Contents

Sunday, July 31st

14:00-14:30

1 XUE Qikun: From topology to topological insulators

Southern University of Science and Technology

Zijin Hall 紫金厅

Abstract: In this talk, I discuss the development of topological insulators, an emerging field in condensed matter physics, based on topology in mathematics since the experimental discovery of quantum Hall effect in 1980. The development has resulted in discoveries of new intriguing quantum effects such as quantum spin Hall effect and quantum anomalous Hall effect. I review the experiments of realizing quantum anomalous Hall effect (Chern insulator) by preparing magnetically doped topological insulator.

14:30-15:00

2 CAO Jinde: Collective intelligence network and mathematics

School of Mathematics, Southeast University

Zijin Hall 紫金厅

Abstract: 本报告将围绕群智网络与数学交叉，简要介绍神经网络与复杂网络、网络群体智能、沥青路面数学建模和智能算法设计等领域的国内外相关研究进展，并对未来发展及应用做几点思考和展望。

15:15-15:45

3 ZHOU Zhi-Hua: Open-environment machine learning

Computer Department and School of Artificial Intelligence, Nanjing University

Zijin Hall 紫金厅

Abstract: 机器学习任务以往通常考虑封闭环境，一般假设学习过程中的诸多关键因素不发生变化，而随着机器学习越来越多地进入现实应用，亟需考虑开放环境带来的挑战，在基础理论保障方面尤其需要探索。

15:45-16:15

4 LIU Qingfeng: Latest progress and future trend of artificial intelligence technology

IFlytek

Zijin Hall 紫金厅

Abstract: 本报告从智能语音、计算机视觉和自然语言处理等方面介绍人工智能技术最新进展以及科大讯飞人工智能技术在教育、医疗等民生领域和智能终端等消费品领域的重要应用，并分析了当前人工智能技术应用中所面临的挑战。在此基础上，探讨人工智能技术的未来发展趋势，其中人工智能与数学等科学学科的交叉融合是人工智能走向新一代的关键。

Monday, August 1st

8:00-9:00

5 BIRKAR Caucher: Moduli of algebraic varieties

YMSC

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: Moduli spaces play a fundamental role in algebraic geometry and well beyond. These spaces are essentially spaces parameterising collections of varieties with certain invariants fixed. I this talk I discuss existence of compact moduli spaces for algebraic varieties in a quite general context.

9:00-10:00

6 WOODIN Hugh: The AD^+ duality program

Harvard University

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: The determinacy axiom, AD, was introduced by Mycielski and Steinhaus over 60 years ago as an alternative to the Axiom of Choice for the study of arbitrary sets of real numbers. The modern view is that determinacy axioms concern generalizations of the borel sets, and deep connections with large cardinal axioms have emerged.

Further a specific technical refinement of AD, this is the axiom AD^+, has also been isolated.The further connections with large axioms have implicitly led to a duality program, which is the AD^+ Duality Program.
The central open problems here are intertwined with those of the Inner Model Program, and this is distilled into a series of specific conjectures. We discuss recent progress and new conjectures.

10:15-11:15

7 LIU Chiu-Chu Melissa: Topological recursion and crepant transformation conjecture

Columbia University

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: The Crepant Transformation Conjecture (CTC), first proposed by Yongbin Ruan and later refined/generalized by others, relates Gromov-Witten (GW) invariants of K-equivalent smooth varieties/orbifolds. The Remodeling Conjecture (proposed by Bouchard-Klemm-Mariño-Pasquetti and proved in full generality by Bohan Fang, Zhengyu Zong and the speaker) relates open and closed GW invariants of a symplectic toric Calabi-Yau 3-orbifold to invariants of its mirror curve defined by Chekhov-Eynard-Orantin Topological Recursion. We will explain how to use the Remodeling Conjecture to derive all-genus open and closed CTC for symplectic toric Calabi-Yau 3-orbifolds. This is based on joint work with Bohan Fang, Song Yu, and Zhengyu Zong.

11:20-12:20

8 YAU Stephen Shing-Toung: The geometry of genome space and its applications

Tsinghua University

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: Imitating Hilbert who proposed twenty-three problems in mathematics in 1900, DAPRA proposed twenty-three problems in pure and applied mathematics in 2008. These problems will be proven to be very influential for the development of mathematics in 21st-century. In the number 15 of DAPRA problems, we are asked to understand "The Geometry of Genome Space". A genome space consists of all known genomes of living beings and provides insights into their relationships, reflecting the important nature of the genomic universe. Mathematically, the genome space can be considered as the moduli space in mathematics. In this talk, we shall show that genome sequences can be canonically embedded in a high-dimensional Euclidean space by means of their natural vectors which describe the nucleotides distribution information within the genome sequence. In this way, we construct genome space as a subspace in a high-dimensional Euclidean space. In this space, a genome sequence is uniquely represented as a point, and how sequences are distributed in the genome space is determined. The similarity of sequences can be measured by the natural metric which is different from the induced metric from the ambient Euclidean space. Like our physical world, the dark matter/dark energy plays a crucial role in the construction of the correct natural metric in genome space. Here, we report the construction of genome spaces of virus, bacteria, and plants with natural metrics. These metrics are quite different in each genome space because different dark matter/dark energy may bend the space-time as predicted by Einstein theory.

DAPRA problem 23 asks: What are the Fundamental Laws of Biology? Our convex hull principle for molecular biology states that the convex hull formed from natural vectors of one biological group does not intersect with the convex hull formed from any other biological group. This can be viewed as one of the Fundamental Laws of Biology for which DAPRA has been looking for since 2008. As applications, we provide the first mathematical method to find undiscovered genome sequence. Our theory allows us to explore where SARS-CoV-2 originated from. It provides a novel geomet-

ric perspective to study molecular biology. It also gives accurate way for large-scale sequences comparison in real-time manner.

9 SUN Binyong: Special unipotent representations of classical Lie groups

Zhejiang University

Purple Palace Chamber 紫金会见厅
Zoom: 687 513 9542, Password: YMSC

Abstract: One fundamental problem in representation theory is the unitary dual problem, namely to construct and classify all irreducible unitary representations of a given Lie group G An important principle is the orbit method introduced by A. A. Kirillov, and it seeks to describe irreducible unitary representations of G by its coadjoint orbits. The most mysterious ingredient of orbit method is to attach irreducible unitary representations to nilpotent coadjoint orbits. Special unipotent representations, introduced by Arthur and Barbasch-Vogan, are attached to nilpotent coadjoint orbits and are expected to be unitary. By using the theory of local theta correspondence initiated by R. Howe, we construct all special unipotent representations of classical Lie groups and show that they are all unitary. This is a report on a joint work with Dan M. Barbarsch, Jia-Jun Ma and Chen-Bo Zhu.

10 FAN Jianqing: Stability and approximability of deep ReLU networks in statistical learning

Princeton University

Golden Thread 红杉厅
Zoom: 892 226 4912, Password: YMSC

Abstract: This talk is on the stability of deep ReLU neural networks for nonparametric regression under the assumption that the noise has only a finite p-th moment. We unveil how the optimal rate of convergence depends on p, the degree of smoothness and the intrinsic dimension in a class

of nonparametric regression functions with hierarchical composition structure when both the adaptive Huber loss and deep ReLU neural networks are used. This optimal rate of convergence cannot be obtained by the ordinary least squares but can be achieved by the Huber loss with a properly chosen parameter that adapts to the sample size, smoothness, and moment parameters. A concentration inequality for the adaptive Huber ReLU neural network estimators with allowable optimization errors is also derived. To establish a matching lower bound within the class of neural network estimators using the Huber loss, we employ a different strategy from the traditional route: constructing a deep ReLU network estimator that has a better empirical loss than the true function and the difference between these two functions furnishes a low bound. This step is related to the Huberization bias, yet more critically to the approximability of deep ReLU networks. As a result, we also contribute some new results on the approximation theory of deep ReLU neural networks.
(Joint work with Yihong Gu and Wenxin Zhou)

11 E Weinan: A mathematical introduction to machine learning

Peking University

Curling Dragon 龙蟠厅
Zoom: 276 366 7254, Password: YMSC

Abstract: Deep learning has changed the way we do artificial intelligence (AI) and is poised to change the way we do science. At the same time, it is generally perceived to be a collection of techniques or even tricks without a solid theoretical foundation. In this talk, we will try to address three questions: What is the magic behind neural network-based machine learning? How can we use deep learning to solve challenging problems in science and scientific computing? Can we formulate more general and maybe mathematically more natural models of machine learning?
The main message is that (deep) neural networks provide an effective tool for approximating high dimensional functions. This allows us to attack

many difficult problems that are known to suffer from the curse of dimensionality. We will discuss the theoretical progress that has been made so far along these lines, and highlight the most pressing unsolved mathematical and practical issues.

13:20-14:20

12 CHEN Zhiming: Some progress of numerical methods for inverse problems

Academy of Mathematics and Systems Science, Chinese Academy of Sciences

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: Inverse problems can be classified as linear or nonlinear according to the linearity or nonlinearity of the governing operator from the unknown function to the data. The first part of my talk is about linear inverse problems. We investigate the regularized solutions and their finite element solutions to the inverse source problems governed by partial differential equations, and we establish the stochastic convergence and optimal finite element convergence rates of these solutions under pointwise measurement data with random noise. Then regularization error estimates and the finite element error estimates are derived with explicit dependence on the noise level, regularization parameter, mesh size, and time step size, which can guide practical choices among these key parameters in real applications. The error estimates also suggest an iterative algorithm for determining an optimal regularization parameter. This part of the talk is based on joint works with Rui Tuo, Wenlong Zhang, and Jun Zou.

