2020
MASTERS LECTURES
大师论坛

HANDBOOK 会议手册

2020年12月18-20日

December 18th - 20th, 2020

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

承办：北京雁栖湖应用数学研究院
Co-host: Yanqi Lake Beijing Institute of Mathematical Sciences and Applications

清華大學 丘成桐数学科学中心
Yau Mathematical Sciences Center Tsinghua University

北京雁栖湖应用数学研究院
YANQI LAKE BEIJING INSTITUTE OF MATHEMATICAL SCIENCES AND APPLICATIONS

目录

01 关于主办方

02 关于大师论坛

03 整体日程

05 分会场 1
06 / 分会场 1 日程
08 / 报告摘要

11 分会场 2
12 / 分会场 2 日程
14 / 报告摘要

20 会务安排

2020 大师论坛 MASTERS LECTURES

关于主办方

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

清华大学 2009 年 12 月成立数学科学中心，聘请国际数学大师丘成桐教授担任中心主任。作为支持清华大学发展数学学科的重大战略举措，2014 年底教育部批准依托清华大学成立丘成桐数学科学中心（简称“数学中心”）。

数学中心是一所研究数学前沿问题、培养新一代数学人才及促进数学思想和成果交流的国际教学科研机构。科研领域以基础数学为核心，开展包括基础数学、应用数学、计算数学及与工程领域相关的跨学科研究。

YMSC has been developing at a fast pace in recent ten years. By the end ofJune 2020, it has 72 full-time faculty members, 41 postdoctoral researchers, 91undergraduates and postgraduates. Currently, it is located in Jinzhai, Jin ChuYuan West Building and Ningzhai at Tsinghua University. YMSC facilities include faculty offices, classrooms, discussion rooms, lecture hall, conference rooms, reference room and administration offices. YMSC makesgreat efforts to create free, open and active environment for faculty members,students and visiting scholars to focus on scientific research and talent cultivations.

北京雁栖湖应用数学研究院
Yanqi Lake Beijing Institute of Mathematical Sciences and Applications

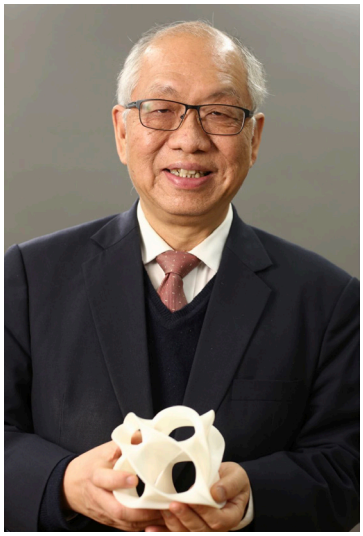
按照“国家战略、世界一流、国际引领”的要求，北京雁栖湖应用数学研究院（Beijing Institute of Mathematical Sciences and Applications，BIMSA）坚持高起点定位、高标准建设。依托清华数学现有力量，利用清华相关学科的综合优势，联合中科院数学与系统科学研究院及北京数学与应用数学及其交叉领域等优势单位，采用新的科研组织形式和人才引进模式推动中国数学科学发展，促进数学与工程应用、产业化的对接融通，提升数学支撑创新发展的能力和水平，为中国科技发展提供核心源动力。

关于大师论坛

“大师论坛”2013 年 1 月由国际数学大师丘成桐教授发起设立，至今已举办十届，每届论坛邀请 2-4 位世界顶级大师做报告。论坛的组织形式以“大师报告”结合大师本人学术领域或研究展开系列研讨，同时根据大师人数会同步举办 2-4 个相关主题研讨会。截至目前，包括 3 位诺贝尔物理学奖、经济学奖得主、9 位菲尔兹奖得主、5 位沃尔夫奖得主及众多院士在内 1350 余名国际前沿著名数学及相关领域学者增加参加了大师论坛及其专题研讨会，贡献国际前沿报告 650 余场。

Masters Lectures was initiated by Professor Shing-Tung Yau in January 2013. At the Masters Lectures each year, 2 to 4 Masters Lectures are delivered by world top masters, along with several related workshops according to the number of masters. So far, about 1,350 celebrated scholars of mathematics and related academic fields have participated in Masters Lectures, including 3 Noble Prize laureates, 7 Fields Medal winners, 5 Wolf Prize winners and a number of academicians. The scholars have presented about 650 lectures on the frontiers of Mathematics and related disciplines.

清华大学丘成桐数学科学中心主任，哈佛大学教授，美国国家科学院院士，美国艺术与科学院院士，中国科学院外籍院士。菲尔兹奖、克拉福德奖、沃尔夫奖、马塞尔格罗斯曼奖得主。



