丘成桐数学科学中心
YAU MATHEMATICAL SCIENCES CENTER

2025
清华几何与分析研讨会
GEOMETRY AND ANALYSIS SEMINAR

2025.3.29

受邀报告人单位

复旦大學 FUDAN UNIVERSITY

上海交通大學 SHANGHAI JIAO TONG UNIVERSITY

同濟大學 TONGJI UNIVERSITY

暨南大學 JINAN UNIVERSITY

清華大學 Tsinghua University

南京郵電大學 Nanjing University of Posts and Telecommunications

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2025 Geometry and Analysis Seminar

The objective of this conference is to foster collaboration and knowledge exchange among experts, young researchers, and students in the fields of geometry and analysis. The conference is scheduled to take place at Tsinghua University at March 29th.

Organizing Committee

Ivan TELPUKHOVSKIY	清华大学	Tsinghua University
王高明 WANG Gaoming	清华大学	Tsinghua University
张城 ZHANG Cheng	清华大学	Tsinghua University
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Conference location

清华大学双清综合楼A座C548报告厅(五层)
Lecture Hall C548 (5th Floor), Shuangqing Complex Building A, Tsinghua University

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Timetable

Time	March 29th, Saturday	
09:30-10:00	**Registration and Opening**	
Host: Ivan TELPUKHOVSKIY		
10:00–10:45	**ZHANG Shuangjian, Kelvin**	Monopolist's profit-maximization v.s. screening problems: a PDE point of view
10:50-11:35	**WANG Changliang**	On compactness of sequences of manifolds with nonnegative scalar curvature
Lunch		
Host: TAN Dong		
13:30–14:15	**HUANG Hongzhi**	Nonnegative Ricci Curvature, Euclidean Volume Growth, and the Fundamental Groups of Open 4-Manifolds
14:20–15:05	**LI Nianzi**	Metric asymptotics on the irregular Hitchin moduli space
15:05-15:30	**Break: Discussions and Coffee**	
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15:30–16:15	**HU Guangming**	Boundary Value Problem and Discrete Schwarz-Pick Lemma for Generalized Hyperbolic Circle Packings
16:20–17:05	**WANG Tongrui**	Minimal surfaces with low genus in lens spaces
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List of Abstracts

March 29th, Saturday

Monopolist's profit-maximization v.s. screening problems: a PDE point of view

张霜剑 ***Zhang Shuangjian Kelvin*** 10:00-10:45

复旦大学数学科学学院、复旦大学应用数学中心
School of Mathematical Science; Center for Applied Mathematics, Fudan University

The principal-agent problem is one of the central problems in microeconomics with many applications. Existence, uniqueness, convexity/concavity, regularity, and characterization of the solutions have been widely studied after Mirrlees and Spence in the 1970s. For multidimensional spaces of agents and products, Rochet and Choné (Econometrica, 1998) reformulated this problem to a concave maximization over the set of convex functions, by assuming agent preferences combine bilinearity in the product and agent parameters with a quasilinear sensitivity to prices. We characterize solutions to this problem by identifying a dual minimization problem. This duality allows us to reduce the solution of the square example of Rochet-Choné to a novel free boundary problem, giving the first analytical description of an overlooked market segment, where the regularity built by Caffarelli-Lions plays a crucial role — an extension of their regularity work to the quasilinear case is also recently studied. In this talk, I will first introduce the historical work on the principal-agent framework under the context of the monopolist problem before moving to the recent progress. The results profoundly connect with the Optimal Transport theory, a powerful tool with potential applications in many areas. This talk contains my joint work with Robert J. McCann and Cale Rankin.

On compactness of sequences of manifolds with nonnegative scalar curvature

王常亮 ***Wang Changliang*** 10:50-11:35

同济大学数学科学学院
School of Mathematical Sciences, Tongji University

Gromov and Sormani conjectured that a sequence of three dimensional Riemannian manifolds with nonnegative scalar curvature and some additional uniform geometric bounds should have a subsequence which converges in some sense to a limit space with some generalized notion of nonnegative scalar curvature. In this talk, I will discuss this conjecture, and report our works on this problem. In particular, we proved some compactness results for sequences of warped product three dimensional manifolds with nonnegative scalar curvature, and for sequences of metrics in conformal classes. This talk based on joint works with Brian Allen, Jiewon Park, Christina Sormani, and Wenchuan Tian.