In the second part, we consider the inverse scattering problems which are typical nonlinear inverse problems. The reverse time migration (RTM) or the closely related prestack depth migration methods are nowadays widely used in exploration geophysics. It is originated in the simple setting of the exploding reflector model. For imaging the complex medium in practical

applications, the analysis of the migration method is usually based on the high frequency assumption, so that the geometric optics approximation can be used. We report our recent efforts in establishing new mathematical understanding of the RTM method without geometric optics assumption for inverse scattering problems. Our resolution analysis, which applies in both penetrable and non-penetrable obstacles with sound soft or impedance boundary condition on the boundary of the obstacle, implies that the RTM imaging functional always peaks on the boundary of the scatterers. This new mathematical understanding leads to several new direct imaging algorithms including: imaging for electromagnetic objects, imaging in half-space acoustics and elasticity, imaging in closed waveguide, and imaging for scattering data without phase information. This part of the talk is based on joint works with Junqing Chen, Guanghui Huang, and Shiqi Zhou.

13 SHEN Xu: p-adic periods and Shimura varieties

Academy of Mathematics and Systems Science, Chinese Academy of Sciences

Purple Palace Chamber 紫金会见厅
Zoom: 687 513 9542, Password: YMSC

Abstract: Shimura varieties are key objects to study in arithmetic geometry and Langlands program. In this talk, we will discuss some recent advances on the geometry and cohomology of Shimura varieties via p-adic Hodge theoretic methods. More precisely, we will talk about Hodge-Tate period maps, F-zips with additional structures for certain Pappas-Rapoport splitting models, and some applications to intersection cohomology and coherent cohomology respectively.

14 CAO Junyan: The geometry of Kähler varieties with numerically effective Ricci curvatures

Université Côte d'Azur

Golden Thread 红杉厅

Zoom: 892 226 4912, Password: YMSC

Abstract: The positivity of Ricci curvature controls the geometry of manifolds. A conjecture of Demailly-Peternell-Schneider predicts that the universal cover of a compact Kähler manifold with numerically effective Ricci curvatures can be split as the product of rational connected manifolds and Ricci flat manifolds. We will present some results related to this conjecture, which are based on the joint works with A.Höring, F. Campana, and S.-I. Matsumura.

15 MOK Ngaiming: Complex differential geometry in action: from uniruled projective manifolds to arithmetico-geometric problems on complex function fields

The University of Hong Kong

Curling Dragon 龙蟠厅
Zoom: 276 366 7254, Password: YMSC

Abstract: Complex differential geometry, beyond its intrinsic value in mathematics, is also profusely applicable to other areas of mathematics. In this talk the author will give a bird's eye view over applications arising from or related to his own research work in algebraic geometry and arithmetic geometry.

For uniruled projective manifolds we focus on the variety of minimal rational tangents (VMRT) of Hwang-Mok and its applications: (1) solving rigidity problems under Kähler deformation on rational homogenenous manifolds G/P of Picard number 1 and generalizations, (2) Cartan-Fubini extension theorem of Hwang-Mok (2001) for VMRT-preserving germs of holomorphic maps, (3) the Recognition Problem for G/P and its solutions, (4) the non-equidimensional Cartan-Fubini extension theorem of Hong-Mok (2010) and the algebraicity theorem for sub-VMRT structures of Mok-Zhang (2022), and (5) Schur and Schubert rigidity theorems for smooth Schubert cycles on G/P of Hong-Mok (2013, 2020) and Mok-Zhang (2022).

For applications to arithmetic geometry we recall (6) results of Mok (1991)

and Mok-To (1993) concerning Mordell-Weil groups of polarized abelian varieties over modular function fields and over function fields obtained from ramified covering maps over the modular variety, (7) the finiteness of points of multiplicities ≥ 2 of a section $\sigma : B \to \mathscr{E}$ of a non-isotrivial elliptic surface $\pi : \mathscr{E} \to B$ of infinite order due to Corvaja-Demeio-Masser-Zannier (2022) and its effective version due to Ulmer-Urzúa (2021), and a differential-geometric proof due to Mok-Ng (Preprint 2022), (8) the Ax-Lindemann theorem of Mok (2019) for rank-1 possibly non-arithmetic lattices, (9) the Ax-Schanuel theorem of Mok-Pila-Tsimerman (2019) for Shimura varieties $X_\Gamma = \Omega/\Gamma$, and (10) the characterization of bialgebraicity for projective subvarieties $Y \subset X_\Gamma$, for X_Γ possibly of infinite volume, uniformized by an algebraic subset $Z \subset \Omega$ (Chan-Mok 2022).

16 DING Peng: Covariate adjustment in multi-armed, possibly factorial experiments

Berkeley CA

Crouching Tiger 虎踞厅
Zoom: 271 534 5558, Password: YMSC

Abstract: Randomized experiments are the gold standard for causal inference, and justify simple comparisons across treatment groups. Regression adjustment provides a convenient way to incorporate covariate information for additional efficiency. This article provides a unified account of its utility for improving estimation efficiency in multi-armed experiments. We start with the commonly used additive and fully interacted models for regression adjustment, and clarify the trade-offs between the resulting ordinary least-squares (OLS) estimators for estimating average treatment effects in terms of finite-sample performance and asymptotic efficiency. We then move on to regression adjustment based on restricted least squares (RLS), and establish for the first time its properties for inferring average treatment effects from the design-based perspective. The resulting inference has multiple guarantees. First, it is asymptotically efficient when the restriction is correctly specified. Second, it remains consistent as long as the restriction on the

coefficients of the treatment indicators, if any, is correctly specified and separate from that on the coefficients of the treatment-covariates interactions. Third, it can have better finite-sample performance than its unrestricted counterpart even if the restriction is moderately misspecified. It is thus our recommendation for covariate adjustment in multi-armed experiments when the OLS fit of the fully interacted regression risks large finite-sample variability in case of many covariates, many treatments, yet a moderate sample size. In addition, the proposed theory of RLS also provides a powerful tool for studying OLS-based inference from general regression specifications. As an illustration, we demonstrate its unique value for studying OLS-based regression adjustment in factorial experiments via both theory and simulation.

14:25-15:25

17 JIN Shi: Quantum algorithms for nonlinear partial differential equations

Shanghai Jiao Tong University

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: Nonlinear partial differential equations (PDEs) are crucial to modelling important problems in science but they are computationally expensive and suffer from the curse of dimensionality. Since quantum algorithms have the potential to resolve the curse of dimensionality in certain instances, some quantum algorithms for nonlinear PDEs have been developed. However, they are fundamentally bound either to weak nonlinearities, valid to only short times, or display no quantum advantage. We construct new quantum algorithms–based on level sets –for nonlinear Hamilton-Jacobi and scalar hyperbolic PDEs that can be performed with quantum advantages on various critical numerical parameters, even for computing the physical observables, for arbitrary nonlinearity and are valid globally in time. These PDEs are important for many applications like optimal control, machine

learning, semi-classical limit of Schrodinger equations, mean-field games and many more.
Depending on the details of the initial data, it can display up to exponential advantage in both the dimension of the PDE and the error in computing its observables. For general nonlinear PDEs, quantum advantage with respect to M, for computing the ensemble averages of solutions corresponding to M different initial data, is possible in the large M limit.
We will also propose quantum algorithms for uncertainty quantification of partial differential equations with quantum advantage over M.
This is a joint work with Nana Liu.

18 ZHU Xi-Ping: On complete noncompact Kaehler manifolds with positive curvature

Sun Yat-sen University

Purple Palace Chamber 紫金会见厅
Zoom: 687 513 9542, Password: YMSC

Abstract: We will discuss the classification of complete noncompact Kaehler manifolds with positive curvature. The theme is Yau's uniformization conjecture which states that any complete noncompact Kaehler manifold with positive bisectional curvature is biholomorphic to the complex Euclidean space. In this talk, we will give a survey on the accomplishments of the conjecture during the past decades and recent developments.
The conjecture for the case of maximal volume growth has been completely confirmed. We will report some recent progress on the case of non-maximal volume growth. Particularly, we can show that any complex two-dimensional complete noncompact Kaehler manifolds with positive sectional curvature and minimal volume growth must be biholomorphic to the complex Euclidean space. This is a joint work with Bing-Long Chen.

19 ZHAO Yufei: Equiangular lines and eigenvalue multiplicities

Massachusetts Institute of Technology

Golden Thread 红杉厅
Zoom: 892 226 4912, Password: YMSC

Abstract: Solving a longstanding problem on equiangular lines, we determine, for each given fixed angle and in all sufficiently large dimensions, the maximum number of lines pairwise separated by the given angle.
A key ingredient is a new result in spectral graph theory: the adjacency matrix of a connected bounded degree graph has sublinear second eigenvalue multiplicity.
My talk will discuss these problems and their connections. Here is an open problem that I would like to understand better: what is the maximum possible second eigenvalue multiplicity of a connected bounded degree graph?