丘成桐
Shing-Tung Yau

学术成就

卡拉比猜想、闵科夫斯基问题、正能量定理、埃尔米特 - 爱因斯坦度量、史密斯猜想、镜对称猜想、刘孙丘度量

2020 大师论坛 MASTERS LECTURES

整体日程

Maters Lectures, Dec.18-20, 2020

Time & Date	Friday 18/12	Time & Date	Saturday 19/12	Time & Date	Sunday 20/12
		7:00-8:00	*Breakfast*		
		Chair	Fu Baohua	Chair	Xinyi Li
		8:00-9:00	**Gregory Lawler**		
		9:10-9:50	Wei Wu	9:10-9:50	Elie Aidekon
		9:30-10:30	Xiaotao Sun	9:30-10:30	Wenfei Liu
		10:30-10:45	*Coffee Break*	10:40-11:00	*Coffee Break*
		10:00-10:40	Rongchan Zhu	10:00-10:40	Lun Zhang
		10:45-11:45	Meng Chen	10:45-11:45	Chen Jiang
		11:00-12:00	**Gregory Lawler**	11:00-12:00	**Gregory Lawler**
		12:30-13:30	*Lunch*		
14:00	Shuttle Bus	Chair	Wu Hao	14:00	Departure
		14:30-15:10	Zhonggen Su		
		15:10-15:50	Kainan Xiang		
		15:50-16:10	*Coffee Break*		
16:00	Registration	16:10-16:50	Changlong Yao		
		16:50-17:20	Yifan Gao		
		17:20-17:50	Mingchang Liu		
		17:00-18:00	**Caucher Birkar**		
18:00-19:30	*Banquet*				
20:00-21:00	Jungkai Chen	20:00-21:00	Yuri Prokhorov		
21:15-22:15	**Caucher Birkar**	21:15-22:15	**Caucher Birkar**		
Remark					
Schedule of whole sessions					
Time Slot of this session, you are kindly suggested to join other Parallel Sessions listed in the program voluntarily					

分会场 1 Algebraic Geometry Workshop

Time & Date	Friday 18/12	Saturday 19/12	Sunday 20/12
7:30—8:30	Registration at 16:00	*Breakfast (60 minutes)*	
9:30—10:30		**Xiaotao SUN**	**Wenfei LIU**
10:45—11:45		**Meng CHEN**	**Chen JIANG**
12:00		*Lunch(60 minutes)*	
13:00—17:00		Free (Hiking)	Departure at14:00
17:00—18:00		**Caucher BIRKAR(II)***	
18:00-20:00	*Opening Ceremony & Dinner*	*Banquet*	
20:00—21:00	**Jungkai CHEN***	**Yuri PROKHOROV***	
21:15—22:15	**Caucher BIRKAR(I)***	**Caucher BIRKAR(III)***	

分会场 2 Probability Theory and Related Fields Workshop

Time & Date	Friday 18/12	Saturday 19/12	Sunday 20/12
7:00—8:00	Registration at 16:00	*Breakfast (60 minutes)*	
8:00—9:00		**Gregory Lawler**	
9:10—9:50		**Wei Wu**	**Elie Aidekon**
10:00—10:40		**Rongchan Zhu**	**Lun Zhang**
10:40—11:00		*Tea and coffee*	
11:00—12:00		**Gregory Lawler**	
12:00		*Lunch(60 minutes)*	
14:30—15:10		**Zhonggen Su**	Depart to Beijing at 14:00
15:10—15:50		**Kainan Xiang**	
15:50-16:10		*Tea and coffee*	
16:10-16:50		**Changlong Yao**	
16:50-17:20		**Yifan Gao**	
17:20-17:50		**Mingchang Liu**	
18:00-20:00	*Opening Ceremony & Dinner*	*Banquet*	
20:00—21:00			
21:15—22:15			

Algebraic Geometry Workshop

Plenary Lectures *Boundedness and moduli of algebraic varieties*

Caucher Birkar
University of Cambridge

Zoom Meeting ID: 388 528 9728
Password: BIMSA
Or scan QR to redirect Zoom Meeting Room

报告人简介

考切尔·比尔卡尔（Caucher Birkar），英籍库尔德裔数学家，现任英国剑桥大学教授。比尔卡尔于 2004 年获英国诺丁汉大学博士学位。他在双有理几何领域做出了重要贡献，主要研究了现代数学中关键问题的基本方面，如最小模型，奇点和线性系统，他的理论为各种长期猜想提供了解决方案。2018 年 8 月 1 日，考切尔·比尔卡尔获得了数学界最高奖菲尔兹奖，他是库尔德人历史上第一个菲尔兹奖得主。

2010 年，考切尔·比尔卡尔与合作者 Cascini-Hacon-Mckernan 共同证明了光滑射影簇的典范环是有限生成的与极小模型纲领中 klt 奇点的 flip 的存在性，这一工作被认为是双有理几何乃至代数几何近 20 年来的最大进展之一。

2016 年，比尔卡尔与合作者 Cascini-Hacon-Mckernan 一起获得了美国数学会颁发的 Moore 奖。同年，他证明了 Borisov-Alexeev-Borisov 猜想，也即证明了一类有奇点的 Fano 代数簇的有界性，这也是他获得菲尔兹奖的原因。

线下地点：BIMSA 负一层 1119 会议室

Venue: Rm 1119, B1, BIMSA

Organizers

Shing-Tung Yau	Harvard Univ. & YMSC, Tsinghua Univ.& BIMSA
Shiu-Yuen Cheng	YMSC, Tsinghua Univ.
Baohua Fu	AMSS
Yifei Chen	AMSS & MCM
Jie Liu	AMSS