Nonnegative Ricci Curvature, Euclidean Volume Growth, and the Fundamental Groups of Open 4-Manifolds

黄虹智 ***Huang Hongzhi*** 13:30-14:15

暨南大学数学系
Department of Mathematics, Jinan University

Let M be a 4-dimensional open manifold with nonnegative Ricci curvature. We prove that if the universal cover of M has Euclidean volume growth, then the fundamental group is finitely generated and contains an abelian subgroup whose index is bounded by a universal constant. This is joint work with Xian-Tao Huang.

Metric asymptotics on the irregular Hitchin moduli space

李念梓 ***Li Nianzi*** 14:20-15:05

清华大学数学科学中心
Yau Mathematical Sciences Center, Tsinghua University

In 1987, Hitchin constructed a complete hyperkähler metric on the moduli space of stable Higgs bundles over compact Riemann surfaces. This construction was generalized for Higgs bundles with irregular singularities by Biquard and Boalch in 2004. In this talk, we study the moduli space of rank-two irregular Higgs bundles over the projective line. Along a curve of specific type, we show that Hitchin's hyperkähler metric is asymptotic to a simpler semi-flat metric at an exponential rate, building on works of Fredrickson, Mazzeo, Mochizuki, Swoboda, Weiss, and Witt. In our gluing construction of the harmonic metric, we introduce a model harmonic metric for weakly parabolic singularities with trivial flags as a new building block besides the usual fiducial solutions. This is based on an estimate of Mochizuki. Furthermore, in the four-dimensional case, we explicitly compute the asymptotic limit of the semi-flat metric and show it is of type ALG or ALG*. Joint work with Gao Chen.

Boundary Value Problem and Discrete Schwarz-Pick Lemma for Generalized Hyperbolic Circle Packings

胡光明 ***Hu Guangming*** 15:30-16:15

南京邮电大学理学院
Department of Mathematics, Nanjing University of Posts and Telecommunications

In 1991, Beardon and Stephenson generalized the classical Schwarz-Pick lemma in hyperbolic geometry to the discrete Schwarz-Pick lemma for Andreev circle packings. This talk continues to investigate the discrete Schwarz-Pick lemma for generalized circle packings (including circle, horocycle or hypercycle) in hyperbolic background geometry. Since the discrete Schwarz-Pick lemma is to compare some geometric quantities of two generalized circle packings with different boundary values, we first show the existence and rigidity of generalized circle packings with boundary values. Motivated by [be,he,ro], we propose the maximum principle for generalized circle packings. Finally, we use the maximum principle to prove the discrete Schwarz-Pick lemma for generalized circle packings.

Minimal surfaces with low genus in lens spaces

王童瑞 ***Wang Tongrui*** 16:20-17:05

上海交通大学数学科学学院
School of Mathematical Sciences, Shanghai Jiao Tong University

In this talk, I will discuss two either-or results for the multiple existences of minimal real projective planes and minimal Klein bottles in certain lens spaces with generic metrics. In particular, we show in positive Ricci $\mathbb{R}P^3$ that there are four distinct minimal real projective planes together with four distinct minimal tori, and the number of minimal tori can be improved to five for almost all metrics of positive Ricci. Our proof is mainly based on a variant multiplicity one theorem for the Simon-Smith min-max theory under certain equivariant settings. This talk is based on the joint work with Xingzhe Li and Xuan Yao.