20 DING Jintai: Post-quantum cryptography standard – a new era

Tsinghua University

Curling Dragon 龙蟠厅
Zoom: 276 366 7254, Password: YMSC

Abstract: On July 5th, 2022, NIST just announced the new post-quantum cryptography standards. In this talk, we will present the history of PQC, its mathematical problems and its impact on the future.

21 HE Xuhua: The G-variations

The Chinese University of Hong Kong

Crouching Tiger 虎踞厅
Zoom: 271 534 5558, Password: YMSC

Abstract: The flag varieties (of a reductive group) play a crucial role in geometry and representation theory. The flag varieties have decompositions into the Schubert cells and the opposite Schubert cells. Moreover, Lusztig introduced a positive structure on the flag varieties, which is compatible with the decompositions above. The totally nonnegative flag varieties have

many nice geometric and representation-theoretic properties, and Lusztig referred to them as "remarkable polyhedral spaces" . Recently, Galashin, Karp, and Lam proved that the totally nonnegative flag varieties are regular CW complexes homeomorphic to closed balls.

There are many other interesting varieties related to reductive and (more generally) Kac-Moody groups, which admit nice decompositions and positive structures. One wonders if they are also "remarkable polyhedral spaces" . In this talk, I will explain the atlas map to relate some of these varieties with the flag variety of a (large) Kac-Moody group and how to use the atlas map to establish some nice properties of these varieties. This talk is based on recent and ongoing joint works with Huanchen Bao.

15:40-16:25

22 CHEN Zhijie: On the singular $SU(3)$ Toda system on the torus

YMSC, Tsinghua University

Curling Dragon 龙蟠厅

Tencent Meeting: 459-858-4057, Password: 2022

Abstract: In this talk, I will talk about our recent works on the singular $SU(3)$ Toda system on the torus. When the parameters are non-critical, we show that the solution number is finite; while when the parameters are critical, we show the existence of infinitely many solutions.

23 GU Yi: Counterexamples to Fujita's conjecture in positive characteristic

Soochow University

Green Willow 绿柳厅

Tencent Meeting: 807-924-4670, Password: 2022

Abstract: Let X be a smooth projective variety of dimension d over field of complex numbers and A be an ample divisor on it. In 1987, Fujita

conjectured that $K+nA$ is free of base points if $n \geq d+1$ and very ample if $n \geq d+2$. We will show this conjecture fails in positive characteristic. More precisely, for any algebraically closed field of positive characteristic and any integer m, we show there is a surface X along with an ample divisor A such that $K+mA$ is not free of base points. This is a joint work with Lei Zhang and Yongming Zhang.

24 JIA Zhigang: Robust color image and video inpainting: model, theory and algorithms

Jiangsu Normal University

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: The image nonlocal self-similarity (NSS) prior refers to the fact that a local patch often has many nonlocal similar patches to it across the image and has been widely applied in many recently proposed machining learning algorithms for image processing. However, there is no theoretical analysis on its working principle in the literature. In this talk, we discover a potential causality between NSS and low-rank property of color images, which is also available to grey images. A new patch group based NSS prior scheme is proposed to learn explicit NSS models of natural color images. The numerical low-rank property of patched matrices is also rigorously proved. The NSS-based QMC algorithm computes an optimal low-rank approximation to the high-rank color image, resulting in high PSNR and SSIM measures and particularly the better visual quality. A new tensor NSS-based QMC method is also presented to solve the color video inpainting problem based on quaternion tensor representation. The numerical experiments on color images and videos indicate the advantages of NSS-based QMC over the state-of-the-art methods.

25 LIU Congwen: On the contractivity conjecture of Pavlović

University of Science and Technology of China

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: In this talk, we present a complete proof of the contractivity conjecture of Pavlović (also of Brevig, Ortega-Cerdá, Seip and Zhao), which states that the classical Hardy space H^p of the unit disc embeds contractively into the weighted Bergman space $A^{\alpha p}_\alpha$, that is, it holds that

$$\|f\|_{A^{\alpha p}_\alpha} \le \|f\|_{H^p}$$

for any $f \in H^p$. Equality holds if and only if f is of the form

$$f(z) = C\,(1 - z\bar{\zeta})^{-2/p}$$

for some constant C and some point $\zeta \in \mathbb{D}$. Here

$$\|f\|_{A^p_\alpha} := \left\{ \frac{\alpha - 1}{\pi} \int_{\mathbb{D}} |f(z)|^p (1 - |z|^2)^{\alpha - 2} dxdy \right\}^{1/p}.$$

26 LIU Dang-Zheng: Phase transition of eigenvalues in non-Hermitian random matrix theory

University of Science and Technology of China

Lily Magnolia 木兰厅
Tencent Meeting: 826-641-7263, Password: 2022

Abstract: Consider a random matrix of size N as an additive deformation of the complex Ginibre ensemble under a deterministic matrix X_0 with a finite rank, independent of N. When some eigenvalues of X_0 separate from the unit disk, outlier eigenvalues may appear asymptotically in the same locations, and their fluctuations exhibit surprising phenomena that highly depend on the Jordan canonical form of X_0. These findings are largely due to Benaych-Georges and Rochet, Bordenave and Capitaine, and Tao. When all eigenvalues of X_0 lie inside the unit disk, we prove that local eigenvalue statistics at the spectral edge form a new class of determinantal point processes, for which correlation kernels are characterized in terms of the repeated erfc integrals. This thus completes a non-Hermitian analogue

of the BBP phase transition in Random Matrix Theory. Duality formulae between different random matrix ensembles play a key role. This talk is based on joint work with Lu Zhang (USTC), arXiv:2204.13171v2.

27 WANG Tingchun: Convergence analysis of numerical methods for the nonlinear Schrödinger-type equations

NUIST

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: In this talk, we propose and analyze several accurate and efficient numerical methods for different types of nonlinear Schrödinger (NLS) equations. By using the energy method and introducing some useful lemmas and techniques, we establish the optimal error estimates of the proposed numerical schemes without limiting the grid ratios and initial values. Numerical results are reported to test the theoretical analysis and simulate several dynamics of the NLS equations.

28 WANG Yue: Some results on steady Prandtl equation with general initial data

Capital Normal University

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: In this talk, I will review some related results and report our recent works on steady Prandtl equations. In the case of adverse pressure gradient, we proved the boundary layer separation for a large class of Oleinik's solutions and studied the local behavior of the solutions near the separation. In the case of favorable pressure gradient, we proved the global C^∞ regularity and studied the asymptotic behavior for general initial data.

29 ZHOU Zhengyi: On fillings of contact links of isolated quotient singularities

CAS

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: I will talk about symplectic fillings of contact links of isolated quotient singularities using Floer theories. I will focus on discussing the non-existence of exact fillings and uniqueness of exact orbifold fillings when the singularity is terminal. In particular, I will explain why odd dimensional real projective spaces with the standard contact structure have no exact filling whenever the dimension is greater than 5 and not equal to 7, which confirms a conjecture of Eliashberg except for the 7-dimensional case.

16:30-17:15

30 CHEN Gao: An attempt towards the Hodge conjecture

University of Science and Technology of China

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: In this talk, we will discuss an attempt towards the Hodge conjecture. Currently, two out of five steps have been solved. We will discuss these two steps as well as some known results related to the rest three unsolved steps.

31 DAI Xiaoying: Convergent orthogonality preserving appoximations of the Kohn-Sham orbitals

Academy of Mathematics and Systems Science, Chinese Academy of Sciences

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: To obtain convergent numerical approximations without orthogonalization operations is of great importance in electronic structure calculations. In this talk, we will introduce an extended gradient flow based Kohn-Sham DFT model, for which we prove the flow is orthogonality preserving and the solution evolves to the ground state. With the help of the gradient flow based Kohn-Sham DFT model, we propose and analyze a class of iteration schemes for the discretized Kohn-Sham model, which preserves the orthogonality of the Kohn-Sham orbitals automatically. With our schemes, the iterative approximations are guaranteed to converge to the Kohn-Sham orbitals without any orthogonalization operations when the initial orbitals are orthogonal. We prove the convergence and get the local convergence rate of the numerical approximations under some reasonable assumptions. This is a joint work with Qiao Wang, Liwei Zhang and Aihui Zhou.

32 FAN Xiaodan: Consistent model-free high-dimensional variable screening for binary response

Department of Statistics, The Chinese University of Hong Kong

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: Analyzing massive datasets of thousands or even millions of variables is becoming a routine task in many scientific research fields and industry applications. Variable selection is indispensable for scientific discoveries from such datasets. Various variable screening procedures, such as SIS and the Kolmogorov filter, are introduced to crudely reduce the dimension to a moderate size by filtering out spurious variables according to their marginal association with the response variable. There are several aspects that we need to improve over these existing variable screening procedures. Firstly, they can only guarantee the sure screening property

instead of consistency. Secondly, they cannot explicitly control the type-I error. We propose a new screening method for selecting variables from high dimensional datasets where the response variable is binary. The new method enjoys consistency instead of only the sure screening property, and enables us to select screening thresholds according to the desired type-I error rate. Moreover, it is a robust model-free method, thus it can handle complex nonlinear association between the response and the covariate. It can even detect covariates which are jointly affecting the response but show no marginal effect.

