



集美清华 求真淬炼
FOR TRUTH AND BEAUTY

2024数学与物理发展前沿国际会议 暨清华大学丘成桐数学科学中心成立15周年大会

2024 CURRENT DEVELOPMENTS IN MATHEMATICS AND PHYSICS
CELEBRATING THE 15TH ANNIVERSARY OF YAU MATHEMATICAL SCIENCES CENTER

会议手册 HANDBOOK

2024.4.3-4.6



清华大学 丘成桐数学科学中心
Yau Mathematical Sciences Center, Tsinghua University



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2024 CURRENT DEVELOPMENTS IN MATHEMATICS AND PHYSICS
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主办方介绍

About YMSC

清华大学 丘成桐数学科学中心

2024年，清华大学丘成桐数学科学中心迎来十五周年庆典。数学科学中心成立于2009年12月，特聘国际著名数学大师丘成桐先生担任中心主任。作为支持清华大学发展数学学科的重大战略举措，教育部于2014年底同意依托清华大学成立“丘成桐数学科学中心”。笃行不怠、赓续前行，十五年来，数学中心在高端人才引进、杰出人才培养、高水平学术研究和数学学科建设等方面实现了跨越式发展，成为具有重要国际影响力的数学研究中心。

截至目前，数学中心现有81位在职教师，含讲席教授1人，长聘教授24人，长聘副教授13人，准聘助理教授43人，博士后51名以及博士研究生百余名，建成以纯粹数学为核心的“五大领域”和“三个交叉研究方向”的综合性学科布局，共六大科研团队。代数与数论、数学物理以及动力系统与随机分析这三个科研团队，已达到世界顶尖水平。

中心国际一流学者云集，目前在职包括丘成桐、Caucher Birkar、Nicolai Reshetikhin、Akito Futaki等国际知名教授，共有2位菲尔兹奖得主、3位院士、1位美国数学会会士；中青年学者出类拔萃，多人入选国家级人才政策和科研基金支持项目。

集美清华，求真淬炼。清华大学丘成桐数学科学中心、数学科学系、求真书院，与北京雁栖湖应用数学研究院紧密合作，携手构筑高水平数学科学人才培养、学术研究的基地，为清华大学迈向世界一流大学前列和中国数学学科的繁荣发展贡献力量。

Yau Mathematical Sciences Center (YMSC) Tsinghua University

The year 2024 heralds a significant milestone for the YMSC as it celebrates its 15th anniversary. In December 2009, Tsinghua University established the Mathematical Sciences Center, with internationally renowned mathematician Professor Shing-Tung Yau as the director. In late 2014, China's Ministry of Education officially approved the establishment of the YMSC at Tsinghua University. Over fifteen years of development, the YMSC has emerged as a world-class research institute. It has excelled in recruiting prestigious group of faculty members, nurturing a new generation of talented scholars, and spearheading cutting-edge research across various disciplines within the Mathematical Sciences.

Currently, the YMSC has 81 full-time faculty members, 51 postdoctoral researchers, and over 100 undergraduate and PhD students. Mathematical research at YMSC covers five major areas and three interdisciplinary research fields. Notably, of the six pillar research teams, the research teams in Algebra and Number Theory, Mathematical Physics, Dynamical Systems and Random Analysis have achieved remarkable original results that contribute significantly to their respective fields. .

The YMSC boasts internationally renowned scholars, currently working at YMSC including Shing-Tung Yau, Caucher Birkar, Nicolai Reshetikhin, and Akito Futaki. Among these esteemed members, there are two Fields Medalists, three Academicians and one AMS member. Many promising young mathematicians of YMSC have been recognized with various national funds and talent support programs.

The YMSC has collaborated with the Department of Mathematical Sciences, the Qiuzhen College of Tsinghua University, and the Yanqi Lake Beijing Institute of Mathematical Sciences and Application, to build a top platform for mathematical education and research, contributing to Tsinghua University's goal of becoming one of the world-class universities, and promoting the growth and prosperity of the mathematical sciences in China.

主办方介绍 About YMSC

中心主任 Director



丘成桐 Shing-Tung Yau

中心主任 YMSC Director

清华大学讲席教授，中国科学院外籍院士

美国国家科学院院士，美国人文与科学院院士

丘成桐教授开创了数学中极为重要的分支“几何分析”。他解决的卡拉比猜想在数学界和物理学界被称为卡拉比 - 丘空间，不单单是代数几何和数论中的主要工具，也成为高能物理中宇宙的主要模型。他先后获得菲尔兹奖 (Fields Medal)、克拉福德奖 (Crafoord Prize)、沃尔夫奖 (Wolf Prize)、马塞尔·格罗斯曼奖 (Marcel Grossmann Awards)、邵逸夫奖 (The Shaw Prize) 等国际科学大奖。

Shing-Tung Yau, the Chair Professor of Tsinghua University, a Foreign Member of the Chinese Academy of Sciences, a Member of the U.S. National Academy of Sciences, and a Member of the American Academy of Arts and Sciences. He contributed to the fusion of geometry and analysis, now known as geometric analysis. He solved the Calabi conjecture, which led to the concept of the Calabi Yau manifolds, revealing the shape of space from the subatomic world of string theory to the astronomical dimensions of the known universe. His work has had a deep and lasting impact on both mathematics and theoretical physics. He has received the Fields Medal (1982), the Crafoord Prize (1994), the Wolf Prize (2010), the Marcel Grossmann Award (2018), and the Shaw Prize (2023).

关于大会 About the Conference



组织者 Organizers

Caucher Birkar

Tsinghua University

Shiu-Yuen Cheng

The Chinese University of Hong Kong
(Shenzhen)

Kenji Fukaya

Stony Brook University

Tian-Jun Li

University of Minnesota

Kefeng Liu

UCLA & CQUT

Chiu-Chu Melissa Liu

Columbia University

Nicolai Reshetikhin

Tsinghua University

Mu-Tao Wang

Columbia University

Xiaokui Yang

Tsinghua University

Chenglong Yu

Tsinghua University

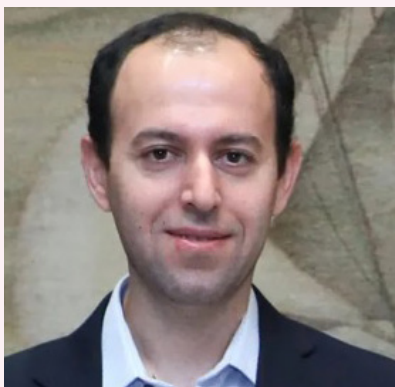
关于大会 About the Conference

报告人 Speakers



Murad Alim

Heriot-Watt University
Edinburgh



Caucher Birkar

Tsinghua University



Huai-Dong Cao

曹怀东
Lehigh University



Qingtao Chen

陈庆陶

Xi'an Jiaotong-Liverpool
University



Chongqing Cheng

程崇庆

Nanjing Normal University



Haibao Duan

段海豹

Academy of Mathematics
and Systems Science, Chinese
Academy of Sciences



Fuquan Fang
方复全

Capital Normal University



Baohua Fu
付保华

Academy of Mathematics
and Systems Science, Chinese
Academy of Sciences



Jixiang Fu
傅吉祥

Fudan University



Akito Futaki

Tsinghua University



Alexander Grigor'yan

University of Bielefeld



Sebastian Heller

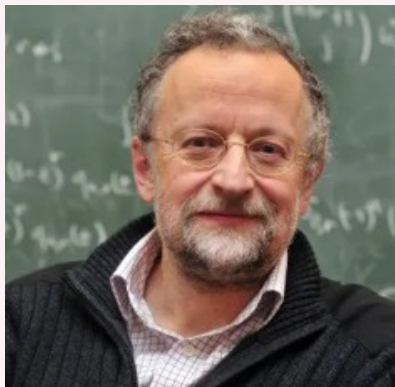
Beijing Institute of
Mathematical Sciences and
Applications

