

Peking Mathematical Journal Conference

(May 17–19, 2024)



北京国际数学研究中心
BEIJING INTERNATIONAL CENTER FOR
MATHEMATICAL RESEARCH



北京大学数学科学学院
School of Mathematical Sciences
Peking University

Beijing, China

2024 Peking Mathematical Journal Conference Schedule

Venue: Lecture Hall, Jiayibing Building, Jingchunyuan 82, BICMR (北京大学镜春园 82 号甲乙丙楼报告厅)

May 17, 2024 (Friday)			
Time	Speaker	Affiliation	Title
08:50–09:00	Gang TIAN (田刚)	Peking University	Opening Speech
Chair: Gang Tian (田刚), Peking University			
09:00–10:00	Yanyan LI (李岩岩)	Rutgers University	Harmonic Functions and Beyond
10:00–10:30	Tea break (茶歇)		
10:30–11:30	Jiangong YOU (尤建功)	Nankai University	Some Problems in Quasi-periodic Schrödinger Operators
11:30–13:00	Lunch (午餐)		
Chair: Ruochuan Liu (刘若川), Peking University			
14:00–15:00	Qi'an GUAN (关启安)	Peking University	Some Recent Progress Related to the Strong Openness Property
15:10–16:10	Xuwen CHEN (陈旭文)	University of Rochester	From Quantum Particles to Compressible Inviscid Fluid
16:20–17:20	Kai-Wen LAN (蓝凯文)	University of Minnesota Twin Cities	De Rham Comparison for Boundary Cohomology
May 18, 2024 (Saturday)			
Time	Speaker	Affiliation	Title
Chair: Jian Ding (丁剑), Peking University			
09:00–10:00	Alexandru IONESCU	Princeton University	On the Stability of Homogeneous Equilibria of the Vlasov–Poisson System
10:00–10:10	Group Photo (合影)		
10:10–10:30	Tea break (茶歇)		
10:30–11:30	Xu-Jia WANG (汪徐家)	Australian National University	The L_p -Minkowski Problem with Supercritical Exponents
11:30–13:00	Lunch (午餐)		
Chair: Zhouli Xu (徐宙利), University of California San Diego			
14:00–15:00	Kaoru ONO (小野 薰)	Kyoto University	TBA
15:10–16:10	Junyi XIE (谢俊逸)	Peking University	Algebraic Dynamics and Recursive Inequalities
16:20–17:20	Wen HUANG (黄文)	University of Science and Technology of China	Full Horseshoe for the Galerkin Truncations of 2D Navier–Stokes Equations with Degenerate Stochastic Forcing

May 19, 2024 (Sunday)			
Time	Speaker	Affiliation	Title
Chair: Xiaobo Liu (刘小博), Peking University			
09:00–10:00	Xiaohua ZHU (朱小华)	Peking University	Limit Structure of KR Flow on Fano Manifolds with Large Symmetry
10:00–10:30	Tea break (茶歇)		
10:30–11:30	Gang LIU (刘钢)	East China Normal University	Complete Kähler Manifolds with Nonnegative Ricci Curvature
11:30–13:00	Lunch (午餐)		
Chair: Jinpeng An (安金鹏), Peking University			
14:00–15:00	Jian DING (丁剑)	Peking University	Random Fractal Metric Spaces
15:10–16:10	Jacob BERNSTEIN	Johns Hopkins University	Self-expanders of Mean Curvature Flow and Their Applications
16:20–17:20	Zhouli XU (徐宙利)	University of California San Diego	Homotopy Groups of Spheres

Hotel: Beijing Friendship Hotel
Address: 1 Zhongguancun South St., Beijing, 100873, P. R. China
Tel: +86 10 68498888



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Titles and Abstracts of One-hour Talks

(Sorted Alphabetically by Last Names)

Self-expanders of Mean Curvature Flow and Their Applications

Jakob Bernstein (Johns Hopkins University)

Abstract: Self-expanders are special solutions of the mean curvature flow which evolve outward by scaling. They arise as models of how the mean curvature flow smooths out conical singularities. I will discuss some recent progress in constructing these solutions and highlight how these constructions can be used to establish some interesting geometric and topological properties of hypersurfaces. Most of what I will discuss is based off of joint work with Lu Wang.