33 HU Yongquan: On mod p Jacquet-Langlands correspondence for $GL_2(\mathbb{Q}_p)$

Morningside Center of Mathematics, AMSS

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: The classical Jacquet-Langlands (J-L) correspondence relates complex representations of GL_n and that of its inner forms. It was proved in 1970's and provides one of the first examples of the functoriality conjecture in Langlands program. However, when we consider representations with p-adic or mod p coefficients, the analogue of J-L correspondence is still poorly understood, even in the simplest case of $GL_2(\mathbb{Q}_p)$. In this talk, we will report some recent progress on the p-adic and mod p J-L correspondence for $GL_2(\mathbb{Q}_p)$. This is joint work with Haoran Wang.

34 LI Mengni: Boundary Hölder regularity for a class of fully nonlinear elliptic equations

Southeast University

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: In this talk, we are concerned with the boundary regularity of solutions to the Dirichlet problem for a class of fully nonlinear elliptic

partial differential equations. Motivated by the case of Monge-Amp‘ere equations, we construct delicate sub-solutions to derive effective boundary regularity estimates of convex solutions to the problem. Emphasis here is on the relation of our boundary regularity result with the convexity of the domain.

35 LI Si: Elliptic chiral homology and chiral index

YMSC

Lily Magnolia 木兰厅
Tencent Meeting: 826-641-7263, Password: 2022

Abstract: We present an effective quantization theory for chiral deformation of two dimensional conformal field theories. We explain a connection between the quantum master equation and the chiral homology for vertex operator algebras. As an application, we construct correlation functions of the curved beta-gamma/b-c system and establish a coupled equation relating to chiral homology groups of chiral differential operators. This can be viewed as the vertex algebra analogue of the trace map in algebraic index theory. The talk is based on the recent work arXiv:2112.14572 [math.QA].

36 MA Qiaozhen: The long time dynamics of the suspension bridge equations

Northwest Normal University

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: In this talk, we are mainly concerned with existence of global attractors for both single and coupled suspension bridge equations. In order to verify the compactness of semigroup (process) associated with the problems we take advantage with the following techniques. (i) We obtain the compactness of semigroup for the single and coupled autonomous suspension bridge equations by using the condition (C) introduced by Ma,

Wang and Zhong. (ii) We first arrive at the compactness of process for the non-autonomous coupled suspension bridge equations exploiting the condition (C*) presented by Zhong and Ma under the condition that the time-dependent forcing term is not translation compact but only translation bounded. And then we achieve the compactness of process for the single non-autonomous suspension bridge equation with state-dependent delay by virtue of the methods of contractive function.

37 WANG Jun: Existence and multiplicity of positive solutions for the elliptic and parabolic system

Jiangsu University

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: In this talk we introduce the recent results on the existence, bifurcation and orbital stability for the elliptic system. On the other hand, we give the existence self-similar solutions to the parabolic equations with positive singular initial value.

38 WU Jie: Aspects of homotopy patterns

BIMSA

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: Recently, Laurent Bartholdi and Roman Mikhailov made a breakthrough progress on dimension problem in group theory using homotopy theory, which leads to a new notion of homotopy pattern introduced by Roman Mikhailov for the Proceedings of the ICM 2022. This talk is an introduction to the work of Laurent Bartholdi and Roman Mikhailov, as well as the relevant research on the theories for homotopy patterns. The talk will also introduce some recent works on homotopy pattern theory given by people in Chinese school of topology. Particularly, we will introduce a recent work of Yu Zhang on the topic.

39 ZHU Baoxuan: Hankel-total-positivity of combinatorial sequences

Jiangsu Normal University

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: Total positivity of matrices is a powerful tool and has many applications in different branches of mathematics. Hankel-total-positivity of sequences can characterize the Stieltjes Moment Problems. In this talk, we will report some results for (coefficientwise) Hankel-total-positivity in combinatorics.

Tuesday, August 2nd

08:00-09:00

40 KISIN Mark: Essential dimension and prismatic cohomology

Harvard University

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: The smallest number of parameters needed to define an algebraic covering space is called its essential dimension.
Questions about this invariant go back to Klein, Kronecker and Hilbert and are related to Hilbert's 13th problem.
In this talk, I will give a little history, and then explain a new approach which relies on recent developments in p-adic Hodge theory.

09:00-10:00

41 RESHETIKHIN Nicolai: Superintegrability and representation theory

YMSC

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: The first part of the talk will be an overview of superintegrability in Hamiltonian mechanics. Examples of superintegrable systems related to moduli spaces of flat connections will be introduced.
The second part of the talk will start with an overview of quantum superintegrability and its relation to representation theory. Examples related to quantization of moduli spaces will be presented.

10:15-11:15

42 DING Jian: Repeated emergence of 4/3-exponent

Peking University

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: In this talk, I will describe the emergence of the 4/3-exponent in two seemingly unrelated models: random distance of Liouville quantum gravity and correlation length for the two-dimensional random field Ising model. I will then explain that such 4/3-exponent, while being unexpected among respective communities even from a physics perspective, has in fact been hinted in Leighton-Shor (1989) and Talagrand (2014) where the 4/3-exponent emerges in a random matching problem. Finally, I will present the heuristic computation which leads to the emergence of the 4/3-exponent.
Based on a joint work with Subhajit Goswami and a joint work with Mateo Wirth.

11:20-12:20

43 ZHANG Hui-Chun: A one-phase free boundary problem on non-collapsing RCD-spaces

Sun Yat-sen University

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: In this talk, we will introduce some regularity results for a one-phase free boundary problem on metric measure spaces with a generalized lower Ricci bound, curvature-dimension condition. It contains the Lipschitz regularity of solutions and the partial regularity of the free boundary. This is based on a joint work with Chung-Kwong Chan, and Xi-Ping Zhu.

44 ZHANG Ping: Global hydrostatic approximation of hyperbolic Navier-Stokes system with small gevrey class 2 data

Peking University

Purple Palace Chamber 紫金会见厅
Zoom: 687 513 9542, Password: YMSC

Abstract: We investigate the hydrostatic approximation of a hyperbolic version of Navier-Stokes equations, which is obtained by using Cattaneo type law instead of Fourier law, evolving in a thin strip $\mathbb{R}x(0,\epsilon)$. The formal limit of these equations is a hyperbolic Prandtl type equation. We first prove the global existence of solutions to these equations under a uniform smallness assumption on the data in Gevrey 2 class. Then we justify the limit globally-in-time from the anisotropic hyperbolic Navier-Stokes system to the hyperbolic Prandtl system with such Gevrey 2 class data. Compared with our previous paper for the hydrostatic approximation of 2-D classical Navier-Stokes system with analytic data, here the initial data belong to the Gevrey 2 class, which is very sophisticated even for the well- posedness of the classical Prandtl system, furthermore, the estimate of the pressure term in the hyperbolic Prandtl system arises additional difficulties. (This is joint work with M. Paicu)

45 LIN Wen-Wei: Eigen-decomposition and fast solvers for 3D Maxwell's equations for photonic crystals and complex media

Department of Applied Mathematics, Yang Ming Chiao Tung University

Golden Thread 红杉厅
Zoom: 892 226 4912, Password: YMSC

Abstract: In this talk, we consider studying the eigen-decomposition and developing the fast solver for 3D Maxwell's equations for photonic crystals and complex media. The fast algorithm for Maxwell's equations (FAME) is proposed for band structure calculations of 3D isotopic/anisotropic photonic crystals(PCs)/chiral media, especially with non-orthogonal Bravais lattices. By directly working with the intrinsic coordinate system with Bravais translation lattices/inverse lattices as basis/inverse basis and covariant/contravariant formulations of Maxwell's equations, the approach proposed here treats non-orthogonal and orthogonal Bravais lattices in an equal and unified manner, and trivially incorporates the Bloch condition in the discretization.

Yee's scheme does not require the coordinate system or mesh be orthogonal, and assisted by linear interpolation it can handle anisotropic media, by which the frequency domain Maxwell's equations are discretized into a genralized eigenvalue problem (GEP). With an alternative understanding of nullspace-deflation techniques, this GEP is transformed into several equivalent nullspace free GEPs (NFGEPs), whose smallest few positive eigenvalues and associated eigenvectors are solved by an iterative eigensolver of the inner-outer type. Comparison with other methods for band structure calculations of 3D anisotropic/isotropic PCs is made to demonstrate the effectiveness and strength of our present approach.

Moreover, for the complex media case, we show the NFGEP has 2×2 Jordan blocks at infinity eigenvalues at a critical chiral parameter. The 2×2 Jordan block will split into complex conjugate eigenpairs which rapidly collide on the real axis and bifurcate into a new positive and a new negative eigenvalues. The corresponding electric and magnetic fields of the resonance modes are peculiarly concentrated inside the material structure.

46 LAM Thomas: Positroids,knots, and Catalan numbers

The University of Michigan

Curling Dragon 龙蟠厅
Zoom: 276 366 7254, Password: YMSC

Abstract: A classical result states that the Poincare polynomial of Grassmannian manifold is given by a Gaussian polynomial, the q-analogue of the binomial coefficient. I will discuss joint work with Pavel Galashin where we prove a variant of this relating the topology of a positroid variety and (q,t)-Catalan numbers. Positroid varieties are remarkable subvarieties of the Grassmannian that have made appearances in total positivity, scattering amplitudes, and Schubert calculus. Our work relies on a connection between the geometry of these spaces and link homology groups of certain "positroid links".