关于大会 About the Conference

报告人 Speakers



Shinobu Hosono
Gakushuin University



Jürgen Jost
Max Planck Institute for
Mathematics in the Sciences



Albrecht Klemm
University of Bonn



Conan Nai Chung Leung
梁迺聪
The Chinese University of
Hong Kong



Si Li
李思
Tsinghua University



Tiexiang Li
李铁香
Southeast University



Yi Li
李逸

Southeast University



Bong H. Lian
连文豪

Brandeis University



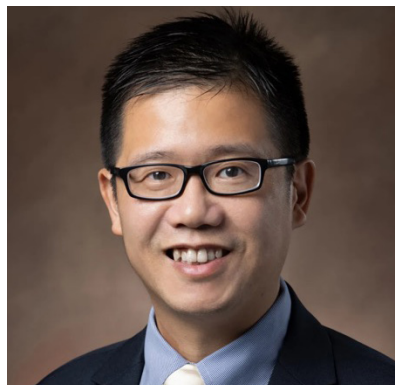
Kefeng Liu
刘克峰

UCLA & CQUT



Eduard Looijenga

University of Chicago



Ronald Lok Ming Lui
雷乐铭

The Chinese University of
Hong Kong



Ngaiming Mok
莫毅明

The University of Hong Kong

关于大会 About the Conference

报告人 Speakers



Nicolai Reshetikhin

Tsinghua University



Rak-Kyeong Seong

Ulsan National Institute of
Science and Technology



Artan Sheshmani

Beijing Institute of
Mathematical Sciences and
Applications



Yuguang Shi

史宇光

Peking University



Wei Song

宋伟

Tsinghua University



Binyong Sun

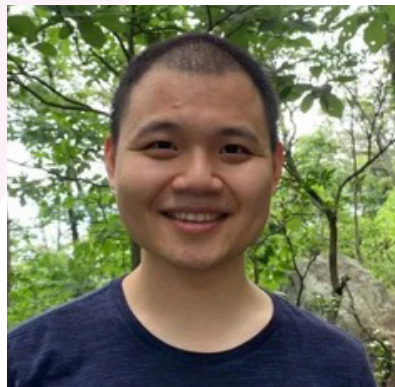
孙斌勇

Zhejiang University



Ye Tian
田野

Academy of Mathematics
and Systems Science, Chinese
Academy of Sciences



Freid Tong

Harvard University



Vadim Vologodsky

Princeton University



Zhouping Xin
辛周平

The Chinese University of
Hong Kong



Zhigang Yao
姚志刚

National University of
Singapore



Stephen Shing-Toung Yau
丘成栋

Tsinghua University

关于大会 About the Conference

报告人 Speakers



Eric Zaslow

Northwestern University



Weiping Zhang

张伟平

Nankai University



Fangyang Zheng

郑方阳

Chongqing Normal University



Xiangyu Zhou

周向宇

Academy of Mathematics
and Systems Science, Chinese
Academy of Sciences



Xiping Zhu

朱熹平

Sun Yat-sen University

特别报告 报告人 Special Lecture Speakers



Rongling Wu
邬荣领

Beijing Institute of
Mathematical Sciences and
Applications



Stephen T. C. Wong

Houston Methodist Hospital

会议日程 Agenda

总体日程 Schedule

会议时间: 2024年4月3日至4月6日

Time: 3rd - 6th, April 2024

会议地点: 清华大学主楼后厅

Venue: Lecture Hall, First Floor of the Main Building, Tsinghua University

Zoom Meeting ID: 4552601552 **Passcode:** YMSC

4月3日 星期三 April 3 (Wednesday)

- 09:00 • 开幕式 Opening Ceremony
- 10:20-11:40 • 学术报告 Lecture
- 13:30-17:20 • 学术报告 Lecture
- 17:30-18:30 • 特别报告 Special Lecture

4月4日 星期四 April 4 (Thursday)

- 09:00-16:50 • 学术报告 Lecture
- 18:30-20:30 • 欢迎晚宴 Banquet

4月5日 星期五 April 5 (Friday)

- 09:00-17:20 • 学术报告 Lecture
- 19:00-20:00 • 特别报告 Special Lecture

4月6日 星期六 April 6 (Saturday)

- 09:00-15:30 • 学术报告 Lecture

学术报告 Academic Program



集美清华 求真淬炼
FOR TRUTH AND BEAUTY

4月3日 April 3
星期三 Wednesday

时间 Time		
09:00-10:00	开幕式 Opening Ceremony	
10:00-10:20	合影 Group Photo	
10:20-10:50	Numbers and geometry Caucher Birkar	Host Shing-Tung Yau
10:50-11:10	Coffee Break 茶歇	
11:10-11:40	A Thurstonian approach to the diffeomorphism group of a 4-manifold Eduard Looijenga	Host Shing-Tung Yau
11:50-13:20	Lunch 午餐 玉树园餐厅 Yu Shu Yuan Canteen	
13:30-14:00	From holomorphic isometries to uniformization problems for subvarieties on quotients of bounded symmetric domains Ngaiming Mok 莫毅明	Host Xiping Zhu
14:00-14:30	Logarithmic vanishing theorems on compact Kahler manifolds Kefeng Liu 刘克峰	Host Xiping Zhu
14:30-15:00	Non-compact manifolds with positive scalar curvature Yuguang Shi 史宇光	Host Xiping Zhu
15:00-15:20	Coffee Break 茶歇	
15:20-15:50	Homological mirror symmetry for singular Calabi-Yau varieties, and GLSM Bong H. Lian 连文豪	Host Yuguang Shi
15:50-16:20	Quantization and Index Theory Si Li 李思	Host Yuguang Shi
16:20-16:50	From Gromov-Witten to Donaldson-Thomas invariants via resurgence Murad Alim	Host Yuguang Shi
16:50-17:20	Asymptotic symmetries from the string worldsheet Wei Song 宋伟	Host Yuguang Shi
17:30-18:30	Special Lecture 特别报告 The Statistical Foundation of Artificial Intelligence Rongling Wu 邬荣领	
18:40-20:00	Dinner 晚餐 玉树园餐厅 Yu Shu Yuan Canteen	

学术报告 Academic Program

4月4日 April 4

星期四 Thursday

时间 Time		
09:00-09:30	Asymptotics of analytic torsion Weiping Zhang 张伟平	Host Kefeng Liu
09:30-10:00	Hybrid quantum systems Nicolai Reshetikhin	Host Kefeng Liu
10:00-10:30	Analysis on fractal spaces and heat kernels Alexander Grigor'yan	Host Kefeng Liu
10:30-10:50	Coffee Break 茶歇	
10:50-11:20	On the Prandtl's Boundary Layer Theory for Steady Sink-Type Flows Zhouping Xin 辛周平	Host Bing-Long Chen
11:20-11:50	Spectral theory of hypergraphs and simplicial complexes Jürgen Jost	Host Bing-Long Chen
11:50-13:20	Lunch 午餐 玉树园餐厅 Yu Shu Yuan Canteen	
13:30-14:00	L^2 estimates for $\bar{\partial}$-equation and geometry of holomorphic vector bundles Xiangyu Zhou 周向宇	Host Weiping Zhang
14:00-14:30	Boundary Regularity of Harmonic Maps between Singular Spaces Xiping Zhu 朱熹平	Host Weiping Zhang
14:30-15:00	Locally Chern homogeneous manifolds Fangyang Zheng 郑方阳	Host Weiping Zhang
15:00-15:20	Coffee Break 茶歇	
15:20-15:50	Hodge Laplacian and geometry of Kuranishi family of Fano manifolds Akito Futaki	Host Hao Xu
15:50-16:20	Mirror symmetry from the moduli spaces of Calabi-Yau manifolds Shinobu Hosono	Host Hao Xu
16:20-16:50	Recent progress of various Volume Conjectures Qingtao Chen 陈庆陶	Host Hao Xu
18:30-20:30	晚宴 Banquet (仅报告人、受邀嘉宾 Invited Only) 文津国际酒店五层阳光厅 Yang Guang Hall, Fifth Floor of Wenjin International Hotel	

学术报告 Academic Program



集美清华 求真淬炼
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4月5日 April 5
星期五 Friday

