flat 2-torus can be minimally and isometrically immersed in S^5. This is a joint work with Ying Lv and Zhenxiao Xie.

Speaker: Xu-Jia Wang
Title: The affine maximal surface equation
Abstract: The affine Bernstein problem and affine Plateau problem in dimension two have been solved 20 years ago. In this talk I will report progress on these two problems in high dimensions.

Speaker: Jie Xiao
Title: Smoothness for p-mean stress on convex domains
Abstract: Given a bounded domain $B \subseteq \mathbb{R}^n$ (the Euclidean $2 \leq n$-space) with its boundary $\partial B$, a solution $u_B$ of the torsion problem

$$\begin{cases} -\triangle u_B = 1 \quad in\ B; \\ u_B = 0 \quad on\ \partial B, \end{cases}$$

is called a stress function of $B$. Via the torsional rigidity

$$\mathcal{T}_n(B) = \int_B u_B(x)\, dx,$$

this talk will demonstrate that given $p \in [1, \infty)$ not only the $p$-maximization problem

$$(\star) \qquad \sup_{\text{all bounded convex domains } B \subseteq \mathbb{R}^n} \int_B \left( \frac{u_B(x)}{|B|^{\frac{2}{n}}} \right)^p \frac{dx}{|B|},$$

is achievable, but also the boundary $\partial B_\star$ of any maximizer $B_\star$ of $(\star)$ is $C^1$-smooth - moreover - if $|\nabla u_{B_\star}|$ is constant on $\partial B_\star$ then $B_\star$ must be a Euclidean ball.

Speaker: Deping Ye
Title: Geometry of Convex Functions: Variational Formulas and Related Minkowski Problems
Abstract: Convex functions play a fundamental role in analysis, geometry, PDEs, and information theory, and thus understanding their analytic and geometric behavior has become increasingly important.
In this talk, I will describe some of our recent developments concerning the geometry of convex functions. I will focus on variational formulas arising from the Asplund sum, which naturally lead to measures associated with convex functions. I will also discuss the corresponding Minkowski-type problems and present their solutions.

Speaker: Jiazu Zhou
Title: Invariant geometric measures and Bonnesen style isoperimetric inequalities
Abstract: Let $K_i\ (i = 0, 1)$ be convex bodies and $G_n$ be group of isometries in the Euclidean space $\mathbb{R}^n$. On asks that if there is $g \in G_n$ such that $gK_1 \subseteq K_0$ or $gK_1 \supseteq K_0$.

We are going to to consider measures $m(g \in G_n : gK_1 \subseteq K_0 \text{ or } gK_1 \supseteq K_0) = m(g \in G_n : gK_1 \cap K_0 \neq \emptyset) - m(g \in G_n : \partial(gK_1) \cap \partial K_0 \neq \emptyset)$. If we can estimate $m_1$ from below and $m_2$ from above interns of invariants of $K_0$ and $K_1$, then we will obtain

$$m\{g \in G_n : gK_1 \subseteq K_0 \text{ or } gK_1 \supseteq K_0\} \geq f\big(I_1(K_0), \cdots, I_k(K_0);\ I_1(K_1), \cdots, I_k(K_1)\big) \quad , \quad (1)$$

where $I_j(K_i)$ ( $i = 0, 1; j = 1, \cdots, k$ ) are volumes, surface areas or quermassintegrals of $K_i$. From (1) we can derive sufficient condition for $gK_1 \subseteq K_0$ or $gK_1 \supseteq K_0$ or some Bonnesen type isoperimetric inequalities.

The talk may cover some joint works of N. Fang, X. Li, H. Wang, D. Wu, W. Xu, C. Zeng, Z. Zhang and B. Zhu.

Speaker: Xia Zhou
Title: On the higher-order affine isoperimetric and isocapacitary inequalities
Abstract: In applications, it is often crucial to compare different geometric invariants defined on convex bodies. For example, the $L_p$ isoperimetric and isocapacitary inequalities compare the $L_p$ surface area, $p$-variational capacity and volume. Their affine analogues show the relation between the $p$-integral affine surface area, the $p$-affine capacity and volme.

The higher-order $L_p$ affine isoperimetric inequalities was recently established by Haddad, Langharst, Putterman, Roysdon, and Ye. Following their approaches, I will talk about how to define the higher-order $p$-affine capacity and discuss the related inequalities to compare it with the volume, the $p$-variational capacity and the higher-order $p$-integral affine surface area. I will also explain how to define the higher-order Orlicz projection and centroid bodies and discuss related inequalities.

Speaker: Baocheng Zhu
Title: Asymptotic theory of unbounded closed convex sets
Abstract: In this talk, we will first discuss the Minkowski problem for unbounded closed convex sets in C, where C is a pointed closed convex cone with nonempty interior in n-dimensional Euclidean space. We will then present an asymptotic perspective on C-pseudo-cones, showing how such a set E can be decomposed into the sum of a C-asymptotic set A and the C-starting point z of E.