47 CHEN Meng: On explicit birational geometry for varieties of general type

Fudan University

Crouching Tiger 虎踞厅
Zoom: 271 534 5558, Password: YMSC

Abstract: The classification strategy for projective varieties of general type contains three parts: minimal model program, exact distribution of birational invariants (i.e. geometric geography), moduli spaces of given invariants. Due to the celebrated work of Birkar-Cascini-Hacon-McKernan, The MMP for varieties of general type was established in 2010. This talk aims to introduce some new progress on high dimensional geography. Especially we talk about the study of varieties with very small positive canonical volumes.

13:20-14:05

48 BAO Chenglong: Learning robust imaging models without paired data

Tsinghua University

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: The observations in practical imaging systems always contain complex noise such that classical approaches are difficult to obtain satisfactory results. In recent years, deep neural networks directly learned a map between the noisy and clean images based on the training on paired data. Despite its promising results in various tasks, collecting the training data is difficult and time-consuming in practice. In this talk, in the unpaired data regime, we will discuss our recent progress for building AI-aided robust models and their applications in image processing. Leveraging the Bayesian inference framework, our model combines classical mathematical modeling and deep neural networks to improve interpretability. Experimental results on various real datasets validate the advantages of the proposed methods.

49 FAN Zhaobing: Geometric approach to quantum algebras

Harbin Engineering University

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: Given a connected reductive group G over p-adic local field $\mathbb{F}$, the corresponding Iwahori-Hecke algebra is a convolution algebra on double coset $I\backslash G/I$, where I is the Iwahori subgroup of G. When G/I is replaced by various flag varieties, different algebras are obtained. In this talk, I will explain the explicit algebra structure and certain properties of those algebras and their corresponding quantum algebras.

50 FENG Xingdong: Deep over-parameterized quantile regression

Shanghai University of Finance and Economics

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: We provide the statistical guarantee (oracle inequalities) for over-parameterized deep quantile regression with ReLU neural networks. The oracle inequalities are given by trading off approximation and statistical (generalization) errors. We have established a novel approximation result for Hölder functions with norm-constrained weights. With this norm controlled approximation, we obtain a nearly size-independent statistical error. Furthermore, our results indicate that the curse of dimensionality is circumvented if data are supported on a low-dimensional Riemannian Manifold.

51 GUI Bin: Equivalence of the braided tensor categories associated to unitary vertex operator algebras and conformal nets

Tsinghua University

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: We report on the history and recent progress in understanding the relationships between unitary vertex operators and conformal nets, with emphasis on the equivalence of their representation theories.

52 LE Pengyu: Perturbation method and asymptotic geometry of Schwarzschild black hole

BIMSA

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: We explain how the perturbation method can be applied to study the asymptotic geometry of a Schwarzschild black hole at its null infinity. We shall introduce a system of propagation equations and elliptic equations to describe the spacetime geometry on a null hypersurface. By exploring the perturbation theory of the above system, we show that one

can obtain the desired asymptotic geometry at null infinity by deforming null hypersurfaces. In particular, this gives rise to an important application to the Penrose inequality for a perturbed vacuum Schwarzschild black hole in general relativity.

53 WANG Kui: The second Robin eigenvalue for Laplacian on space forms

Soochow University

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: In this talk, we will focus on first and second eigenvalues of Laplacian with boundary conditions, including Dirichlet, Neumann, Robin and Steklov eigenvalues. Precisely, we will show that geodesic balls in non-positively curved space forms and non-compact rank-1 symmetric space maximize the second Robin eigenvalue among bounded domains of the same volume. This talk is based on some joint works with Xiaolong Li (Wichita State University) and Haotian Wu (The University of Sydney).

54 WU Yunhui: Recent progress on first eigenvalues of hyperbolic surfaces for large genus

Tsinghua University

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: In this talk we wil discuss several recent results on first eigenvalues of closed hyperbolic surfaces for large genus. For example, we show that a random hyperbolic surface of large genus has first eigenvalue greater than $\frac{3}{16} - \epsilon$, extending Mirzakhani's lower bound 0.0024. This talk is based on several joint works with Yuhao Xue.

55 XU Daxin: Parallel transport for Higgs bundles over p-adic curves

Morningside Center of Mathematics, Chinese Academy

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: Faltings conjectured that under the p-adic Simpson correspondence, finite dimensional p-adic representations of the geometric étale fundamental group of a smooth proper p-adic curve X are equivalent to semi-stable Higgs bundles of degree zero over X. We will talk about an equivalence between these representations and Higgs bundles whose underlying vector bundle admits potentially a strongly semi-stable reduction of degree zero. These Higgs bundles are semi-stable of degree zero and we will investigate some evidence for Faltings' conjecture.

56 ZHANG Youjin: Frobenius manifolds and bihamiltonian integrable hierarchies

Tsinghua University

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: We review recent progress in the study of properties of a certain class of bihamiltonian integrable hierarchies associated with semisimple Frobenius manifolds. These integrable hierarchies are certain deformations of the so called Principal Hierarchies of Frobenius manifolds which are hierarchies of bihamiltonian integrable PDEs of hydrodynamic type. They are shown to possess Virasoro symmetries when the central invariants of the corresponding bihamiltonian structures are constant. In particular, when the central invariants of the bihamiltonian structures are equal to 1/24, the Virasoro symmetries are proved to be linearizable, and the corresponding integrable hierarchies are equivalent to the topological deformations of the Principal Hierarchies.

14:10-14:55

57 CHEN Min: An (F_1, F_4)-partition of planar graphs with girth 6

Department of Mathematics, Zhejiang Normal University

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: Let $G = (V, E)$ be a graph.If the vertex set $V(G)$ can be partitioned into two non-empty subsets V_1 and V_2 such that $G[V_1]$ and $G[V_2]$ are graphs with maximum degree at most d_1 and d_2, respectively, then we say that G has a $(\Delta_{d_1}, \Delta_{d_2})$-partition. A similar definition can be given for the notation (F_{d_1}, F_{d_2})-partition if $G[V_i]$ is a forest with maximum degree at most d_i, where $i \in \{1, 2\}$.
The maximum average degree of G is defined to be $\mathrm{mad}(G) = \max\{\frac{2|E(H)|}{|V(H)|} : H \subseteq G\}$.In this talk, we prove that every graph G with $\mathrm{mad}(G) \leq \frac{16}{5}$ admits an (F_1, F_4)-partition. As a corollary, every planar graph with girth at least 6 admits an (F_1, F_4)-partition. This improves a result in [O. V. Borodin, A. V. Kostochka, Defective 2-colorings of sparse graphs, J. Combin. Theory Ser. B 104 (2014) 72–80.] saying that every graph G with $\mathrm{mad}(G) \leq \frac{16}{5}$ admits a (Δ_1, Δ_4)-partition. This is joint work with André Raspaud and Weiqiang Yu.

58 GU Jie: Volume conjecture, Chern-Simons theory and resurgence

Yau Center, Southeast University

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: Volume Conjecture, as well as its generalisation like the Quantum Modularity theory, relates 3d topology to diverse fields in mathematics, for instance, hyperbolic geometry, quantum group, modular forms, number

theory, and etc, and therefore is an important subject in the field of 3d topology. We reinterpret Volume Conjecture using physics language, especially the complex Chern-Simons theory and the resurgence theory, and proceed to define new 3d topological invariants.

59 HUANG Ruizhi: Homotopy of manifolds

AMSS

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: Homotopy properties are basic global properties of geometric objects. From 2014, techniques in unstable homotopy theory are used to study homotopy of manifolds effectively. In this talk, I will review the progress in this topic, especially on a series of recent work of myself joint with Stephen Theriault. In particular, we will discuss the integral/local or rational homotopy of manifolds in various contexts such as for manifolds with prescribed embeddings, blow ups, free loop spaces, open books, etc.

60 LIAO Gang: Symbolic extensions for 3-dimensional diffeomorphisms

Soochow University

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: The coding of dynamical system is a way to simulate chaotic behavior by symbolic dynamics. We prove that every C^r diffeomorphism with $r > 1$ on a three-dimensional manifold admits symbolic extensions, i.e. topological extensions which are subshifts over a finite alphabet.

61 MING Mei: Local well-posedness to the capillary water-waves problem with contact angles

Yunnan University

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: We investigate the water-waves problem in a bounded two-dimensional corner domain with surface tension. The local well-posedness is proved when the contact angles lie in $(0, \pi/2)$. The theory of singularity decompositions for related elliptic systems and some interesting structures in the water-waves problem will be introduced and discussed in this talk. The related papers are joint works with Chao Wang.

62 QIU Lingyun: Non-line-of-sight imaging

Tsinghua University

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: Non-line-of-sight imaging aims at recovering obscured objects from multiple scattered light. It has recently received widespread attention due to its potential applications such as autonomous driving, rescue operations, and remote sensing. However, in cases with high measurement noise, obtaining high-quality reconstructions remains a challenging task. In this work, we establish a unified regularization framework, which can be tailored for different scenarios, including indoor and outdoor scenes with substantial background noise under both confocal and non-confocal settings. The proposed regularization framework incorporates sparseness and non-local self-similarity of the hidden objects as well as smoothness of the measured signals. We show that the estimated signals, albedo, and surface normal of the hidden objects can be reconstructed robustly even with high measurement noise under the proposed framework. Reconstruction results on synthetic and experimental data show that our approach recovers the hidden objects faithfully and outperforms state-of-the-art reconstruction algorithms in terms of both quantitative criteria and visual quality.