时间 Time		
09:00-09:30	Calabi-Yau period motives in quantum field theory and general relativity Albrecht Klemm	Host Melissa Liu
09:30-10:00	From Legendrians to Wavefunctions Eric Zaslow	Host Melissa Liu
10:00-10:30	Higher order Jacobian matrix theory Stephen Yau 丘成栋	Host Melissa Liu
10:30-10:50	Coffee Break 茶歇	
10:50-11:20	Geometry of 4-dimensional gradient Ricci solitons Huai-Dong Cao 曹怀东	Host Fangyang Zheng
11:20-11:50	A flow of the LYZ (dHYM) equation Jixiang Fu 傅吉祥	Host Fangyang Zheng
11:50-13:20	Lunch 午餐 玉树园餐厅 Yu Shu Yuan Canteen	
13:30-14:00	Distribution on achirality Ye Tian 田野	Host Nicolai Reshetikhin
14:00-14:30	Geometry of special nilpotent orbits Baohua Fu 付保华	Host Nicolai Reshetikhin
14:30-15:00	Crystalline periodic cyclic homology Vadim Vologodsky	Host Nicolai Reshetikhin
15:00-15:20	Coffee Break 茶歇	
15:20-15:50	Manifold Fitting -An Invitation to Statistics Zhigang Yao 姚志刚	Host Yuhong Yang
15:50-16:20	From Computational Quasiconformal Geometry to Deep Learning for Imaging Ronald Lok Ming Lui 雷乐铭	Host Yuhong Yang
16:20-16:50	Fast Algorithm and Electromagnetic Field Behavior of 3D Photonic Crystals Tiexiang Li 李铁香	Host Yuhong Yang
16:50-17:20	Mapping the Phase Space of toric Calabi-Yau 3-folds using Explainable Machine Learning Rak-Kyeong Seong	Host Yuhong Yang
17:30-18:40	Dinner 晚餐 玉树园餐厅 Yu Shu Yuan Canteen	
19:00-20:00	Special Lecture 特别报告 人工智能在医学中的变革性应用：药物靶向受疾病影响的微环境及自动化中风检测、诊断和治疗 Transformative Applications of Artificial Intelligence in Medicine: Drug targeting Disease-affected Microenvironments and Automated Stroke Detection, Diagnosis, and Treatment Stephen T.C. Wong	

学术报告 Academic Program

4月6日 April 6

星期六 Saturday

时间 Time		
09:00-09:30	Bazaikin spaces Fuquan Fang 方复全	Host Huai-Dong Cao
09:30-10:00	Special unipotent representations of classical Lie groups Binyong Sun 孙斌勇	Host Huai-Dong Cao
10:00-10:30	Equivariant Lagrangian correspondences and application Conan Nai Chung Leung 梁迺聪	Host Huai-Dong Cao
10:30-10:50	Coffee Break 茶歇	
10:50-11:20	Searching for hyperbolic orbits by minimizing the action Chongqing Cheng 程崇庆	Host Ji-Xiang Fu
11:20-11:50	Monge-Ampere equations and complete Calabi-Yau metrics Freid Tong	Host Ji-Xiang Fu
11:50-13:20	Lunch 午餐 玉树园餐厅 Yu Shu Yuan Canteen	
13:30-14:00	Make Schubert calculus calculable Haibao Duan 段海豹	Host Entao Zhao
14:00-14:30	Scalar curvatures of some geometric flows Yi Li 李逸	Host Entao Zhao
14:30-15:00	Minimal surfaces, WZW and multiple zeta values Sebastian Heller	Host Entao Zhao
15:00-15:30	BV differentials and Derived Lagrangian intersections in moduli spaces of surfaces on Fano and CY threefolds Artan Sheshmani	Host Entao Zhao
17:00-18:00	Dinner 晚餐 玉树园餐厅 Yu Shu Yuan Canteen	

题目与摘要

Title and Abstract



Numbers and geometry

🕒 April 3 (Wednesday)
10:20-10:50

👤 **Caucher Birkar**
Tsinghua University

👤 主持人 Host
Shing-Tung Yau

Abstract: In this talk I will explain some interesting connections between finite sets of integer numbers and different kinds of geometries.

A Thurstonian approach to the diffeomorphism group of a 4-manifold

🕒 April 3 (Wednesday)
11:10-11:40

👤 **Eduard Looijenga**
University of Chicago

👤 主持人 Host
Shing-Tung Yau

Abstract: In the 1970s Thurston showed that a mapping class of oriented surface of finite type is naturally represented by a distinguished conjugacy class of (almost) diffeomorphisms. This gave in particular a classification of these mapping classes. This has not an interesting generalization to dimension 3 (mainly because of the work of Thurston himself), but as we will see, the situation is different in dimension 4, especially when the 4-manifold underlies a complex surface. The work I'll describe here is joint with Benson Farb.

题目与摘要

Title and Abstract

From holomorphic isometries to uniformization problems for subvarieties on quotients of bounded symmetric domains

🕒 April 3 (Wednesday)
13:30-14:00

👤 **Ngaiming Mok 莫毅明**
The University of Hong Kong

👤 主持人 Host
Xiping Zhu

Abstract Consider a Kähler manifold (X, g) . When g can be expanded in power series, in his seminal work on holomorphic isometries Eugenio Calabi introduced the notion of the *diastasis* and proved powerful extension theorems on holomorphic isometries from Kähler manifolds into space forms such as the projective space equipped with the Fubini-Study metric. On a bounded domain $U \Subset \mathbb{C}^n$ we denote by ds_U^2 the Bergman metric on U (which is Kähler). Among bounded domains there are the bounded symmetric domains Ω classified by Élie Cartan such that (Ω, ds_Ω^2) are symmetric in the sense of Riemannian geometry, $\Omega = G/K$ in standard notation. Here $\Omega \Subset \mathbb{C}^n$ in their standard realizations are semi-algebraic, i.e., defined by algebraic inequalities in the $2n$ real Euclidean coordinates underlying $\mathbb{C}^n \cong \mathbb{R}^{2n}$. By an irreducible algebraic subvariety of Ω we mean an irreducible component of the intersection $V \cap \Omega$ of an affine algebraic subvariety $V \subset \mathbb{C}^n$ with the bounded symmetric domain $\Omega \Subset \mathbb{C}^n$. In this lecture I will explain: (1) *how the study of holomorphic isometries between bounded domains was motivated by problems in arithmetic dynamics*, (2) *how their solutions were generalized to yield algebraicity results for holomorphic isometries with respect to the Bergman metric*, (3) *how the study of the asymptotic behavior of holomorphic isometries of the Poincaré disk led to a uniformization theorem for projective varieties covered by algebraic subvarieties of Ω* , and (4) *how the latter serves as a starting point for research in functional transcendence theory concerning $X_\Gamma = \Omega/\Gamma$, where $\Gamma \subset G$ is an arbitrary lattice*.

Logarithmic vanishing theorems on compact Kahler manifolds

🕒 April 3 (Wednesday)
14:00-14:30

👤 **Kefeng Liu 刘克峰**
UCLA & CQUT

👤 主持人 Host
Xiping Zhu

Abstract: I will discuss joint work with C.-L. Huang, X.-Y. Wan and X.-K. Yang about a number of new vanishing theorems for sheaves of logarithmic differential sheaves on compact Kahler manifolds with simple normal crossing divisors which generalize various classical vanishing theorems.

Non-compact manifolds with positive scalar curvature

🕒 April 3 (Wednesday)
14:30-15:00

👤 **Yuguang Shi 史宇光**
Peking University

👤 主持人 Host
Xiping Zhu

Abstract: The talk consists of two parts. In the first part of the talk, I will discuss a kind of open manifolds carries no complete positive scalar curvature metric, and in the second part of the talk, I will discuss Llarull type theorems on complete manifolds with positive scalar curvature. The talk based on my recent joint works with T.Hao, Y.Sun, R.Wu, J.Wang and J.Zhu.

Homological mirror symmetry for singular Calabi-Yau varieties, and GLSM

🕒 April 3 (Wednesday)
15:20-15:50

👤 **Bong H. Lian 连文豪**
Brandeis University

👤 主持人 Host
Yuguang Shi

Abstract: I will describe some progress toward understanding HMS for a new class of singular CY mirror pairs. In earlier joint works with S. Hosono, T.J. Lee, H. Takagi and S.-T. Yau, we found a new class of mirror pairs given double covers of toric manifolds branched over a certain special configurations of divisors. We now propose a categorical version of this by using the idea of non-commutative resolutions. The latter are realized by certain GLSM theories. This is based on joint work, some still on-going, with T.J. Lee, M. Romo and L. Santilli.