Existence of Prescribed Mean Curvature Surfaces of Abitrary Codimensions

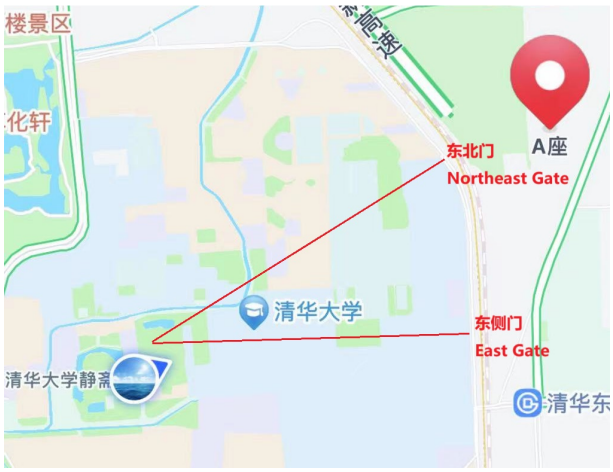
高瑞 ***Gao Rui*** 17:10-17:55

上海交通大学数学科学学院
School of Mathematical Sciences, Shanghai Jiao Tong University

Constant Mean Curvature (CMC) and Prescribed Mean Curvature (PMC) surfaces are pivotal in diverse fields including mathematics, physics, and biology. They arise naturally in partitioning problems, isoperimetric problems, general relativity, two-phase interface problems, tissue growth etc. Despite the well-established existence theory for CMC and PMC hypersurfaces, constructing closed surfaces with prescribed mean curvature vector, admitting prescribed topology and controlled Morse index in general n-dimensional compact Riemannian manifold remains elusive. In this talk, we will outline our recent advancements in the existence theory for PMC spheres with arbitrary codimensions, contributing to a supplement of such area. This talk is based on the joint work with Prof. Miaomiao Zhu.

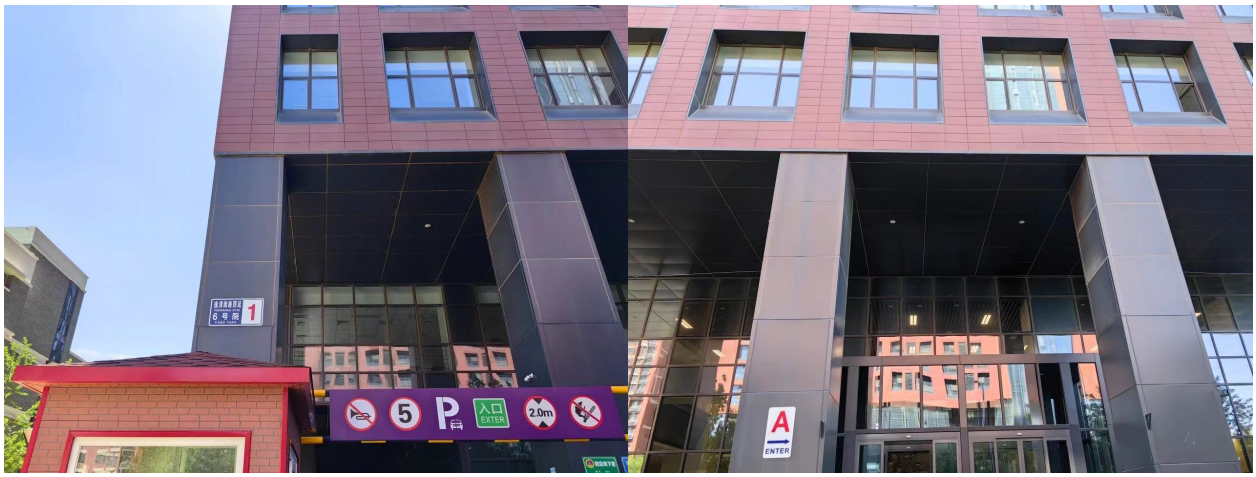
Useful Information

A Guide to Shuangqing Complex Building A



To commute between Jingzhai 静斋/Jiasuo 甲所 and Shuangqing Building, one can go through the **East Gate** or **Northeast Gate**. Please also refer to the campus map page.

Then follow the red path to the Shuangqing Complex Building A (Yau Mathematics Science Center).