63 TANG Xingdong: Non-degeneracy of bubble solutions for nonlinear Hartree equations

Nanjing University of Information Science and Technology

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: The non-degeneracy of bubble solutions for nonlinear elliptic equations plays a key ingredient in constriction of new bubbling solutions and blow-up solutions for the corresponding parabolic and hyperbolic equations. We concern with non- degeneracy of bubble solutions for the critical nonlinear Hartree equations

$$-\Delta u(x) - \boldsymbol{\alpha}(N,\lambda)\int_{\mathbb{R}^n}\frac{u^p(y)}{|x-y|^\lambda}dy\ u^{p-1}(x) = 0. \qquad \text{(CNHE)}$$

degeneracy property of bubble solutions for (CNHE).

64 ZHANG Li-Xin: Covariate-adaptive randomization in clinical trials for balancing covariates

School of Mathematical Sciences, Zhejiang University

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: Balancing treatment allocation over influential covariates is an important issue in clinical trials. In literature, a lot of covariate-adaptive designs are proposed for balancing covariates. In this talk, we consider the theory of the covariate-adaptive designs. The asymptotic type I error and asymptotic power of hypothesis testing to compare the treatment effects under covariate-adaptive randomization procedures are considered. It is shown that the usual test has not precise type I error and will lose power if the covariates are not balanced well. The efficient covariate-adaptive designs are introduced so that the loss of power is asymptotically ignorable. The talk is based on works of Ma, Hu and Zhang (2015), Hu and Zhang (2013), Hu, Ye and Zhang (2022+), Ma, Li, Zhang and Hu (2022+).

15:10-15:55

65 CHEN Junqing: Mathematical and numerical aspects of an inverse eddy problem

Tsinghua University

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: I will talk about the mathematical and numerical study of an inverse eddy current problem. We study the ill-posedness of the inverse eddy current problem, then in the framework of regularization, we prove the existence and the stability of solution under different regularization terms. After that, we conduct the numerical study of the inverse problem. We discretize the state and adjoint equations with finite element method, then propose iterative methods based on gradient to solve the discrete inverse problem. We use adjoint method to compute the gradient of objective functional to the inverse problem. Finally, I will give some numerical examples to show the efficiency of the proposed algorithm.

66 DUAN Yongjiang: Small Hankel operators between weighted Bergman spaces

Northeast Normal University

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: Let $\mathcal{D}$ be the class of radial weights on the unit disk D which satisfy both forward and reverse doubling conditions. Suppose that $\omega, \nu \in \mathcal{D}$, $0 < p, q < \infty$ and $f \in Hol(D)$, we characterize the small Hankel operator $h_f : A^p_\omega \to A^q_\nu$ under a mild restriction of the symbol function f. This talk is based on the recent joint work with J. Rattya, S. Wang and F. Wu.

67 GAO Hui: de Rham crystals on the prismatic site

Southern University of Science and Technology

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: Let O_K be a mixed characteristic complete discrete valuation ring with perfect residue field. We will discuss de Rham crystals over the prismatic site of O_K, particularly its relation with Galois representations. This is joint work with Yu Min and Yupeng Wang.

68 LI Haozhao: Finite time singularities for mean curvature flow of surfaces

University of Science and Technology of China

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: In this talk I will survey some recent progress on finite time singularities of mean curvatrue flow of surfaces, including the extension problem and Ilmanen's multiplicity-one conjecture of mean curvature flow under type I mean curvature bound.

69 LIU Xiaodong: Direct sampling method for inverse scattering problems

AMSS, Chinese Academy of Sciences

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: Inverse scattering problems aim to look for unknown objects from the scattered fields or its far field patterns. In the last ten years, the direct sampling methods have attracted a lot of attention and there are rich results for such type methods. We introduce a framework for designing the direct sampling method for inverse scattering problems. In particular, for the case with near field measurements, we avoid the assumption that the measurement surface should far away from the unknown objects.

70 LU Hongliang: Co-degree threshold for rainbow perfect matchings in uniform hypergraphs

Xi'an Jiaotong University

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: Let k and n be two integers, with $k \geq 3$, $n \equiv 0 \pmod{k}$, and n sufficiently large. We determine the $(k-1)$-degree threshold for the existence of a rainbow perfect matchings in n-vertex k-uniform hypergraph. This implies the result of Rödl, Ruciński, and Szemerédi on the $(k-1)$-degree threshold for the existence of perfect matchings in n-vertex k-uniform hypergraphs. In our proof, we identify the extremal configurations of closeness, and consider whether or not the hypergraph is close to the extremal configuration. In addition, we also develop a novel absorbing device and generalize the absorbing lemma of Rödl, Ruciński, and Szemerédi. This is joint work with Yang Wang and Xingxing Yu.

71 WANG Shicheng: Extendability over the 4-sphere and invariant spin structures of surface automorphisms

Peking University

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: The talk is about to use spin structures on surfaces to study the extendability of surface automorphisms over the 4-sphere.

72 WANG Yun: Some progress on Leray's problem

Soochow University

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: In this talk, I will give a brief introduction of some recent results on Leray's problem. We study the axisymmetric flows in a pipe and prove the existence and uniqueness of axisymmetric solutions to the Navier-Stokes equations with large flux. Far field behavior of the solution is also studied. This talk is based on joint work with Chunjing Xie and Kaijian Sha.

73 XIA Chao: Heintze-Karcher's inequality and Alexandrov's soap bubble theorem

Xiamen University

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: Heintze-Karcher's inequality is an interesting geometric inequality for embedded closed hypersurfaces, which can be used to prove Alexandrov's soap bubble theorem on embedded closed CMC hypersurfaces in the Euclidean space. In this talk, we introduce two extensions, one is on closed hypersurfaces in warped product manifolds, the other is on capillary hypersurfaces in the half-space, a ball or a wedge. The main focus is on two different approaches towards the Heintze-Karcher inequality.

16:00-17:00

74 FIGALLI Alessio: Generic regularity in obstacle problems

Eidgenössische Technische Hochschule Zürich

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: The classical obstacle problem consists of finding the equilibrium position of an elastic membrane whose boundary is held fixed and which is constrained to lie above a given obstacle. By classical results of

Caffarelli, the free boundary is smooth outside a set of singular points. Explicit examples show that the singular set could be, in general, as large as the regular set. In a recent paper with Ros-Oton and Serra we show that, generically, the singular set has codimension 3 inside the free boundary, solving a conjecture of Schaeffer in dimension $n \leq 4$. The aim of this talk is to give an overview of these results.

Wednesday, August 3rd

08:00-09:00

75 XIN Zhouping: Free interface problems and stabilizing effects of transversal magnetic fields

The Chinese University of Hong Kong

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: Dynamical interface motions are important flow patterns and fundamental free boundary problems in fluid mechanics, and have attracted huge attentions in the mathematical community. Such waves for purely inviscid fluids are subject to various instabilities such as Kelvin-Helmholtz and Rayleigh-Taylor instabilities unless other stabilizing effects such as surface tension, Taylor-sign conditions or dissipations are imposed. However, in the presence of magnetic fields, it has been known that tangential magnetic fields may have stabilizing effects for free surface waves such as plasma-vacuum or plasma-plasma interfaces (at least locally in time), yet whether transversal magnetic fields (which occurs often for interfacial waves for astrophysical plasmas) can stabilize typical free interfacial waves remains to be some open problems. In this talk I will show the stabilizing effects of the transversal magnetic fields for some interfacial waves for both compressible and incompressible multi-dimensional magnetohydrodynamics (MHD). First, I will present the local (in time) well-posedness in Sobolev space of multi-dimensional compressible MHD contact discontinuities, which are

most typical interfacial waves for astrophysical plasma and prototypical fundamental waves for systems of hyperbolic conservations. Such waves are characteristic discontinuities for which there is no flow across the discontinuity surface while the magnetic field crosses transversally, which lead to a two-phase free boundary problem that may have nonlinear Rayleigh-Taylor instability and whose front symbols have no ellipticity. We overcome such difficulties by exploiting full the transversality of the magnetic fields and designing a nonlinear approximate problem, which yield the local well-posed without loss of derivatives and without any other conditions such as Rayleigh-Taylor sign conditions or surface tension. Second, I will discuss some results on the global well-posedness of free interface problems for the incompressible inviscid resistive MHD with transversal magnetic fields. Both plasma-vacuum and plasma-plasma interfaces are studied. The global in time well-posedness of both interface problems in a horizontally periodic slab impressed by a uniform non-horizontal magnetic field near an equilibrium are established, which reveal the strong stabilizing effect of the transversal field as the global well-posedness of the free boundary incompressible Euler equations (without the irrotational assumptions) around an equilibrium is unknown. This talk is based on joint works with Professor Yanjin Wang. The research works reported here are partially supported by Hong Kong RGC Earmarked Research Grants: CUHK14301421, CUHK14300819, CUHK14302819, CUHK14300917, and CUHK14302917.