题目与摘要

Title and Abstract

Quantization and Index Theory

🕒 April 3 (Wednesday)
15:50-16:20

👤 **Si Li 李思**
Tsinghua University

👤 主持人 Host
Yuguang Shi

Abstract: We discuss some basic ideas and various recent mathematical developments on the connection between quantization that arises from topological/chiral field theory and index type theorem. We illustrate renormalization group flow as a version of Hochschild-Kostant-Rosenberg theorem. This comparison reveals a connection between elliptic chiral homology and a chiral analogue of algebraic index theory.

From Gromov-Witten to Donaldson-Thomas invariants via resurgence

🕒 April 3 (Wednesday)
16:20-16:50

👤 **Murad Alim**
Heriot-Watt University Edinburgh

👤 主持人 Host
Yuguang Shi

Abstract: The generating function of higher genus Gromov-Witten invariants of Calabi-Yau threefolds can be computed by topological string theory and is given by an asymptotic series in the topological string coupling. I will discuss how a piecewise analytic function in the string coupling can be obtained from this series via resurgence analysis and how Donaldson-Thomas invariants of the same geometry can be obtained from the corresponding Stokes factors. This is based on various joint works with Lotte Hollands, Arpan Saha, Iván Tulli and Jörg Teschner as well as on work in progress.

Asymptotic symmetries from the string worldsheet

🕒 April 3 (Wednesday)
16:50-17:20

👤 **Wei Song 宋伟**
Tsinghua University

👤 主持人 Host
Yuguang Shi

Abstract: Asymptotic symmetry plays an essential role in bottom-up holography. Asymptotic symmetry plays an essential role in bottom-up holography. Asymptotic symmetry plays an essential role in bottom-up holography. Symmetry has been a guiding principle in modern theoretical physics. In particular, the study of asymptotic symmetry is very useful in setting up holographic dualities in the bottom-up approach. In this talk, I will try to answer the following question: how can we find the asymptotic symmetries from string theory? We will study several examples including string theory on the backgrounds of AdS3 with NS-NS flux, flat spacetime, and the TsT/TTbar correspondence.

The Statistical Foundation of Artificial Intelligence

🕒 April 3 (Wednesday)
17:30-18:30


👤 **Rongling Wu 邬荣领**
Beijing Institute of Mathematical Sciences and Applications

Abstract: Artificial intelligence (AI) is profoundly impacting science and society by applying algorithms and machine learning to enable machines to perform humanlike tasks. As a branch of mathematics to collect, analyze, interpret, display, and organize data, statistics is the theoretical core of AI to improve performance and accuracy. In this talk, I will present several state-of-the-art statistical methods that have been widely used in Alacross various fields. My team attempts to develop statistically principled reasoning and theory to validate the application of AI and enhance its interpretability and sustainability. Our approach builds on statistical mechanics theory and methodology derived from interdisciplinary integration. I will illustrate the methodology with a wide range of applications.

题目与摘要

Title and Abstract

Asymptotics of analytic torsion


 April 4 (Thursday)
09:00-09:30


 **Weiping Zhang 张伟平**
Nankai University

 主持人 Host
Kefeng Liu

Abstract: We will describe a joint work with Bismut and Xiaonan Ma on the asymptotics of the (real) Ray-Singer analytic torsion. The pioneering work in the Thesis of Gang Tian on the asymptotics of Bergman kernel, supervised by Professor Yau, plays an important role in this work.

Hybrid quantum systems


 April 4 (Thursday)
09:30-10:00


 **Nicolai Reshetikhin**
Tsinghua University

 主持人 Host
Kefeng Liu

Abstract: A hybrid quantum system consists of a classical Hamiltonian system that "drives" a quantum system. Quantum system does not affect the classical system. In physics examples of such systems are known as the Born-Oppenheimer approximation. The talk will start with the description of the mathematical framework for such systems. Then integrable hybrid systems will be defined. An example of a hybrid integrable system is the spin Calogero-Moser system will be described and its relation to dynamical Haldane-Shastry models will be explained.

Analysis on fractal spaces and heat kernels

 April 4 (Thursday)
10:00-10:30

 **Alexander Grigor'yan**
Univeristy of Bielefeld

 主持人 Host
Kefeng Liu

Abstract: We discuss elements of Analysis on Ahlfors-regular metric spaces (in particular, on fractals) from the point of view on the notion of heat kernel. Such spaces are characterized by two parameters: the Hausdorff dimension and the walk dimension, where the latter determines the space/time scaling for a diffusion process. We present also the characterization of the walk dimension via Besov function spaces. We also discuss heat kernel bounds for diffusion and jump processes on such spaces.

On the Prandtl's Boundary Layer Theory for Steady Sink-Type Flows

🕒 April 4 (Thursday)
10:50-11:20

👤 **Zhouping Xin 辛周平**
The Chinese University of
Hong Kong

👤 主持人 Host
Bing-Long Chen

Abstract: In this talk, I will present some results on the large Reynolds number limits and asymptotic behaviors of solutions to the steady incompressible Navier-Stokes equations in two-dimensional infinitely long convergent nozzles. The main results show that the Prandtl's laminar boundary layer theory can be rigorously established and the sink-type Euler flow superposed with a self-similar Prandtl's boundary layer flow is shown to be uniformly structurally stable as long as the viscous flow has a given negative mass flux and the boundaries of the nozzle satisfy a curvature decreasing condition. Furthermore, the asymptotic behaviors of the solutions at both the vertex and infinity can be determined uniquely which plays a key role in the stability analysis. Some of key ideas in the theory will be discussed. This talk is based on a joint work with Dr. Chen Gao.

Spectral theory of hypergraphs and simplicial complexes

🕒 April 4 (Thursday)
11:20-11:50

👤 **Jürgen Jost**
Max Planck Institute for
Mathematics in the Sciences

👤 主持人 Host
Bing-Long Chen

Abstract: Motivated by a wide range of applications, from chemistry, social networks, pattern formation and computer science, we develop the spectral theory of oriented hypergraphs and simplicial complexes. Among other results, a Cheeger type inequality for simplicial complexes will be presented.

题目与摘要

Title and Abstract

L^2 estimates for $\bar{\partial}$ -equation and geometry of holomorphic vector bundles

🕒 April 4 (Thursday)
13:30-14:00

👤 **Xiangyu Zhou 周向宇**
Academy of Mathematics
and Systems Science, Chinese
Academy of Sciences

👤 主持人 Host
Weiping Zhang

Abstract: In this talk, we'll present our recent result on characterizing Nakano positivity via solving $\bar{\partial}$ -equations with L^2 estimates (established by Deng-Ning-Wang-Zhou). As an application, we give a solution of Lempert's problem, which asked whether the limit metric of an increasing sequence of hermitian metrics of Nakano semi-positive curvature on holomorphic vector bundles is still Nakano semi-positive.

Boundary Regularity of Harmonic Maps between Singular Spaces

🕒 April 4 (Thursday)
14:00-14:30

👤 **Xiping Zhu 朱熹平**
Sun Yat-sen University

👤 主持人 Host
Weiping Zhang

Abstract: Regularity of geometric elliptic equations is one of main themes in geometric analysis. M. Gromov and R. Schoen in 1992 initiated to study of the theory of harmonic maps into Riemannian simplicial complexes with non-positive curvature. Subsequently, N. Koveraar, R. Schoen, J. Jost and F.-H. Lin extended this theory to general metric spaces. A typical regularity result states that harmonic maps from an Alexandrov space with curvature bounded from below to a CAT(0)-space must be Holder continuous. In 2018, we proved the harmonic maps are actually Lipschitz continuous, which answered a question proposed by Jost and Lin. Recently, A. Mondino and D. Semola and N. Gigli extended the Lipschitz regularity to the case that the domain is an RCD spaces (i.e. metric measure space with synthetic lower bounds on the Ricci curvature). In this talk, I will report our recent results on boundary regularity for harmonic maps on RCD spaces. This is a joint work with Hui-Chun Zhang.

Locally Chern homogeneous manifolds

🕒 April 4 (Thursday)
14:30-15:00

👤 **Fangyang Zheng 郑方阳**
Chongqing Normal University

👤 主持人 Host
Weiping Zhang

Abstract: In this talk we will discuss a special type of compact Hermitian manifolds, whose Chern connection has parallel torsion and curvature. We will show that such manifolds must be either Kahler (hence locally Hermitian symmetric) or Chern flat. The same question can be asked for other canonical metric connections, where we only have partial answers.