分会场 1 Algebraic Geometry Workshop 整体议程

Time & Date	Friday 18/12	Saturday 19/12	Sunday 20/12
7:30—8:30	Registration at 16:00	*Breakfast (60 minutes)*	
9:30—10:30		**Xiaotao SUN**	**Wenfei LIU**
10:45—11:45		**Meng CHEN**	**Chen JIANG**
12:00		*Lunch(60 minutes)*	
13:00—17:00		Free (Hiking)	Departure at14:00
17:00—18:00		**Caucher BIRKAR(II)***	
18:00-20:00	*Opening Ceremony & Dinner*	*Banquet*	
20:00—21:00	**Jungkai CHEN***	**Yuri PROKHOROV***	
21:15—22:15	**Caucher BIRKAR(I)***	**Caucher BIRKAR(III)***	
Remark			
Schedule of this session			
Dinner, Banquet or Sightseeing			
Time Slot of this session, you are kindly suggested to join other Parallel Sessions listed in the program voluntarily			

DAY 1 December 18, 2020 (Beijing Time)

Beijing Time	Session Chair: Baohua Fu, AMSS
16:00	Registration
18:00	Opening Dinner
20:00-21:00	**Jungkai CHEN**, Taiwan University ***Birational maps in minimal model program (Online)***
21:15-22:15	**Caucher BIRKAR**, University of Cambridge, UK ***Boundedness and moduli of algebraic varieties I (Online)***

Conference Program

DAY 2 December 19, 2020 (Beijing Time)

Beijing Time	Session Chair: Baohua Fu, AMSS
9:30 – 10:30	**Xiaotao SUN**, Tianjin University ***Vanishing theorems of some GIT quotients***
10:30-10:45	Tea Break
10:45-11:45	**Meng CHEN**, Fudan University ***On minimal varieties growing from quasismooth weighted hypersurfaces***
12:00	Lunch
17:00-18:00	**Caucher BIRKAR**, University of Cambridge, UK ***Boundedness and moduli of algebraic varieties II (Online)***
18:00	Banquet
20:00-21:00	**Yuri PROKHOROV**, Steklov Mathematical Institute ***On the rationality of Fano threefolds over non-closed fields (Online)***
21:15-22:15	**Caucher BIRKAR**, University of Cambridge ***Boundedness and moduli of algebraic varieties III (Online)***

DAY 3 December 20, 2020 (Beijing Time)

Beijing Time	Session Chair: Baohua Fu, AMSS
9:30-10:30	**Wenfei LIU**, Xiamen University ***On automorphisms of elliptic surfaces acting on CH_0***
10:30-10:45	Tea Break
10:45-11:45	**Chen JIANG**, Shanghai Center for Mathematical Sciences ***Positivity in hyperk\"{a}hler manifolds via Rozansky—Witten theory***
12:00	Lunch
14:00	Departure

Plenary Lectures

Boundedness and moduli of algebraic varieties (Online)

Caucher Birkar, University of Cambridge

Online: Meeting ID: 388 528 9728Password: BIMSA
Time: 21:15-22:15 PM; 17:00-18:00PM; 21:15-22:15 PM

Abstract: Boundedness and moduli spaces play important roles in algebraic geometry. The subject has evolved in different directions depending on the type of objects being parameterized. In these lectures I will focus on boundedness and moduli of algebraic varieties. The first lecture will be a general introduction into the subject. The second and third lectures treat boundedness and moduli of varieties of log general type and of log Calabi-Yau type.
About Speaker: Caucher Birkar is a professor at the University of Cambridge in the United Kingdom. His research area is algebraic geometry. In the International Congress of Mathematicians in 2018, Prof. Caucher Birkar was awarded the Fields medal, the highest honor for mathematicians, for his works on boundedness of Fano varieties and the minimal model program.

Birational maps in minimal model program (Online)

Jungkai Chen, Taiwan University

Time: 20:00-21:00 PM
Online & Offline

Abstract: In this talk, we will going to survey the recent progress in explicit description of birational maps in minimal model programs in dimension three and higher. We also also address some relative results on the factorization of birational maps.

Vanishing theorems of some GIT quotients

Xiaotao Sun, Tianjin University

Time: 9:30 – 10:30 AM
Offline

Abstract: I will discuss two approach to prove vanishing theorems of a GIT quotient. One works well when unstable locus has large codimension, another works when one of the GIT quotients (for different linearizatons) is Fano.

On minimal varieties growing from quasismooth weighted hypersurfaces

Meng Chen, Fudan University

Time: 10:45-11:45AM
Offline

Abstract: We establish an effective nefness criterion for the canonical divisor of a weighted blow-up over a weighted hypersurface, from which we construct plenty of new minimal 3-folds including 59 families of minimal 3-folds of general type, several infinite series of minimal 3-folds of Kodaira dimension 2, 2 families of minimal 3-folds of general type on the Noether line, and 12 families of minimal 3-folds of general type near the Noether line. Then we prove effective lower bounds of canonical volumes of minimal n-folds of general type with canonical dimension n − 1 or n − 2. Examples are provided to show that the theoretical lower bounds are optimal or nearly optimal in higher dimensions. This is a joint work with Chen Jiang and Binru Li.

On the rationality of Fanothreefolds over non-closed fields (Online)

Yuri Prokhorov,Steklov Mathematical Institute

Time: 20:00-21:00PM
Online & Offline

Abstract: We discuss rationality problem of smooth Fanothreefolds of Picard number one over algebraically non-closed fields. The talk is based on a joint work with A. Kuznetsov.