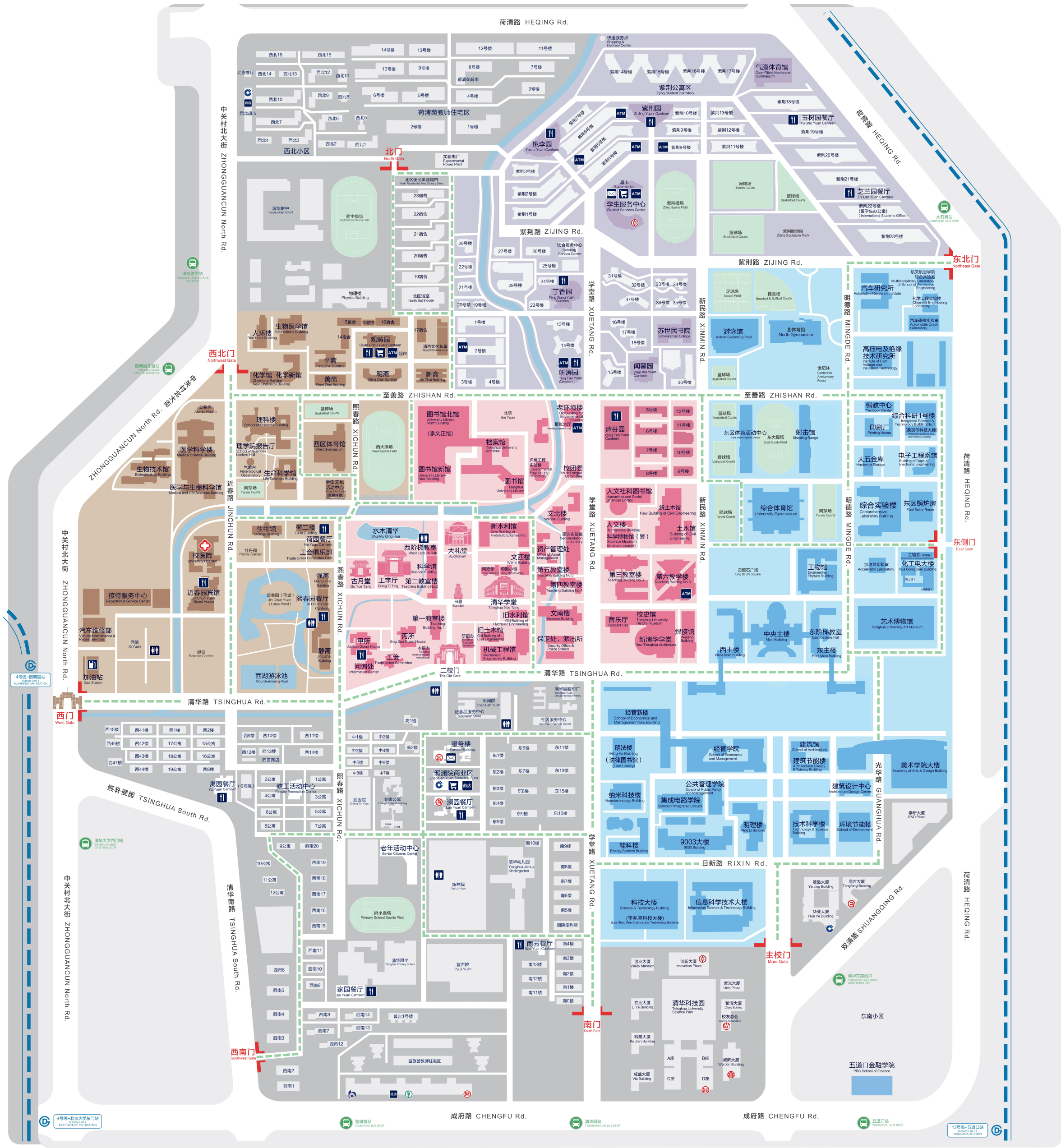
Exterior views of the building.

Address:
双清综合楼A座
北京市海淀区逸清南路西延6号院1号
Shuangqing Complex Building A
No. 1, Courtyard 6, West Extension of Yiqing South Road, Haidian District, Beijing

Remarks:
双清公寓马路对面、清华附小（双清校区）西侧
Across the street from Shuangqing Apartments, on the west side of Tsinghua University Primary School (Shuangqing Campus).

请持有效证件（工作证、学生证）进入。访问人员请携带身份证/护照。
Please enter with valid identification (work ID, student ID). Visitors should bring their ID card/passport.

Campus Map



荷清路 HEQING Rd.
紫荆路 ZIJING Rd.
至善路 ZHISHAN Rd.
清华路 TSINGHUA Rd.
日新路 RIXIN Rd.
成府路 CHENGFU Rd.
学堂路 XUETANG Rd.
新民路 XINMIN Rd.
明德路 MINGDE Rd.
熙春路 XICHUN Rd.
近春路 JINCHUN Rd.
中关村北大街 ZHONGGUANCUN North Rd.
光华路 GUANGHUA Rd.
双清路 SHUANGQING Rd.
清华南路 TSINGHUA South Rd.
北门
西北门
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西门
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