Hodge Laplacian and geometry of Kuranishi family of Fano manifolds

🕒 April 4 (Thursday)
15:20-15:50

👤 **Akito Futaki**
Tsinghua University

👤 主持人 Host
Hao Xu

Abstract: We study the geometry of Kuranishi family of deformations of Fano manifolds. We first show, using the Bochner-Kodaira formula, that the Kaehler form remains to be a Kaehler form under small deformations. We then obtain the Ricci potential formula, and study the deformations of Fano manifolds with weighted solitons. Partly based on a joint work with X.F. Sun and Y.Y. Zhang.

Mirror symmetry from the moduli spaces of Calabi-Yau manifolds

🕒 April 4 (Thursday)
15:50-16:20

👤 **Shinobu Hosono**
Gakushuin University

👤 主持人 Host
Hao Xu

Abstract: The moduli spaces of Calabi-Yau threefolds are complicated objects although we know that they admit local parameters due to the Bogomolov-Tian-Todorov theorem. Since its discovery in the 90s, mirror symmetry of Calabi-Yau manifolds has been motivating us to study the moduli spaces of Calabi-Yau threefolds globally. In this talk, based on my collaborations with Hiromichi Takagi, I will show interesting an example of Calabi-Yau threefolds where we can observe the birational geometry and also Fourier-Mukai partners of mirror Calabi-Yau manifolds from the global descriptions of the moduli spaces. I will also focus on some modular properties for the potential functions of the higher genus Gromov-Witten invariants.

题目与摘要

Title and Abstract

Recent progress of various Volume Conjectures


🕒 April 4 (Thursday)
16:20-16:50

👤 **Qingtao Chen 陈庆陶**
Xi'an Jiaotong-Liverpool University

👤 主持人 Host
Hao Xu

Abstract: The original Volume Conjecture of Kashaev-Murakami-Murakami predicts a precise relation between the asymptotics of the colored Jones polynomials of a knot in S^3 and the hyperbolic volume of its complement. I will first discuss two different directions that lead to generalizations of this conjecture. The first direction concerns different quantum invariants of knots, arising from the colored $SU(n)$ (with the colored Jones polynomial corresponding to the case $n = 2$). I will first display subtle relations between congruence relations (joint work with K. Liu, P. Peng and S. Zhu), cyclotomic expansions and the original Volume Conjecture for colored Jones polynomials of knots. I will then generalize this point of view to the colored $SU(n)$ invariant of knots. Certain congruence relations for colored $SU(n)$ invariants lead us to formulate cyclotomic expansions and a Volume Conjecture for these colored $SU(n)$ invariants and we also proved the case of the figure eight knot, which is a joint work with K. Liu and S. Zhu in 2015. In 2021, we proved cyclotomic expansion for the colored $SU(n)$ invariants of double twist knots which is also a joint with K. Liu and S. Zhu. I will also discuss similar ideas for the superpolynomials that arise in HOMFLY-PT homology. In fact, I proposed cyclotomic expansion conjectures and Volume conjectures for superpolynomials. Another direction for generalization involves the Witten-Reshetikhin-Turaev and the Turaev-Viro quantum invariants of 3-manifolds. In a joint work with T. Yang, we formulated a new Volume Conjecture for the asymptotics of these 3-manifolds invariants evaluated at certain roots of unity, and numerically checked it for many examples. Interestingly, this conjecture uses roots of unity that are different from the one usually considered in literature. This may indicate that the understanding of this new phenomenon requires new physical and geometric interpretations that go beyond the usual quantum Chern-Simons theory. I will also introduce a work on Krillov-Reshetikhin quantum $6j$ -symbols done by J. Murakami & me. Finally I will explain some recent progress on original Volume Conjecture, which is a recent joint work with S. Zhu.

Calabi-Yau period motives in quantum field theory and general relativity


 April 5 (Friday)
09:00-09:30


 **Albrecht Klemm**
University of Bonn

 主持人 Host
Melissa Liu

Abstract: We show that Feynman integrals occurring in standard quantum field theories or perturbative worldline approaches to the scattering of real black holes are related to periods of Calabi-Yau varieties of various dimensions. After defining what mathematical properties a Calabi-Yau period motive has, we explain how the applications of the latter lead to an efficient analytic evaluation of the Feynman integrals in dimensional regularisation.

From Legendrians to Wavefunctions

 April 5 (Friday)
09:30-10:00

 **Eric Zaslow**
Northwestern University

 主持人 Host
Melissa Liu

Abstract: I will summarize constructions and results relating Legendrian surfaces to brane wavefunctions and conjectural connections to enumerative geometry. The approach generalizes seminal work of Aganagic and Vafa, the key being to understand brane moduli, recalling prior work with Yau. This talk is based on previous works with David Nadler, David Treumann, Harold Williams, Vivek Shende, Linhui Shen, Gus Schrader and Mingyuan Hu.

题目与摘要

Title and Abstract

Higher order Jacobian matrix theory

🕒 April 5 (Friday)
10:00-10:30

👤 **Stephen Yau 丘成栋**
Tsinghua University

👤 主持人 Host
Melissa Liu

Abstract: The higher Nash blow-up of an algebraic variety replaces singular points with limits of certain spaces carrying higher order data associated to the variety at non-singular points. Inspired by the higher Nash blow-up, we develop higher order Jacobian matrix theory, a generalization of the Jacobian matrix theory in the usual sense.

This theory has many applications. First of all, we use it to construct many new invariants of isolated singularities, which generalize the Tjurina algebra and the Milnor algebra in singularity theory. Secondly, it provides a method of computing the inverse of an automorphism of formal power series rings, which allows us to solve systems of non-linear equations and explicitly do power series calculations related to the implicit function theorem. Thirdly, it provides a new perspective on the study of finite determinacy of power series rings, from which many useful conclusions emerge. Finally, higher order Jacobian matrix theory gives matrix representations of homomorphisms of formal power series rings and multiplications within one such ring. It should be emphasized that all the operations in this theory can be easily promoted to formal power series rings over integral domains.

All the astonishing applications in this talk are directly from higher order Jacobian matrix theory merely consisting of manual computations, and the novel theory presented herein demonstrates substantial potential for a plethora of applications across diverse branches of mathematics, with the aforementioned four applications representing merely a fraction of the extensive possibilities.

This is a joint work with SHUANGHE FAN, AND HUIQING ZUO.

Geometry of 4-dimensional gradient Ricci solitons

🕒 April 5 (Friday)
10:50-11:20

👤 **Huai-Dong Cao 曹怀东**
Lehigh University

👤 主持人 Host
Fangyang Zheng

Abstract: Ricci solitons are self-similar solutions to Hamilton's Ricci flow and natural extensions of Einstein manifolds. They often arise as singularity models hence play a significant role in the study of Ricci flow. In this talk, I will present some recent progress on 4-dimensional gradient shrinking and steady Ricci solitons, including those with nonnegative or half nonnegative isotropic curvature.

A flow of the LYZ (dHYM) equation

🕒 April 5 (Friday)
11:20-11:50

👤 **Jixiang Fu 傅吉祥**
Fudan University

👤 主持人 Host
Fangyang Zheng

Abstract: We talk about a flow of the LYZ equation on a compact Kahler manifold, including the existence and convergence of its longtime solution, and its application to the degenerate case on a compact Kahler surface. This is a joint work with S.-T. Yau and Dekai Zhang.

Distribution on achirality

🕒 April 5 (Friday)
13:30-14:00

👤 **Ye Tian 田野**
Academy of Mathematics and
Systems Science, Chinese Academy
of Sciences

👤 主持人 Host
Nicolai Reshetikhin

Abstract: For a fixed geometric model, we are concerned with the distribution of commensurable classes containing non-orientable members among classes containing achiral members. For example, in the case of Sol 3-manifolds, it is very close to a distribution problem in number theory. But for hyperbolic 3-manifolds, it has a different pattern. The talk is based on our joint works with Shicheng Wang and Zhongzi Wang, and with Hang Yin.