On automorphisms of elliptic surfaces acting on CH_0

Wenfei Liu, Xiamen University

Time: 9:30-10:30 AM
Offline

Abstract: Let σ ∈ Aut(X) be an automorphism of a smooth projective surface. It is predicted by the generalized Bloch conjecture that, if σ induces trivial action on H^(i,0) (X) for i>0, then it also induces trivial action on the 0-th Chow group CH_0 (X). In this talk, I will report on some recent progress about this problem in the case of elliptic surfaces. This is a joint work with DU Jiabin.

Positivity in hyperk\"{a}hler manifolds via Rozansky—Witten theory

Chen Jiang,Shanghai Center for Mathematical Sciences

Time: 10:45-11:45 AM
Offline

Abstract: For a hyperk\"{a}hler manifold X of dimension 2n, Huybrechts showed that there are constants $a_0,a_2,\ldots,a_2n$ such that

$$\chi(L) = \sum_{i=0}^{n} \frac{a_{2i}}{(2i)!} q_X(c_1(L))^i$$

for any line bundle L on X, where q_X is the Beauville--Bogomolov--Fujiki quadratic form of X. Here the polynomial $\sum_{i=0}^{n} \frac{a_{2i}}{(2i)!} q^i$ is called the Riemann--Roch polynomial of X. In this talk, I will discuss recent progress on the positivity of coefficients of the Riemann--Roch polynomial and also positivity of Todd classes. Such positivity results follows from a Lefschetz-type decomposition of the root of Todd genus via the Rozansky—Witten theory, following the ideas of Hitchin, Sawon, and Nieper-Wißkirchen.

Probability Theory and Related Fields Workshop

Plenary Lectures *Random walks arising in statistical physics*

Gregory Lawler
The University of Chicago

Zoom Meeting ID: 849 963 1368
Password: YMSC
Or scan QR to redirect Zoom Meeting Room

报告人简介

Gregory Lawler, 美国芝加哥大学教授，美国科学院院士。2019 年，他获得沃尔夫奖，主要获奖工作为他在随机游走领域的贡献。

Gregory Lawler 为概率论的发展做出了开创性的贡献。他获得了关于布朗运动诸多属性的突出成果，例如覆盖次数，相交指数和子集的维数。在研究随机曲线时，Lawler 介绍了一个现在的经典模型，即循环擦除随机游走（Loop-ErasedRandom Walk, LERW），并建立了该模型的许多性质。虽然很容易定义，但事实证明它具有基本性质，并且显示出与统一生成树 (uniform spanning trees) 和二聚体倾斜（dimer tilings）有关。这项工作为 Oded Schramm 引入 SLE 曲线之后的大量突破奠定了很多基础。 Lawler，Schramm 和 Werner 计算了布朗相交指数，证明了 Mandelbrot 猜想：布朗边界具有 Hausdorff 维数 4/3 并且确定 LERW 具有共形不变的缩放限制（scaling limit）。反过来，这些结果为 Lawler 和其他人进一步激动人心的进步铺平了道路。

线下地点：BIMSA 一层 1110 会议室

Venue: Rm 1110, F1, BIMSA

Organizers

Shing-Tung Yau	Harvard Univ. & YMSC, Tsinghua Univ.& BIMSA
Shiu-Yuen Cheng	YMSC, Tsinghua Univ.
Hao Wu	YMSC, Tsinghua Univ.
Jianping Jiang	BIMSA

分会场 2 Probability Theory and Related Fields Workshop 整体议程

Time & Date	Friday 18/12	Saturday 19/12	Sunday 20/12
7:00—8:00	Registration at 16:00	*Breakfast (60 minutes)*	
8:00—9:00		**Gregory Lawler**	
9:10—9:50		**Wei Wu**	**Elie Aidekon**
10:00—10:40		**Rongchan Zhu**	**Lun Zhang**
10:40—11:00		*Tea and coffee*	
11:00—12:00		**Gregory Lawler**	
12:00		*Lunch(60 minutes)*	
14:30—15:10		**Zhonggen Su**	Depart to Beijing at 14:00
15:10—15:50		**Kainan Xiang**	
15:50-16:10		*Tea and coffee*	
16:10-16:50		**Changlong Yao**	
16:50-17:20		**Yifan Gao**	
17:20-17:50		**Mingchang Liu**	
18:00-20:00	*Opening Ceremony & Dinner*	*Banquet*	
20:00—21:00			
21:15—22:15			
Remark			
Schedule of this session			
Dinner,Banquet or Sightseeing			
Time Slot of this session, you are kindly suggested to join other Parallel Sessions listed in the program voluntarily			

DAY 1 December 18, 2020 (Beijing Time)

Beijing Time	
16:00	Registration
18:00	Opening Dinner

Conference Program

DAY 2 December 19, 2020 (Beijing Time)

