Joint Meeting in Mathematics
The University of Hong Kong - Shenzhen International Center for Mathematics
Spring 2026

Probability Theory and Its Applications
April 24 & 25, 2026
Room 210, Run Run Shaw Building, The University of Hong Kong

April 24, 2026 (Friday)

Time & Speaker	Topic
09:25 - 09:30	Opening remarks
09:30 - 10:30 Van Vu	A new approach to perturbation theory: the notion of relative norm
10:30 - 11:00	Coffee break
11:00 - 12:00 Zhuosong Zhang	Refined Berry-Esseen bounds under local dependence
12:00 - 14:00	Lunch
14:00 - 15:00 Jieliang Hong	Exceptional times for the instantaneous propagation of superprocess
15:00 - 16:00 Jiaqiang Wen	Mean-field BSDEs with quadratic growth
16:00 - 16:30	Coffee break
16:30 - 17:30 Mo Dick Wong	Hearing the shape of Liouville quantum gravity
18:00 - 20:00	Dinner

April 25, 2026 (Saturday)

Time & Speaker	Topic
09:00 - 10:00 Wei Qian	No double points on the boundaries of Brownian loop-soup clusters at the critical intensity

10:00 - 10:30		Coffee break
10:30 - 11:30	Wangjun Yuan	Operator Norm Bounds for Multi-leg Matrix Tensors and applications to Random Matrix Theory
11:30 - 12:30	Zhigang Bao	Law of fractional logarithm for random matrices
13:00 - 14:30		Lunch

Titles and Abstracts

Zhigang Bao (HKU)
Law of fractional logarithm for random matrices

In this talk, I will introduce the recent resoloution of the Paquette-Zeitouni law of fractional logarithm (LFL) for the extreme eigenvalue of Wigner matrices in full generality. Our result holds for any Wigner minor process and both symmetry classes, in particular for the GOE minor process, while the previous results cover only the GUE case which is determinantal. Lacking the possibility for a direct comparison with the Gaussian case, we develop a robust and natural method for both key parts of the proof. On one hand, we rely on a powerful martingale technique to describe precisely the strong correlation between the largest eigenvalue of an N by N Wigner matrix and its (N-k) by (N-k) minor if k<<N^{2/3}. On the other hand, we use dynamical methods to show that this correlation is weak if k>>N^{2/3}. This is a joint work with Giorgio Cipolloni, László Erdős, Joscha Henheik, Oleksii Kolupaiev.

Jieliang Hong (SUSTech)
Exceptional times for the instantaneous propagation of superprocess

For a Dawson-Watanabe superprocess X on R^d, it is shown in Perkins (1990) that if the underlying spatial motion belongs to a particular class of L\'evy processes that admit jumps, then for any fixed $t>0$, the closed support of X_t is the whole space almost surely when conditioned on $\{X_t\neq 0\}$, the so-called "instantaneous propagation property". In this paper, for the superprocess on R^d whose spatial motion is the symmetric stable process of index $\alpha \in (0,2/3)$, we prove that there exist exceptional times at which the support is compact and nonempty. Moreover, we show that the set of exceptional times is dense with a full Hausdorff dimension. Besides, we prove that near extinction, the support of the superprocess is concentrated arbitrarily close to the extinction point, thus upgrading the corresponding results in Tribe (1992) from $\alpha \in (0,1/2)$ and $d=1$ to $\alpha \in (0,2/3)$ and $d\geq 1$. We further show that the set of such exceptional times also admits a full Hausdorff dimension. This talk is based on a joint work with Leonid Mytnik.

Wei Qian (HKU)
No double points on the boundaries of Brownian loop-soup clusters at the critical intensity

We show that there do not exist double points on the boundaries of Brownian loop-soup clusters at the critical intensity. Such double points are closely related to a question of rewiring excursions into loops in the critical Brownian loop soup.

In previous works, we introduced a certain generalized disconnection exponent to compute the Hausdorff dimension of simple and double points on the boundaries of Brownian loop-soup clusters, for all intensities $c\in (0,1]$. It turns out that at the critical intensity $c=1$, the dimension of double points on the boundaries of clusters have Hausdorff dimension exactly zero.