From Quantum Particles to Compressible Inviscid Fluid

Xuwen Chen (University of Rochester)

Abstract: We derive the classical compressible Euler equation as the limit of 3D quantum N -particle dynamics as N tends to infinity and Planck's constant tends to zero. We forge together the hierarchy method and the modulated energy method. We establish strong and quantitative convergence up to the 1st blow up time of the limiting Euler equation. During the course of the proof, we prove, as theoretically predicted, that the macroscopic pressure emerges from the space-time averages of microscopic interactions, which are in fact, Strichartz-type bounds and we have hence found a physical meaning for the Strichartz type bounds. The grand scheme also applies to the Euler-Poisson situation.

Random Fractal Metric Spaces

Jian Ding (Peking University)

Abstract: I will review recent progress on random fractal metric spaces including metrics of Liouville quantum gravity, critical long-range percolation metrics as well as the exponential metric of a log-correlated fields in three dimensions and above. This talk is based on joint works with Julien Dubedat, Alexander Dunlap, Hugo Falconet, Subhajit Goswami, Ewain Gwynne, Ofer Zeitouni, Fuxi Zhang and Zijie Zhuang in various combinations.

Some Recent Progress Related to the Strong Openness Property

Qi'an Guan (Peking University)

Abstract: The multiplier ideal sheaf plays an important role in several complex variables, complex geometry and algebraic geometry. The strong openness property for multiplier ideal sheaves was conjectured by Demailly and proved by Guan–Zhou. In this talk, we will recall some recent progress related to the strong openness property.

Full Horseshoe for the Galerkin Truncations of 2D Navier–Stokes Equations with Degenerate Stochastic Forcing

Wen Huang (University of Science and Technology of China)

Abstract: In this talk, we will introduce the existence of full horseshoe for the Galerkin truncations of 2D Navier–Stokes equations with degenerate stochastic forcing (Hypoelliptic condition). We will also review weak horseshoe and semi-horseshoe. This based on joint works with Dr. Zhang.

On the Stability of Homogeneous Equilibria of the Vlasov–Poisson System

Alexandru Ionescu (Princeton University)

Abstract: I will discuss the topic of linear and nonlinear stability of homogeneous equilibria among solutions of the Vlasov–Poisson system, both in the unconfined Euclidean space and in the confined periodic domains. The Euclidean problem differs significantly from the classical work on Landau damping in the periodic setting, in several ways. Most importantly, the linearized problem cannot satisfy a “Penrose condition”. As a result, our system contains resonances (small divisors) and the electric field can decay at most polynomially. This is joint work with Benoit Pausader, Xuecheng Wang, and Klaus Widmayer.

De Rham Comparison for Boundary Cohomology

Kai-Wen Lan (University of Minnesota Twin Cities)

Abstract: Let X be any variety smooth but not necessarily proper over the p -adic numbers. In joint works with Hansheng Diao, Ruochuan Liu, and Xinwen Zhu, we constructed a Riemann–Hilbert functor sending any p -adic étale local system L over X to a regular integrable connection $RH(L)$ over X , and we showed that, when L is de Rham, we have a comparison isomorphism between the étale cohomology of L and the de Rham cohomology of $RH(L)$ after tensoring with Fontaine’s period ring B_{dR} . In joint work with Ruochuan Liu and Xinwen Zhu that is published in the Peking Mathematical Journal, we also established compatible analogues for the compactly supported cohomology and the so-called interior cohomology. In this talk, I will explain yet another analogue for the so-called boundary cohomology, which naturally complements the interior cohomology, and some further generalizations, based on joint work with David Sherman. I will start with a general review, and explain our strategy. If time permits, I will also explain some applications to Shimura varieties.