09:00-10:00

76 FUKAYA Kenji: Atiyah-Floer conjecture

The State University of New York at Stony Brook

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: This talk is based on joint works with A. Daemi and partially with M. Lipyanskiy.
In 1980's A. Floer discovered infinite dimensional homology theory, Floer

homology. There are two versions of Floer homology theory on in gauge theory and the other is in symplectic geometry. Atiyah-Floer conjecture concerns relations between these two versions. In this talk I will survey background of the conjecture and explains certain progress on it. Especially I will talk about:
An idea of its proof in certain versions especially the version where gauge theory side is one for $SO(3)$ versions.
Various functorial formulations of the conjecture, such as its formulation as a (2) functors.

10:15-11:00

77 FAN Chenjie: On stochastic NLS: wellposedness and long time behavior

Chinese Academy of Sciences

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: We present our study on stochastic NLS with a multiplicative noise. The aim is to understand how such a noise can impact a dispersive system. We will present local theory, global wellposedness, and long time behavior. Joint work with Weijun Xu and Zehua Zhao.

78 GAO Nan: Categorical methods in representation theory

Shanghai University

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: In this talk, we mainly study the counterpart of Gorenstein binary under Morita-Tachitawa correspondence, in which the double centraliser property plays a key role. We show the relationship between double

centraliser properties and the monomorphism categories, where the latter can be embedded into the module categories of Morita context algebras. Under the representation framework of Morita context algebras, taking the recollements and ladders of Abelian categories and triangulated categories as main tools, we study the derived category of Gorenstein projective modules, give the conditions that the derived category of a pre-projective algebra is located in one ladder, give the recursive structure of quasi-heredity algebras, establish the dual and equivalent high symmetry relationship between monomorphism category and epimorphism category of a Morita context algebra, and con- struct Auslander-Reiten theory of the monomorphism categories of dualisable pro-species.
This is based on the joint work with Steffen könig, Pu Zhang, Julian Külshammer, Chrysostomos Psaroudakis and Sondre Kvamme.

79 HU Yong: Universal quadratic forms over p-adic fields and number fields

Southern University of Science and Technology

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: Let k be a positive integer and let $f = f(x_1, \cdots, x_n)$ be an integral quadratic form. We say that f is k-universal if for every integral quadratic form $g = g(y_1, \cdots, y_k)$ in k variables, there exist linear forms with integral coefficients $l_1(y_1, \cdots, y_k), \cdots, l_n(y_1, \cdots, y_k)$ such that $f(l_1, \cdots, l_n) = g$. In this talk, I will report some recent progress on the classifi- cation of k-universal quadratic forms over p-adic fields and number fields. This is based on joint works with He Zilong and Xu Fei.

80 LIAO Lingmin: Simultaneous shrinking target problem of the dynamical systems x2 and x3

Wuhan University

Silver Birch 白桦厅

Tencent Meeting: 779-007-6479, Password: 2022

Abstract: Consider the dynamical systems x2 module one and x3 modulo one on the unit interval. Balls in the unit interval with fixed center and decreasing radius are called shrinking targets. We study the size of the sets of points whose orbits under the dynamical systems x2 and x3 simultaneously fall into a given sequence of shrinking balls. A zero-one law for the Lebesgue measure of such sets is established. The Hausdorff dimension formula is also obtained when the radii of the balls decrease exponentially. We underline that one part of the dimensional formula is established under the famous abc conjecture. This is a joint work with Bing Li, Sanju Velani and Evgeniy Zorin.

81 LIU Lixin: The geometry and metrics on Teichmüller spaces

School of Mathematics, Sun Yat-Sen University

Ginkgo 银杏厅

Tencent Meeting: 683-915-7137, Password: 2022

Abstract: We'll talk about the relations among various metrics on Teichmüller spaces and moduli spaces. And we'll talk the property of extremal length functions in Teichmüller spce, the existence of angle for Teichmüller metric, and the geodesic preserving maps for Teichmu¨ller spaces and hyperbolic surfaces.

82 REN Juliana: PAGOSA and its applications in high energetic material fields

Yangzhou University

Lily Magnolia 木兰厅

Tencent Meeting: 826-641-7263, Password: 2022

Abstract: This work will introduce a coupled algorithm based on FVM and FLIP+MPM, and then apply it to the related study of in high energetic

materials. Firstly, we treat different materials in different ways, thus get PAGOSA. Then, we verified the capabilities of PAGOSA with FLIP+MPM to handle the fracture of ductile materials by some benchmark problems. Subsequently, we investigate the fracture/fragmentation of ductile material and the recompression of the damaged ductile material under double-shock wave using the presented PAGOSA with FLIP+MPM, analyze the influences of parameters on the spallation and the conditions that can lead to the coalescence of the spallation part. Moreover, to reduce the computational cost of our simulations, we introduce the simple machine learning to our algorithm.

83 XU Yan: Structure-preserving arbitrary Lagrangian-Eulerian high order methods for hyperbolic conservation law with source term

University of Science and Technology of China

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: This work develops the structure-preserving discontinuous Galerkin meth- ods and finite volume weighted essentially non-oscillatory (WENO) hybrid schemes for t hyperbolic conservation laws with source term under the arbi- trary Lagrangian-Eulerian (ALE) framework, which can preserve a general hydrostatic equilibrium state and positivity-preserving property under a suit- able time step at the same time. Such equations mainly include the shallow water equations with non-flat bottom topography and the Euler equations with gravitation. By introducing well-balanced numerical fluxes and corre- sponding source term approximations, we established well-balanced schemes on moving mesh. We also discuss about the weak positivity property of the proposed schemes, and the positivity-preserving limiter can be applied to effectively enforce the positivity-preserving property. Numerical examples have been provided not only to demonstrate the good properties but also to show the advantages on moving mesh.

84 YANG Nanjun: Milnor-Witt motive, Bockstein spectral sequence and applications

BIMSA

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: Chow-Witt ring is a cohomology theory on smooth schemes. Its study stemmed from the existence question of the nowhere vanishing section of vector bundles. It closely relates to Hermitian K-theory and derives an enumerative geometry resulting in quadratic forms.
Milnor-Witt motive is the motive theory based on Chow-Witt ring, originating from that of Voevodsky's. In this talk, we apply Bockstein spectral sequence to recover MW-motivic cohomology by means of motivic cohomology as a Steenrod algebra module. In particular, we discuss the split MW-motive where only 2-torsions appear, which applies to Grassmannian bundles and complete flag bundles.

85 YIN Wanke: Finite types conditions for real smooth hypersurfaces

Wuhan University

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: Finite type conditions arise natually during the study of weakly pseudoconvex hypersurfaces in $\mathbb{C}^n$. They are essentially the different kinds of measurements of the degeneracy of the Levi form. In this talk, we will focus on the relations and the applications of these finite types. In particular, we will introduce the recent progress on the Bloom Conjecture and the D'Angelo Conjecture.

86 ZHANG Shuo: Partially adjoint discretizations of adjoint operators: preservation of strong dualities and closed range theorem

Academy of Mathematics and Systems Science, Chinese Academy of Sciences

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: This talk concerns the discretizations in pair of adjoint operators between Hilbert spaces so that the adjoint properties can be preserved. The main features are

- the adjoint properties concerned are the closed range theorem and Poincaré-Alexander-Lefschetz type strong dualities;
- theframeworktodescribeadjointproperties,whichworksforaninfinite family of finite-dimensional operators, is theory of partially adjoint operators;
- the methodology to construct partially adjoint discretizations is by a conforming discretization (CD) and an accompanied-by-conforming discretization (ABCD) for each of the operators.

The validities of the theoretical framework and the formal construction of discretizations are illustrated by a systematic family of in-pair discretizations of the adjoint exterior differential operators. Some new finite element schemes are stimulated.

11:05-11:25

87 WU Caiying: Signal reconstruction by conjugate gradient algorithm based on smoothing norm

Inner Mongolia University

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: The norm regularized minimization problem is a non-differentiable problem and has a wide range of applications in the field of compressive sensing. Many approaches have been proposed in the literature. Among them, smoothing norm is one of the effective approaches. This topic follows this path, in which we adopt six smoothing functions to approximate the norm. Then, we recast the signal recovery problem as a smoothing penalized least squares optimization problem, and apply the nonlinear conjugate gradient method to solve the smoothing model. The algorithm is shown globally convergent. In addition, the simulation results not only suggest some nice smoothing functions, but also show that the proposed algorithm is competitive in view of relative error.

11:05-11:50

88 GUO Ruihan: Arbitrary high-order fully-decoupled numerical schemes for phase-field models of two-phase incompressible flows

Zhengzhou University

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: Due to the coupling between the hydrodynamic equation and the phase-field equation in two-phase incompressible flows, it is desirable to develop efficient and high-order accurate numerical schemes that can decouple these two equations. One popular and efficient strategy is adding an explicit stabilizing term to the convective velocity in the phase-field equation to decouple them. The resulting numerical methods are only first-order accurate in time, and it seems extremely difficult to generalize the idea of stabilization to the second-order version or higher. In this talk, we employ the spectral deferred correction method to improve the temporal accuracy,

based on the first-order decoupled and energy stable scheme constructed by the stabilization idea. The novelty lies in how decoupling and linear implicit properties are maintained to improve efficiency. Within the framework of the spatially discretized local discontinuous Galerkin method, the resulting numerical schemes are fully decoupled, efficient, and high-order accurate in both time and space. Numerical experiments are performed to validate the high order accuracy and efficiency of the methods for solving phase-field models of two-phase incompressible flows.