Beijing Time	Session Chair: Hao Wu, YMSC, Tsinghua University
8:00-9:00	**Gregory Lawler**, The University of Chicago, USA ***Random walks arisingin statistical physics (Online)***
9:10-9:50	**Wei Wu**, New York University Shanghai, China ***Massless phases for the Villain model in d ≥ 3***
Beijing Time	Session Chair: Jianping Jiang, BIMSA
10:00-10:40	**Rongchan Zhu**, Beijing Institute of Technology ***Large N Limit of the O(N) Linear Sigma Model via Stochastic Quantization***
10:40-11:00	Tea Break
11:00-12:00	**Gregory Lawler**, The University of Chicago, USA ***Loop measures, Gaussian fields and determinants (Online)***
12:00	Lunch
14:30-15:10	**Zhonggen Su**, Zhejiang University ***Fluctuations on Plancherel integer partitions around its limit shape***
15:10-15:50	**Kainan Xiang**, Xiangtan University ***Limit set of branching random walks on hyperbolic groups***
15:50-16:10	Tea Break
16:10-16:50	**Changlong Yao**, AMSS ***Asymptotics for critical and near-critical first-passage percolation on the triangular lattice***
16:50-17:20	**Yifan Gao**, Peking University ***On the chemical distance exponent for the two-sided level-set of the 2D Gaussian free field***
17:20-17:50	**Mingchang Liu**, Tsinghua university ***Crossing probability in Gaussian Free field***
18:00	Banquet

DAY 3 December 20, 2020 (Beijing Time)

Beijing Time	Session Chair: Xinyi Li, Peking University
9:10-9:50	**Elie Aidekon**, New York University Shanghai, China ***Cluster explorations of the loop soup on a metric graph related to the Gaussian free field.***
10:00-10:40	**Zhang Lun**, Fudan University ***Asymptotics of the Pearceydetermiant***
10:40-11:00	Tea Break
11:00-12:00	**Gregory Lawler**, The University of Chicago, USA ***Fractal measures (Online)***
12:00	Lunch
14:00	Departure

Random walks arising in statistical physics

Gregory Lawler

时间：2020年12月19日上午8:00-9:00， 11:00-12:00，12月20日上午11:00-12:00.

地点：zoom 会议 ID：849 963 1368 密码： YMSC

Abstract:

Part 1:Random walks arising in statistical physics

I have been studying random paths with strong interactions arising in statistical physics for over forty years. I will survey of the program and how much we have learned in this time. I will discuss the idea of scaling limits (which leads, say, to the construction of the Schramm-Loewner evolution), the interplay between the discrete and the continuous, and the relationship between the spatial dimension of the ambient space and the fractal dimension of the paths. The talk will also discuss questions that we do not know how to answer and are topics for future research.

Part 2: Loop measures, Gaussian fields and determinants

Much of the analysis of random paths especially in two dimensions has considered the underlying "field" that generate the paths. Two closely related basic fields are the Gaussian free field and loop measures (and soups). I will give an introduction to these in both discrete and continuous settings and give the relationship with random paths (SLE) and the determinant of the Laplacian.

Part 3: Fractal measures

I will discuss the construction and analysis of fractal measures such as the occupation time or natural parametrization (Minkowski content) of the Schramm-Loewner evolution (SLE) and exceptional points of Brownian motion as well as measures arising from exponentiating Gaussian fields (Liouville quantum gravity).

Massless phases for the Villain model in $d \geq 3$

吴炜 (We Wei)
NYU Shanghai

Abstract: The XY and the Villain models are mathematical idealization of real world models of liquid crystal, liquid helium, and superconductors. Their phase transition has important applications in condensed matter physics and led to the Nobel Prize in Physics in 2016. However we are still far from a complete mathematical understanding of the transition. The spin wave conjecture, originally proposed by Dyson and by Mermin and Wagner, predicts that at low temperature, large scale behaviors of these models are closely related to Gaussian free fields. I will review the historical background and discuss some recent progress on this conjecture in $d \geq 3$. Based on the joint work with Paul Dario (Tel Aviv).

Large N Limit of the $O(N)$ Linear Sigma Model via Stochastic Quantization

朱蓉婵 (Zhu Rongchan)

Beijing Institute of Technology

Abstract: In this talk we discuss large N limits of a coupled system of N interacting Φ^4 equations posed over $\mathbb{T}^d$ for $d = 1,2,3$, known as the $O(N)$ linear sigma model. Uniform in N bounds on the dynamics are established, allowing us to show convergence to a mean-field singular SPDE, also proved to be globally well-posed. Moreover, we show tightness of the invariant measures in the large N limit. For large enough mass, they converge to the (massive) Gaussian free field, the unique invariant measure of the mean-field dynamics, at a rate of order $1/\sqrt{N}$ with respect to the Wasserstein distance. We also consider fluctuations and obtain tightness results for certain $O(N)$ invariant observables, along with an exact description of the limiting correlations in $d = 1,2$. This talk is based on joint work with Hao Shen, Scott Smith and Xiangchan Zhu.