Harmonic Functions and Beyond

Yanyan Li (Rutgers University)

Abstract: A harmonic function of one variable is a linear function. A harmonic function of two variables is the real or imaginary part of an analytic function. A harmonic function of n variables is a function u satisfying

$$\frac{\partial^2 u}{\partial x_1^2} + \cdots + \frac{\partial^2 u}{\partial x_n^2} = 0.$$

We will first recall some basic results on harmonic functions: the mean value property, the maximum principle, the Liouville theorem, the Harnack inequality, the Bôcher theorem, the capacity and removable singularities. We will then present a number of more recent results on some conformally invariant elliptic and degenerate elliptic equations arising from conformal geometry. These include results on Liouville theorems, Harnack inequalities, and Bôcher theorems.

Complete Kähler Manifolds with Nonnegative Ricci Curvature

Gang Liu (East China Normal University)

Abstract: We discuss recent rigidity results on complete Kähler manifolds with nonnegative bisectional curvature and nonnegative Ricci curvature. In particular, we gave a new characterization of certain complete Ricci flat Kähler manifolds.

TBA

Kaoru Ono (Kyoto University)

Abstract: TBA

The L_p -Minkowski Problem with Supercritical Exponents

Xu-Jia Wang (Australian National University)

Abstract: The L_p -Minkowski problem is an extension of the classical Minkowski problem. It can be formulated as the Monge–Ampère equation

$$\det(D^2u + uI) = f(x)u^{p-1} \quad \text{on } S^n.$$

The corresponding functional is related to the Blaschke–Santaló inequality. Accordingly the problem can be divided into the sub-critical case $p > -n - 1$, the critical case $p = -n - 1$, and the supercritical case $p < -n - 1$. There is a wealth of phenomena regarding the existence and multiplicity of solutions. In this talk we will discuss the existence of solutions for p in the super-critical range $p < -n - 1$, and the limit shape of solutions as $p \rightarrow -\infty$.

Algebraic Dynamics and Recursive Inequalities

Junyi Xie (Peking University)

Abstract: We get three basic results in algebraic dynamics:

- (1) We give the first algorithm to compute the dynamical degrees to arbitrary precision.
- (2) We prove that for a family of dominant rational self-maps, the dynamical degrees are lower semi-continuous with respect to the Zariski topology. This implies a conjecture of Call and Silverman.
- (3) We prove that the set of periodic points of a cohomologically hyperbolic rational self-map is Zariski dense.

In fact, for every dominant rational self-map, we find a family of recursive inequalities of some dynamically meaningful cycles. Our proofs are based on these inequalities.

Homotopy Groups of Spheres

Zhouli Xu (University of California San Diego)

Abstract: Up to continuous deformations, all based continuous maps between two spheres form an abelian group, and is called a homotopy group of the target sphere. It turns out that determination of these groups is a very hard problem in topology. The structures of the homotopy groups of spheres are closely related to many topics in topology, such as the Hopf invariant problem, the Kervaire invariant problem, and the number of smooth structures on a given sphere.

In this talk, I will review some classical and recent methods of computing these groups, and discuss a new result joint with Weinan Lin and Guozhen Wang.

Some Problems in Quasi-periodic Schrödinger Operators

Jiangong You (Nankai University)

Abstract: I will survey some of recent progress in quasi-periodic operators and propose some open questions.

Limit Structure of KR Flow on Fano Manifolds with Large Symmetry

Xiaohua Zhu (Peking University)

Abstract: By Hamilton–Tian conjecture, the limit of KR flow is a singular KR soliton on a Q -Fano variety. Thus it is interesting to determine the limit by deformation of Kähler metrics along the KR flow. In this talk, I will review some progress on KR flow on spherical Fano manifolds and discuss how to construct the algebraic structure of limit along the flow. My talk is based on my recent works jointly with Tian, Li and Wang.