In a more recent work, we develop a unified approach to establish the non-existence of several types of random fractals in the Brownian motion which have dimension zero: Apart from the aforementioned double points on the boundaries of loop-soup clusters, we also show the non-existence of pioneer triple points in the planar Brownian motion, the pioneer double cut points of the planar and three-dimensional Brownian motions.

This talk is based on several works, some of which are joint with Y. Gao, X. Li and R. Liu.

Van Vu (HKU)
A new approach to perturbation theory: the notion of relative norm

Matrix-perturbation bounds quantify how the spectral characteristics of a baseline matrix A change under additive noise E. Classical results, including Weyl's inequality for eigenvalues and the Davis–Kahan theorem for eigenvectors and eigenspaces, have long played a foundational role in mathematics. These bounds are known to be sharp in worst-case analysis.
In the 10 years, we have been working to develop a perturbation framework that leverages the interaction between E and the eigenvectors of A, leading to the notion of relative norm, which can be used to replace the operator norm of E in many applications. This perspective yields quantitative improvements over classical bounds, particularly when E is random, a common scenario in applications.
This talk surveys these developments and main ideas, focusing on recent results concerning eigenspace perturbation. If time allows, we will discuss extensions to other spectral functionals and applications in different areas.

Jiaqiang Wen (SUSTech)
Mean-field BSDEs with quadratic growth

In this talk, I will present some of our recent work on general mean-field backward stochastic differential equations with quadratic growth, including theoretical results on existence and uniqueness, comparison theorems, and applications to particle systems, optimal control problems, and PDEs.

Mo Dick Wong (HKU)
Hearing the shape of Liouville quantum gravity

The Liouville quantum gravity (LQG) surface, formally defined as a 2-dimensional Riemannian manifold with conformal factor being the exponentiation of a Gaussian free field, is closely related to random planar geometry as well as scaling limits of models from statistical mechanics. In this talk, I shall explain a Weyl law for subcritical LQG surfaces and also discuss some challenges and ongoing work in the critical case.

Wangjun Yuan (SUSTech)
Operator Norm Bounds for Multi-leg Matrix Tensors and applications to Random Matrix Theory

We investigate the extremal values of partial traces of matrix tensors under operator norm constraints. To evaluate these multi-linear quantities, we develop a comprehensive graphical formalism that encodes multi-leg partial traces, partial permutations, and their moments using colored directed graphs. With this graphical framework, we establish optimal, sharp bounds for the partial trace $(\mathrm{Tr}_{\sigma_1} \otimes \ldots \otimes \mathrm{Tr}_{\sigma_k})(A_1, \ldots, A_m)$ over matrices bounded by $\|A_i\| \le 1$. Specifically, we prove that this maximum evaluates exactly to $N^{M(\sigma_1,\ldots,\sigma_k)}$, where N is the dimension and M represents the maximal number of directed cycles in the associated graph across all possible internal vertex pairings. We further derive explicit operator norm estimates for matrices generated by partial traces of partial permutations. Finally, we apply these combinatorial bounds to multi-matrix random matrix theory. By examining models involving Ginibre ensembles, we extend concepts of asymptotic freeness to matrix coefficient algebras, establishing operator norm estimates that rigorously separate the asymptotic behavior of non-crossing and crossing pairings. This is a joint work with Benoit Collins.

Zhuosong Zhang (SUSTech)

Refined berry-esseen bounds under local dependence

A family of locally dependent random variables means that random variables within a subset are independent of random variables outside their neighborhood. In this talk, we consider the CLT for the sum of locally dependent random variables, and in particular, we establish refined Berry–Esseen type bounds under the following local-dependence assumptions. The proofs are based on Stein's method together with a concentration inequality approach. We develop a new class of concentration inequalities that extend classical results and achieve optimal convergence rates under more general dependence structures. This is a joint work with Qi-Man Shao and Zhi-Jun Cai.