题目与摘要

Title and Abstract

Geometry of special nilpotent orbits

🕒 April 5 (Friday)
14:00-14:30

👤 **Baohua Fu 付保华**
Academy of Mathematics
and Systems Science, Chinese
Academy of Sciences

👤 主持人 Host
Nicolai Reshetikhin

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

Crystalline periodic cyclic homology

🕒 April 5 (Friday)
14:30-15:00

👤 **Vadim Vologodsky**
Princeton University

👤 主持人 Host
Nicolai Reshetikhin

Abstract: Grothendieck discovered that de Rham cohomology of a smooth projective scheme over the ring of p -adic integers functorially depends on the mod p fiber. In this talk I will describe a similar phenomenon in the context of cyclic homology of a category. Namely, I will explain that the (p -completed) periodic cyclic homology of any differential graded category over \mathbb{Z}_p functorially depends on its reduction modulo p . Our approach is inspired by Bhatt's construction of crystalline cohomology via derived de Rham cohomology.

The talk is based on a joint work with Alexander Petrov.

Manifold Fitting -An Invitation to Statistics

🕒 April 5 (Friday)
15:20-15:50

👤 **Zhigang Yao 姚志刚**
National University of Singapore

👤 主持人 Host
Yuhong Yang

Abstract: While classical statistics has dealt with observations which are real numbers or elements of a real vector space, nowadays many statistical problems of high interest in the sciences deal with the analysis of data which consist of more complex objects, taking values in spaces which are naturally not (Euclidean) vector spaces but which still feature some geometric structure. This manifold fitting problem can go back to H. Whitney's work in the early 1930s (Whitney (1992)), and finally has been answered in recent years by C. Fefferman's works (Fefferman, 2006, 2005). The solution to the Whitney extension problem leads to new insights for data interpolation and inspires the formulation of the Geometric Whitney Problems (Fefferman et al. (2020, 2021a)): Assume that we are given a set $Y \subset \mathbb{R}^D$. When can we construct a smooth d -dimensional submanifold $\widehat{M} \subset \mathbb{R}^D$ to approximate Y , and how well can \widehat{M} estimate Y in terms of distance and smoothness? To address these problems, various mathematical approaches have been proposed (see Fefferman et al. (2016, 2018, 2021b)). However, many of these methods rely on restrictive assumptions, making extending them to efficient and workable algorithms challenging. As the manifold hypothesis (non-Euclidean structure exploration) continues to be a foundational element in statistics, the manifold fitting problem, merits further exploration and discussion within the modern statistical community. Leveraging the generative adversarial framework, our new method learns smooth mappings between low-dimensional latent space and high-dimensional ambient space, echoing the Riemannian exponential and logarithmic maps. The well-trained neural networks provide estimations for the latent manifold, facilitate data projection onto the manifold, and even generate data points that reside directly within the manifold. Through an extensive series of simulation studies and real data experiments, we demonstrate the effectiveness and accuracy of our approach in capturing the inherent structure of the underlying manifold within the ambient space data. Notably, our method exceeds the computational efficiency limitations of previous approaches and offers control over the dimensionality and smoothness of the resulting manifold. This advancement holds significant potential in the fields of statistics and computer science. The seamless integration of powerful neural network architectures with generative adversarial techniques unlocks new possibilities for manifold fitting, thereby enhancing data analysis. The implications of our findings span diverse applications, from dimensionality reduction and data visualization to generating authentic data. Collectively, our research paves the way for future advancements in non-linear data analysis and offers a beacon for subsequent scholarly pursuits. This talk is based on some results from the following references:

<https://www.pnas.org/doi/10.1073/pnas.2311436121> (Yao, Su and Yau, 2023),

<https://arxiv.org/abs/2304.07680> (Yao, Su, Li and Yau, 2022)

<https://arxiv.org/abs/1909.10228> (Yao and Xia, 2019).

题目与摘要

Title and Abstract

From Computational Quasiconformal Geometry to Deep Learning for Imaging

🕒 April 5 (Friday)
15:50-16:20

👤 **Ronald Lok Ming Lui 雷乐铭**
The Chinese University of
Hong Kong

👤 主持人 Host
Yuhong Yang

Abstract: Computational Quasiconformal (CQC) Geometry studies deformation patterns between shapes and has found important applications in imaging science, including image registration, analysis, and segmentation. The integration of CQC theories into deep neural networks, leveraging advancements in deep learning techniques, has the potential to enhance the efficiency and accuracy of these imaging tasks even further. In this talk, I will give an overview on how CQC and deep learning can play an important role in image processing. This work is supported by HKRGC GRF.

Fast Algorithm and Electromagnetic Field Behavior of 3D Photonic Crystals

🕒 April 5 (Friday)
16:20-16:50

👤 **Tiexiang Li 李铁香**
Southeast University

👤 主持人 Host
Yuhong Yang

Abstract: Photonic crystals (PhCs) are materials with a periodic dielectric profile, which can prevent light of certain frequencies from propagating in some polarisation directions within the materials, this range of frequencies is called a photonic band-gap. Calculating the band structure of PhCs is an important means to study their optical properties, which is modeled as a frequency domain Maxwell eigenvalue problem. In this work, we study the numerical method for 3D PhCs and the electromagnetic field behavior of 3D chiral PhCs. By employing the intrinsic coordinate system as the oblique basis, we develop a unified discrete framework and a fast algorithm to compute the smallest few positive eigenvalues and corresponding eigenvectors. For 3D chiral media, when the chirality parameter is a critical value, we discover that the electromagnetic fields of the resonance modes are localized inside the structure, with only a slight amount of field leaking into the background dielectric material.

Mapping the Phase Space of toric Calabi-Yau 3-folds using Explainable Machine Learning

🕒 April 5 (Friday)
16:50-17:20

👤 **Rak-Kyeong Seong**
Ulsan National Institute of
Science and Technology

👤 主持人 Host
Yuhong Yang

Abstract: This talk will give a brief introduction on how bipartite graphs on a torus represent 4-dimensional quiver gauge theories and their moduli space which is a toric Calabi-Yau 3-fold - a cone over a Sasaki-Einstein 5-manifold. Under mirror symmetry, the bipartite graph can be identified with the tropical projection of the mirror curve obtained from the Newton polytope associated to the toric Calabi-Yau 3-fold. Changes to the complex structure moduli of the mirror Calabi-Yau determine the overall shape of the bipartite graph on the torus. For certain choices of complex structure moduli, the bipartite graph undergoes a graph mutation which is identified with Seiberg duality of the associated 4-dimensional quiver gauge theory. This graph mutation is also known to be related to mutations in underlying cluster algebras. This talk will discuss recent progress in understanding when such mutations occur from the point of view of Calabi-Yau mirror symmetry with the help of new computational techniques such as machine learning.

Transformative Applications of Artificial Intelligence in Medicine: Drug targeting Disease-affected Microenvironments and Automated Stroke Detection, Diagnosis, and Treatment

🕒 April 5 (Friday)
19:00-20:00

👤 **Stephen T. C. Wong**
Houston Methodist Hospital

Abstract: Artificial intelligence (AI) is poised to revolutionize medical research, education, and clinical practice by harnessing vast, multi-modal data sets, cutting-edge biotechnologies, and unparalleled computational capabilities. Its potential to automate tasks, enhance efficiency, improve access, and foster innovation has already been demonstrated. However, the capacity of AI to tackle complex challenges, which traditionally rely on the nuanced cognitive skills of clinicians and researchers to analyze and interpret extensive, multimodal data at various scales, remains an area of exploration. This presentation explores two pivotal AI applications in medicine: drug discovery focusing on disease-specific microenvironments, and the use of cognitive AI technologies for the comprehensive management of acute stroke, including its detection, diagnosis, and treatment. Through these case studies, we aim to spark insightful discussions on AI's transformative impact on medical research and practice. Furthermore, the success of cognitive automation in healthcare prompts a reevaluation of the roles of physicians, reshaping the patient-doctor dynamic and the overall patient experience.