Fluctuations on Plancherel integer partitions around its limit shape

苏中根 (Su Zhonggen)

Zhejiang University

Abstract: For a natural number n, let $\mathscr{P}_n$ be the space of all integer partitions λ of n, namely $\lambda = (\lambda_1, \lambda_2, \ldots, \lambda_l)$ such that $\lambda_1 \geq \lambda_2 \geq \cdots \geq \lambda$ and $\lambda_1 + \lambda_2 + \cdots + \lambda_l = n$. Let $P_{pl}(\lambda) = \frac{d_\lambda^2}{n!}$, where d_λ stands for the numbers of all standard Young tableaux with shape λ. A remarkable result, almost simultaneously obtained by Logan and Shepp, Vershik and Kerov in the seventies, is that there is a limit shape $\omega(x)$ for suitably scaled λ under the probability measure P_{pl}. In this talk we will report a Gaussian fluctuation result for $\lambda_{[\sqrt{n}x]}$ around the shape curve $\omega(x)$. The result complements, in a striking way, the well-known theorem of Kerov on the generalized Gaussian convergence. The proofs are based on the poissonization techniques and the Costin–Lebowitz–Soshnikov central limit theorem for determinantal point processes.

Limit set of branching random walks on hyperbolic groups

向开南 (Xiang Kainan)

Xiangtan University

Abstract: Let Γ be a nonelementary hyperbolic group with a word metric d and $\partial\Gamma$ its hyperbolic boundary equipped with a visual metric d_a for some parameter $a > 1$. Fix a superexponential symmetric probability μ on Γ whose support generates Γ, and denote by ρ the spectral radius of the random walk Y on Γ with step distribution μ. Let ν be a probability on $\{1, 2, 3, \ldots\}$ with mean $\lambda = \sum_{k=1}^{\infty} k\nu(k) < \infty$.

Let $\mathrm{BRW}(\Gamma, \nu, \mu)$ be the branching random walk on Γ with offspring distribution ν and base motion Y. Write Λ for the limit random subset of $(\partial\Gamma, d_a)$ consisting of all accumulation points of the trace of $\mathrm{BRW}(\Gamma, \nu, \mu)$. Denote by H the volume growth rate for the trace of $\mathrm{BRW}(\Gamma, \nu, \mu)$ and by h the Hausdorff dimension of the limit set (Λ, d_a). We prove the following two universality results:

(a) H is almost surely a deterministic, strictly increasing and continuous function of $\lambda \in [1, 1/\rho]$, is bounded by the square root of the volume growth rate of Γ, and has critical exponent $1/2$ at $1/\rho$ in the sense that for some positive constant C,

$$H(1/\rho) - H(\lambda) \sim C\sqrt{1/\rho - \lambda} \quad \text{as } \lambda \uparrow 1/\rho.$$

(b) For $\mathrm{BRW}(\Gamma, \nu, \mu)$ with $\lambda \in [1, 1/\rho)$, almost surely $h = \log_a H(\lambda)$. Thus $h(\cdot)$ has critical exponent $1/2$ near $1/\rho$ in a "weak" sense that

$$h(1/\rho-) - h(\lambda) \sim \frac{C}{H(1/\rho)\log a}\sqrt{1/\rho - \lambda} \text{ as } \lambda \uparrow 1/\rho.$$

We conjecture that the Hausdorff dimension of (Λ, d_a) in the critical case $\lambda = 1/\rho$ is $\log_a H(1/\rho)$ almost surely. This has been confirmed on free groups or the free product (by amalgamation) of finitely many finite groups.

This talk is based on a joint work with Sidoravicius Vladas and Wang Longmin.

Asymptotics for critical and near-critical first-passage percolation on the triangular lattice

姚昌龙 (Yao Changlong)
Academy of Mathematics and Systems Science

Abstract: We study Bernoulli first-passage percolation on the triangular lattice in which sites have 0 and 1 passage times with probability p and $1-p$, respectively. We consider the following three cases: (1) $p = p_c = 1/2$. Let $a(0,n)$ denote the first-passage time from the origin to the point n. We obtain explicit limit theorems for $a(0,n)/\log(n)$ and $\mathrm{Var}[a(0,n)]/\log(n)$. The proof relies on the conformal loop ensemble CLE(6) and a color switching trick. (2) $p > p_c$. We give exact asymptotics for the first-passage times from the origin to the infinite cluster with 0-time sites, as p tends to p_c from above. The proof uses the result in the critical case and Russo's formula. (3) $p < p_c$. Let $L(p)$ denote the correlation length, and let $B(p)$ denote the limit shape in the classical shape theorem. We show that the rescaled limit shape $B(p)/L(p)$ converges to a Euclidean disk, as p tends to p_c from below. The proof relies on the scaling limit of near-critical percolation established by Garban, Pete and Schramm (2018) and the construction of the collection of continuum clusters introduced by Camia, Conijn and Kiss (2019).

On the chemical distance exponent for the two-sided level-set of the 2D Gaussian free field

高一帆 (Gao Yifan)
Peking University

Abstract: We introduce the chemical distance for the two-sided level-set percolation of the two-dimensional discrete Gaussian free field on a box V_N of side length N. We will show that for some $\varepsilon > 0$, with probability tending to 1 as N goes to infinity, there exists no open path of length less than $N^{1+\varepsilon}$ connecting two vertices with macroscopic distance. This talk is based on a joint work with Fuxi Zhang.

Crossing probability in Gaussian Free field

刘明昶 (Liu Mingchang)
Tsinghua university

Abstract: Two-dimensional Gaussian free field (GFF) is a natural 2D time analogue of Brownian motion. Crossing probability is a delicate quantity for GFF. We will introduce discrete GFF(dGFF) and metric graph GFF(mGFF). Both objects converge to continuum GFF as distributions. However, the crossing probabilities in dGFF and in mGFF are distinct. In this talk, we focus on the mGFF case. It turns out that the crossing probability in mGFF converges to the "fusion" of the so-called pure partition functions. Moreover, we find that the scaling limits of crossing probabilities satisfy a third-order PDE system.
This talk is based on a joint work with Hao Wu.

Cluster explorations of the loop soup on a metric graph related to the Gaussian free field

Elie Aidekon
NYU Shanghai

Abstract: We give a Markov property for the loop soup on a metric graph which mimics that of the Gaussian free field, and describe the law of the loop soup conditionally on its occupation field.

Asymptotics of the Pearcey determinant

张仑 (Zhang Lun)
Fudan University

Abstract: The Pearcey kernel is a classical and universal kernel arising from random matrix theory, which describes the local statistics of eigenvalues when the limiting mean eigenvalue density exhibits a cusp-like singularity. It appears in a variety of statistical physics models beyond matrix models as well. In this talk, we are concerned with the Fredholm determinant $\det\left(I-\gamma K_{s,\rho}^{\mathrm{Pe}}\right)$, where $0\leq\gamma\leq 1$ and $K_{s,\rho}^{\mathrm{Pe}}$ stands for the trace class operator acting on $L^2(-s,s)$ with the Pearcey kernel. We obtain asymptotics of this determinant as $s\to+\infty$, which is also interpreted as large gap asymptotics in the context of random matrix theory. It comes out that the Pearcey determinant exhibits a significantly different asymptotic behavior for $\gamma=1$ and $0<\gamma<1$, which suggests a transition will occur as the parameter γ varies. This talk is based on two recent joint works with Dan Dai and Shuai-Xia Xu.

会务安排

一 报到注册

报到时间：12 月 18 日（星期五）16:00　　**报到地点：**北京雁栖湖酒店一层大堂

二 整体议程

<table>
<tr><th>Friday 18/12</th><th>Saturday 19/12</th><th>Sunday 20/12</th></tr>
<tr><td rowspan="3">Registration at 16:00</td><td colspan="2">Breakfast 7:00-8:00
Western Restaurant, B1, Hotel</td></tr>
<tr><td colspan="2">Lecture Time</td></tr>
<tr><td colspan="2">Lunch 12:00-13:30
Western Restaurant, B1, Hotel</td></tr>
<tr><td></td><td>Lecture Time</td><td rowspan="3">Departure at 14:00</td></tr>
<tr><td>Opening Ceremony & Dinner 18:00-20:00
HAI YAN HALL（海晏厅）</td><td>Banquet 18:00-20:00
HAI YAN HALL（海晏厅）</td></tr>
<tr><td>Lecture Time</td><td>Lecture Time</td></tr>
</table>