题目与摘要

Title and Abstract

Bazaikin spaces

🕒 April 6 (Saturday)
09:00-09:30

👤 **Fuquan Fang 方复全**
Capital Normal University

👤 主持人 Host
Huai-Dong Cao

Abstract: Manifolds with positive sectional curvature have been a central object dates back to the beginning of Riemannian geometry. Up to homeomorphism, there are only finitely many examples of simply connected positively curved manifolds in all dimensions except in dimension 7 and 13 , namely, Aloff-Wallach spaces and Eschenburg spaces in dimension 7 , and the Bazaikin spaces in dimension 13 . The topological classification modelled on the 7 -dimensional examples has been carried out by Kreck-Stolz which leads to a complete solution for the Aloff-Wallach spaces. The main goal of this paper is to solve the topological classification of 13 -dimensional manifolds modelled on the Bazaikin spaces.

Special unipotent representations of classical Lie groups

🕒 April 6 (Saturday)
09:30-10:00

👤 **Binyong Sun 孙斌勇**
Zhejiang University

👤 主持人 Host
Huai-Dong Cao

Abstract: Inspired by the study of automorphic forms, Arthur suggested the existence of certain collections of representations of linear real reductive groups. Arthurs desired representations, the special unipotent representations, were defined by Barbasch-Vogan and Adams-Barbasch-Vogan. For classical Lie groups, we construct all the special unipotent representations, by using the theory of local theta correspondence initiated by R. Howe. We also proved that all these representations are unitarizable, as predicted by Arthur-Barbasch-Vogan. This is a report on a joint work with Dan M. Barbarsch, Jia-Jun Ma and Chen-Bo Zhu.

Equivariant Lagrangian correspondences and application

🕒 April 6 (Saturday)
10:00-10:30

👤 **Conan Nai Chung Leung 梁迺聪**
The Chinese University of
Hong Kong

👤 主持人 Host
Huai-Dong Cao

Abstract: I will explain equivariant Lagrangian correspondence tri-module structures and their application to equivariant Floer theory and a conjecture of Teleman. This is a joint work with Siu-Cheong Louis Lau and Yan-Lung Leon Li.

Searching for hyperbolic orbits by minimizing the action

🕒 April 6 (Saturday)
10:50-11:20

👤 **Chongqing Cheng 程崇庆**
Nanjing Normal University


👤 主持人 Host
Ji-Xiang Fu


Abstract: It was discovered by Poincare that minimal closed geodesic on surface is hyperbolic and Birkhoff thought it also holds for Riemannian manifold with higher dimensions. Unfortunately, Birkhoff's conjecture is not true. Nevertheless, Mane made a conjecture that it is generic phenomenon that minimal measure is supported by hyperbolic periodic orbit. In this talk, I shall introduce some recent progress about this topic.

题目与摘要

Title and Abstract

Monge-Ampere equations and complete Calabi-Yau metrics


 April 6 (Saturday)
11:20-11:50


 **Freid Tong**
Harvard University

 主持人 Host
Ji-Xiang Fu

Abstract: I will discuss a new free-boundary problem for a Monge-Ampere equation which arises in the study of complete Calabi-Yau metrics. This is based on joint work with T. Collins and S.-T. Yau.

Make Schubert calculus calculable

 April 6 (Saturday)
13:30-14:00


 **Haibao Duan 段海豹**
Academy of Mathematics
and Systems Science, Chinese
Academy of Sciences

 主持人 Host
Entao Zhao

Abstract: Hilbert's 15th problem called for a rigorous foundation of Schubert calculus, of which a long-standing and challenging part is the Schubert problem of characteristics. In the course of securing a foundation for algebraic geometry, Van der Waerden and A. Weil attributed this problem to the intersection theory of flag manifolds.

This talk surveys the background, content, and solution of the 15th problem. Our main results are a unified formula for the characteristics, and a systematic description of the intersection theory of flag manifolds. We illustrate the effectiveness of the formula and the algorithm by explicit examples.

Scalar curvatures of some geometric flows

 April 6 (Saturday)
14:00-14:30

 **Yi Li 李逸**
Southeast University

 主持人 Host
Entao Zhao

Abstract: This is a survey on scalar curvatures of three kinds of Ricci-type flows.

Minimal surfaces, WZW and multiple zeta values

🕒 April 6 (Saturday)
14:30-15:00

👤 **Sebastian Heller**
Beijing Institute of Mathematical
Sciences and Applications

👤 主持人 Host
Entao Zhao

Abstract: Minimal surfaces are critical points of the area functional. In my talk, I will explain how minimal surfaces in the 3-sphere can be described using monodromy data. For examples like the Lawson and Karcher-Pinkall-Sterling surfaces, these monodromy data lead to families of Fuchsian systems whose coefficients can be computed iteratively in terms of (alternating) multiple zeta values like $\zeta(3)$. I will explain how to extract geometric quantities like the area and the enclosed volume from the monodromy data by using the Chern-Simons line bundle on the moduli space of flat connections. As an application of our approach, the areas of the Lawson surfaces $\xi_{1,g}$ are shown to be strictly monotonic in their genus g . This talk is based on joint work with S. Charlton, L. Heller and M. Traizet.

BV differentials and Derived Lagrangian intersections in moduli spaces of surfaces on Fano and CY threefolds

🕒 April 6 (Saturday)
15:00-15:30

👤 **Artan Sheshmani**
Beijing Institute of Mathematical
Sciences and Applications

👤 主持人 Host
Entao Zhao

Abstract: We elaborate on construction of a derived Lagrangian intersection theory on moduli spaces of divisors on compact Calabi Yau threefolds. Our goal is to compute deformation invariants associated to a fixed linear system of divisors in CY3. We degenerate the CY3 into a normal crossing singular variety composed of Fano threefolds meeting along a K3. The deformation invariance arguments, together with derived Lagrangian intersection counts over the special fiber of the induced moduli space degeneration family, provides one with invariants of the generic CY fiber.

会务信息 Conference Service Information

注册信息 Registration

报到时间

2024年4月3日(星期三) 上午 8:30-11:30

2024年4月4日(星期四) 上午 8:30-11:30

报到地点

清华大学主楼一层

备注: 注册发放会议资料含胸牌、会议手册等, 并收集报销所需材料。

Time

April 3rd, 2024 8:30-11:30am (Wed.)

April 4th, 2024 8:30-11:30am (Thur.)

Location

first floor, the Main Building of Tsinghua University

Remarks: Distributing conference materials, including badges, conference manuals, collecting materials required for reimbursement, etc..

酒店信息 Hotel Information

酒店信息

酒店名称	酒店地址	电话
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清华大学甲所宾馆	双清路 30 号清华大学校内工字厅南侧	010-62784943

酒店费用说明

酒店房费说明 公付房费的参会人，住宿日期超过会期（4月2日至4月7日），需自付超出部分房费。在酒店所产生的餐费、房杂费，洗衣费、房间食品等额外费用，需自付。

酒店入住及退房政策 **文津国际酒店：** 退房时间可延迟到退房当日 14:00，14:00 ~ 18:00 退房加收半天房费，超过 18:00 退房加收一天房费。

清华大学甲所宾馆： 退房时间为退房当日 12:00，12:00 ~ 18:00 退房加收半天房费，超过 18:00 退房加收一天房费。

Hotel Information

Hotel	Address	Phone
Wenjin International Hotel	Building 5, No.1 Courtyard, Zhongguancun East Road, Haidian District, Beijing	010-62525566
Jia Suo Hotel	30 Shuangqing Road, Tsinghua University	010-62784943

Notes

Room rates For the participants whose room rates are paid by the organizer, the organizer only pays the room rates from April 2rd to April 7th(not including postpone room fees). The expenses for meals and laundry as well as the incidental expenses and extra consumption in the hotels shall be paid by the participants themselves.

Check-in/out policies **Wenjin International Hotel:** The check-out time can be postponed to 14:00 on the check-out day, and half-day room rate will be charged for checking-out at 14:00-18:00 and 1-day room rate for checking-out after 18:00.

Jia Suo Hotel: The check-out time of this hotel is 12:00. If the check-out needs to be postponed, additional half-day room rate will be charged before 18:00, and full-day room rate after 18:00.