三 交通信息

发车时间：12 月 18 日 14:00、16:00

上车地点：清华大学问询处停车场（校内）- 清华大学东南门紫光国际大厦停车场（校外）

返回时间：12 月 20 日 14:00

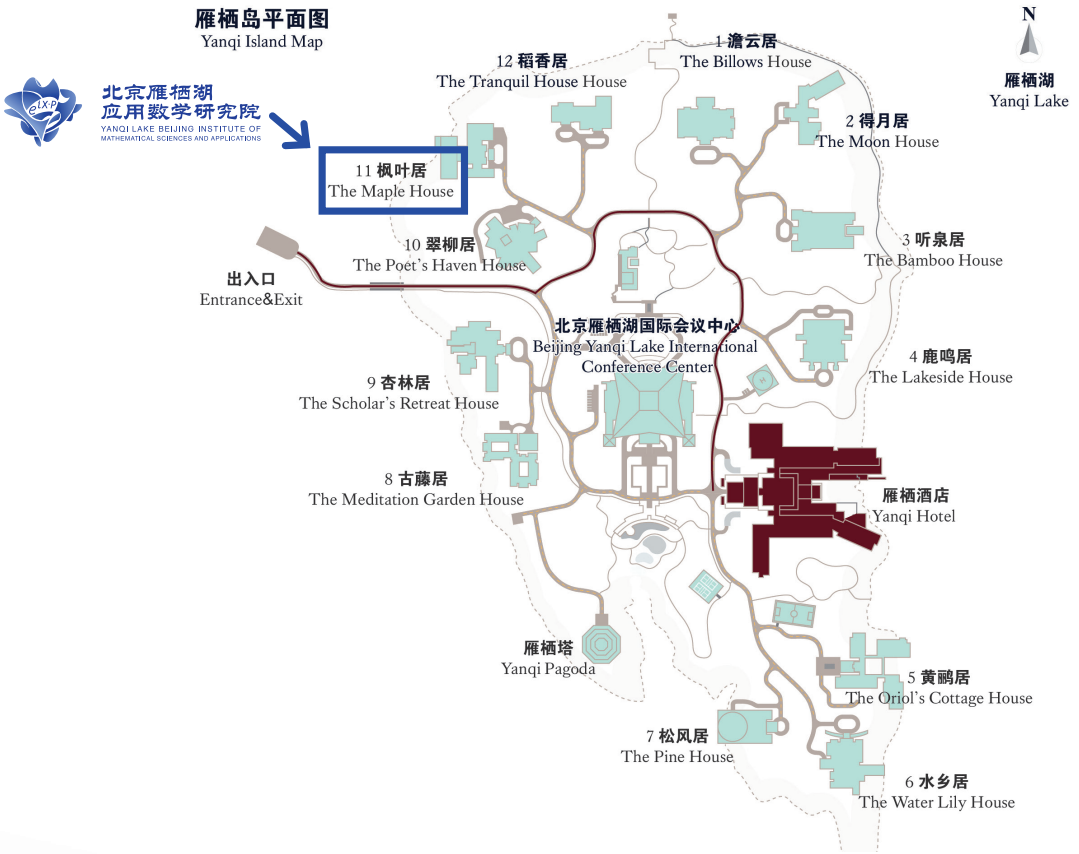
上车地点：雁栖酒店门前 - 11 号楼枫叶居门前

自驾车、出租车　导航地址为**“北京市怀柔区雁栖湖湖心岛凯宾斯基酒店枫叶居地上停车场”**，凭会议通知邮件入场。

11 号楼 WIFI：SXKXYJY

密码：12345678

四 其他信息



酒店 24 小时服务热线 13552919002

参会须知

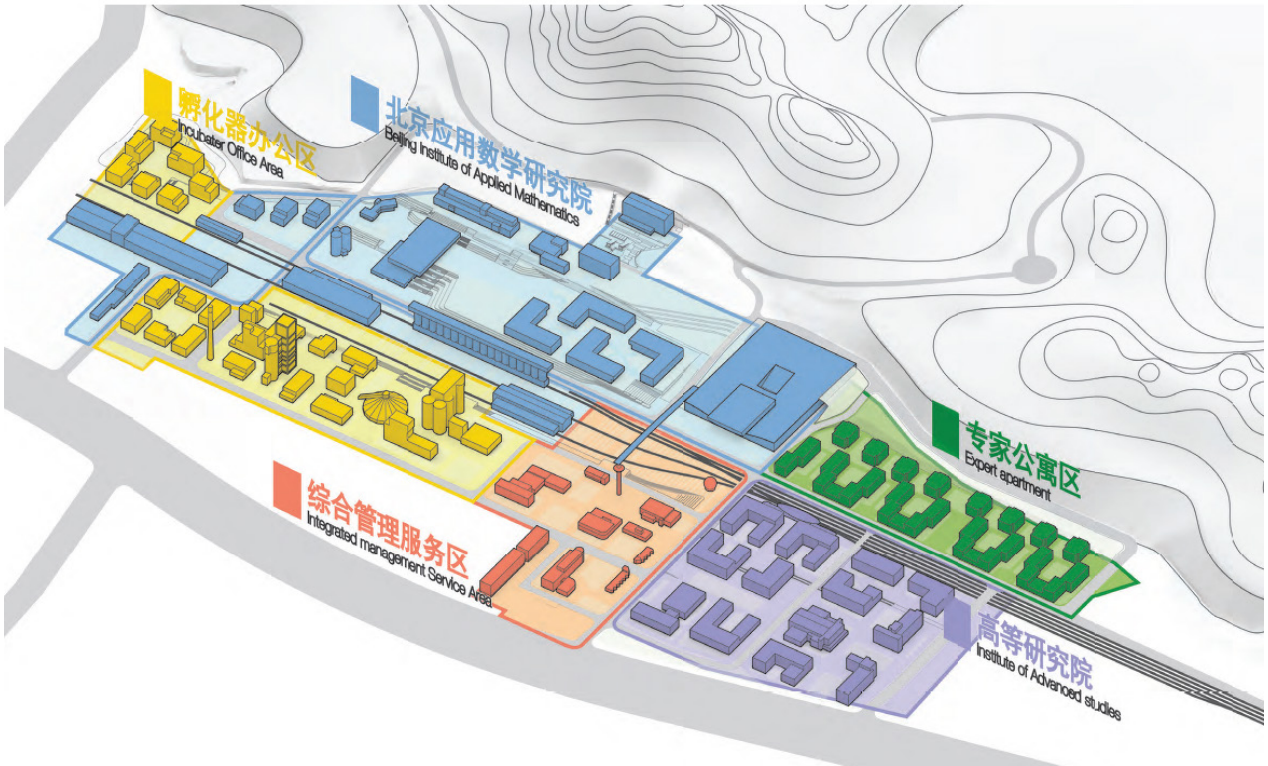
本会议手册旨在为参会人提供会议的相关信息，仅供会议期间参考使用。未尽事宜及日程变动、临时活动，请随时留意分会场发布的通知。为了确保大会顺利举行，使您和其他参会人员有更好的参会体验，请您注意以下有关事项：

1. 会议期间，请您全程佩戴胸牌，凭胸牌出入会议场地、就餐、乘车等；
2. 进入会场后，请关闭移动电话和其他电子设备，或将其设定为静音状态；
3. 请勿在会场内以及其他禁烟场所吸烟；
4. 请携带身份证或护照；
5. 因活动现场人员密集，请带好口罩。

会务组联系方式：

- 会务秘书：李雪阳，13439894243
- 王泽：18600629065

北京雁栖湖应用数学研究院永久院址规划图



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MATHEMATICAL SCIENCES AND APPLICATIONS