会务信息

Conference Service Information

餐饮安排 Catering

- 4月3日至6日** 早餐 由所在酒店提供。
- 4月3日至6日** 午餐和晚餐 (4月4日晚除外), 报告人和邀请参会人集中在清华大学玉树园餐厅用餐, 凭胸牌就餐。
- 4月4日晚** 不参加晚宴的参会人晚餐自行安排, 可以在熙春园、甲所、观畴园三层就餐, 可使用现金 / 支付宝 / 微信 / 支付。
- 欢迎晚宴** 4月4日 18:30, 欢迎晚宴 (**仅受邀嘉宾**)
晚宴地点: 文津酒店五层阳光宴会厅。

参会期间均需凭胸牌到指定地点用餐, 请随身携带胸牌, 其他时间用餐, 请自行解决。

- 3rd-6th April, 2024** Breakfasts, Provided by the hotels.
- 3rd-6th April, 2024** Lunches and Dinners (except 4 April Banquet) will be provided by Yu Shu Yuan Canteen of Tsinghua University for speakers and invited attendees.
- 4th April, 2024** Welcome Banquet (**Only for invited guests**)
Banquet Venue: Yang Guang Hall on the fifth floor of Wenjin International Hotel.

*During the conference, you are required to bring your badge and meal vouchers to the designated location for dining. For dining at other times, please handle it yourself.

车辆信息 Transportation

主办方根据会议日程安排车辆接送, 具体信息如下:

The organizer arranges shuttle buses for conference attendees, the bus schedule is typo, as follows:

4月3日—4月6日

- 08:30** 文津国际酒店 → 清华大学主楼
- 11:50** 清华大学主楼 → 玉树园餐厅
- 13:10** 玉树园餐厅 → 清华大学主楼

4月3日晚

- 18:40** 清华大学主楼 → 文津国际酒店、玉树园餐厅
- 20:00** 玉树园餐厅 → 文津国际酒店

4月4日晚

- 17:00** 清华大学主楼 → 文津国际酒店
- 20:40** 文津国际酒店 → 清华大学 / 甲所宾馆

4月5日晚

- 18:40** 玉树园餐厅 → 清华大学主楼, 文津国际酒店
- 20:20** 清华大学主楼 → 文津国际酒店

4月6日晚

- 17:00** 清华大学主楼 → 玉树园餐厅
- 18:00** 玉树园餐厅 → 文津国际酒店

April 3rd - April 6th

- 08:30** Wenjin International Hotel → Main Building of Tsinghua University
- 11:50** Main Building → Yu Shu Yuan Canteen
- 13:10** Yu Shu Yuan Canteen → Main Building

April 3rd

- 18:40** Main Building → Wenjin International Hotel / Yu Shu Yuan Canteen
- 20:00** Yu Shu Yuan Canteen → Wenjin International Hotel

April 4th

- 17:00** Main Building → Wenjin International Hotel
- 20:40** Wenjin International Hotel → Tsinghua University / Jia Suo Hotel

April 5th

- 18:40** Main Building / Wenjin International Hotel → Yu Shu Yuan Canteen
- 20:20** Main Building → Wenjin International Hotel

April 6th

- 17:00** Main Building → Yu Shu Yuan Canteen
- 18:00** Yu Shu Yuan Canteen → Wenjin International Hotel

备注: 会议期间主办方安排车辆到指定地点, 您也可以步行前往。所有车辆有“2024 数学与物理发展前沿国际会议 -- 暨清华大学丘成桐数学中心成立 15 周年大会”标识, 届时有工作人员或志愿者引领, 请佩戴胸牌。

Note: All shuttle buses are marked with a sign of "Current Developments in Mathematics and Physics 2024 — Celebrating 15th Anniversary of Yau Mathematical Sciences Center".

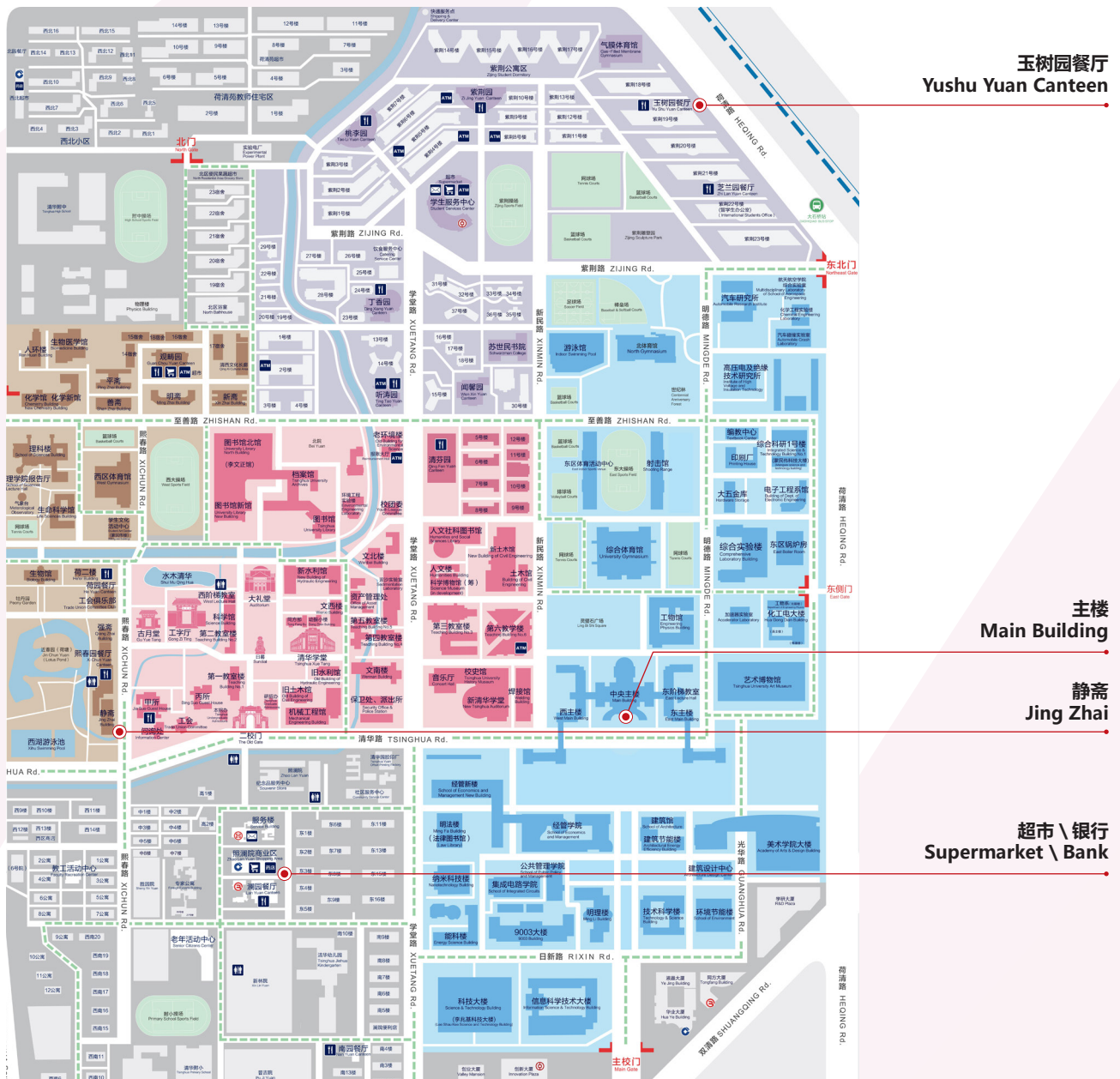
会务信息

Conference Service Information

会议联络表 Contact Information

地点	时间	联系人	手机号码
大会开幕式 Opening Ceremony			
清华大学主楼后厅 Lecture Hall, First Floor of the Main Building, Tsinghua University	4月3日上午 9:00 April 3rd	Zhang Lei	13810633413
		Sun Lijuan	15201586046
		Lu Pei	15624955339
学术报告 Lecture			
清华大学主楼后厅 Lecture Hall, First Floor of the Main Building, Tsinghua University	4月3-6日 April 3rd – April 6th	Jiang Bowen	18701683970
		Han Tian	18211182395
欢迎晚宴 Welcome Banquet			
文津国际酒店五层阳光厅 Yang Guang Hall, 5th Floor, Wenjin International Hotel	4月4日晚 18:30 April 4th	Zhang Lei	13810633413
		Sun Lijuan	15201586046
		Lu Pei	15624955339

会议场地分布图 Map





15 YEARS
ANNIVERSARY
OF YMSC
2009-2024

集美清华 求真淬炼
FOR TRUTH AND BEAUTY