89 HONG Zhimin: Introducing bootstrap test technique to identify spatial heterogeneity in geographically and temporally weighted regression models

Department of Mathematics, School of Sciences, Inner Mongolia University of Technology

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: In this paper, an extended mixed geographically and temporally weighted regression (EMixed-GTWR) model is proposed to capture the fusion of the temporal stationarity and spatio-temporal heterogeneity in a regression relationship. A residual-based bootstrap test method is introduced to detect the spatially varying coefficients in a geographically and temporally weighted regression (GTWR) model. Since the spatially and spatio-temporally varying coefficients cannot be estimated simultaneously, a two-step procedure is applied to estimating both regression coefficients. Both global homogeneity and spatial heterogeneity in a GTWR model can be detected by the proposed bootstrap test technique. The two simulation experiments with comparison to the existing test methods and models are performed to evaluate the performance of the proposed test and model, including the accuracy of the bootstrap test in approximating the null distribution of the test statistic, the power in identifying the spatio-temporally varying coefficients and the accuracy of the EMixed-GTWR model estimation to the coefficients. The simulation results demonstrate that the boot-

strap test and the EMixed-GTWR model work well. Furthermore, a real data experiment is analyzed to illustrate the application of the bootstrap test technique and the EMixed-GTWR model.

90 HUANG Jianguo: Two numerical methods for an elliptic Hemivariational inequality with applications to contact mechanics

School of Mathematical Sciences, Shanghai Jiao Tong University

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: Hemivariational inequalities (HVIs) are widely encountered in many industrial and engineering applications. In this talk, we first devise an abstract framework of numerical method for solving an elliptic hemivariational inequality with convex constraint. Convergence of the method is explored under the minimal solution regularity available from the well-posedness of the hemivariational inequality. A Cea-type inequality is derived for error estimation. As a typical example, a virtual element method is proposed to solve a frictionless unilateral contact problem and its optimal error estimates is obtained as well. Next, we are concerned with a deep learning method for the previous problem without constraint, where an expectation minimization problem is formulated based on the variational principle of the underlying HVI, which is further solved by stochastic optimization algorithms. The method is applied to solve two practical problems in contact mechanics, one related to a frictional bilateral contact problem and the other related to a frictionless normal compliance contact problem. Numerical results are reported to show the performance of the two methods. This is a joint work with Fang Feng (East China Normal University), Weimin Han (University of Iowa), Chunmei Wang (University of Florida) and Haoqin Wang (Shanghai Jiao Tong University).

91 LI Xiaoshan: Extension of multiple-valued holomorphic functions on a Stein space

Wuhan University

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: A version of the classical Kerner's theorem for a singular Stein space with a compact strongly pseudoconvex boundary has been recently established by Huang-Xiao when the dimension of Stein space is greater of equal to 3. A partial result for the case of complex dimension two was also obtained. In this talk, we will give a confirmative answer to the two dimensional case left open in its full generality. This talk is based on a joint work with Xiaojun Huang.

92 LI Yusheng: Ramsey numbers in sparse graphs

School of Mathematical Sciences, Tongji University

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: This talk is a survey for the topics on Ramsey thresholds of graphs in random graph space and the surplus Ramsey numbers of the order the sparse graphs of exact order of Ramsey numbers, where some surplus subgraphs are deleted from the complete graphs.

93 XU Weijun: A homogenisation problem with singular random force

Peking University

Lily Magnolia 木兰厅
Tencent Meeting: 826-641-7263, Password: 2022

Abstract: We consider a model that combines renormalisation in singular stochastic PDEs and periodic homogenisation simultaneously. I will

explain the motivations for these questions and present our current status of understanding. Joint work in progress with Yilin Chen (Peking University).

94 YANG Daqing: On refined forest covering and packing of graphs

Department of Mathematics, Zhejiang Normal University

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: Let M be a loopless matroid on E with rank function r_M. Let $\Gamma(M) = \max_{\emptyset \neq X \subseteq E} \frac{|X|}{r_M(X)}$ and $\Phi(M) = \min_{r_M(X)<r(M)} \frac{|E|-|X|}{r_M(E)-r_M(X)}$. Fan et al. in [" Extensions of matroid covering and packing", European J. Combin. 76 (2019) 117–122] extended the Matroid Covering and Packing Theorem to the following result: If $\Gamma(M) = k + \varepsilon$, where $k \geq 0$ is an integer and $0 \leq \varepsilon < 1$, then E can be partitioned into $k+1$ independent sets with one of size at most $\varepsilon \cdot r_M(E)$. If $\Phi(M) = k + \varepsilon$, then M has $k+1$ disjoint independent sets such that k are bases and the other has size at least $\varepsilon \cdot r_M(E)$. The fractional arboricity of a graph G, denoted by $\Gamma_f(G)$, is defined as $\Gamma_f(G) = \max_{H \subseteq G, v(H)>1} \frac{e(H)}{v(H)-1}$. As some refinements of forest covering of graphs, Montassier, Ossona de Mendez, Raspaud, and Zhu in [" Decomposing a graph into forests", J. Combin. Theory Ser. B 102 (2012) 38-52] proposed the Nine Dragon Tree (NDT) Conjecture and the Strong Nine Dragon Tree (SNDT) Conjecture. The NDT Conjecture asserts that if $\Gamma_f(G) \leq k + \frac{d}{k+d+1}$, then G decomposes into $k+1$ forests with one having maximum degree at most d. The SNDT Conjecture asserts that if $\Gamma_f(G) \leq k + \frac{d}{k+d+1}$, then G decomposes into $k+1$ forests such that for one of the forests, every connected component contains at most d edges.
The NDT Conjecture was confirmed by Jiang and Yang in [" Decomposing a graph into forests: the Nine Dragon Tree Conjecture is true", Combinatorica 37(6) (2017) 1125–1137]. In this talk, we shall talk about our recent progress on the SNDT Conjecture: an approximate version of the SNDT Conjecture. This is a joint work with Yaqin Zhang and Chenbo Zhu.

13:20-14:05

95 CHANG Xiangke: On the Novikov peakon system together with its spectral and inverse spectral problems

AMSS, Chinese Academy of Sciences

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: We present some results on the Novikov peakon system together with its spectral and inverse spectral problems. In particular, we introduce a mixed type Hermite–Padé approximation whose unique solution is a sequence of polynomials constructed with the help of Pfaffians. These polynomials belong to the family of recently proposed partial-skew-orthogonal polynomials. The relevance of partial-skew-orthogonal polynomials is especially visible in the approximation problem germane to the Novikov peakon problem so that we obtain explicit inverse formulae in terms of Pfaffians by reformulating the inverse spectral problem for the Novikov multipeakons. Furthermore, we investigate two Hermite–Padé approximations for the related spectral problem of the discrete dual cubic string, and show that these approximation problems can also be solved in terms of partial-skew-orthogonal polynomials and nonsymmetric Cauchy biorthogonal polynomials. This formulation results in new correspondence among several integrable lattices.

96 DONG Chao-Ping: Dirac series

Soochow University

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: Since the verification of Vogan conjecture by Huang and Pandzic in 2002, Dirac cohomology became an interesting invariant for Lie group representations. This talk aims to report recent progresses on the

classification of Dirac series (irreducible unitary representations with non-zero Dirac cohomology) and advertise its potential link with automorphic forms.

97 HU Chuangqiang: On the k-th Tjurina number of weighted homogeneous singularities

BIMSA

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: In this talk, we give a brief introduction of isolated hypersurface singularity. An important result of J. Mather and S. S.-T. Yau states that the analytic isomorphism type of an isolated hypersurface singularity is determined by the isomorphism class of the k-th moduli algebra. It is a natural problem asking how to compute the k-th Tjurina Number, the dimension of k-th moduli algebra. Geometrically, the k-th Tjurina Number characterizes the infinitesimal deformations along some specific fat points up to the multiplicity. Associated with a weighted hypersurface singularity, we introduce the classical Koszul complex and the modified version. From the nice property of the homology and the filtration of modified Koszul complex, we derive an explicit formula for the series of k-th Tjurina numbers.

98 HUANG Yi: The Lipschitz theory of hyperbolic surfaces

YMSC, Tsinghua University

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: In a famous unpublished preprint, Thurston develops the Lipschitz theory of hyperbolic surfaces motivated by the desire to construct a hyperbolic parallel to the classical approach to Teichmüller theory. Consequentially, he builds from scratch a beautiful theory tying together optimal

Lipschitz homeomorphisms and the lengths of simple closed geodesics on hyperbolic surfaces. We hope to give a gentle introduction to Thurston-Teichmüller theory, and to showcase some recent developments along this theme. This is work in collaboration with Athanase Papadopoulos and Ken'ichi Ohshika.

99 JIA Qiang: Some generalized Halanay-type inequalities and their applications in multi-agent systems

Jiangsu University

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: This talk first presents some novel generalized Halanay-type inequalities, and gives sufficient conditions to guarantee their stability for scenarios with changeable coefficients and diminishing disturbances, where the difference between the involved coefficients over certain length of time interval is shown to be critical in reaching convergence. Then, these inequalities are utilized to study consensus issues of multi-agent systems under several typical configurations, such as the existence of intermittent communications and the privacy preserving consensus problem. Finally, the validity of the derived criteria and the efficiency of the protocol designs are demonstrated by using numerical examples.

100 LI Xiaobin: Mirror symmetry and boundary conditions

School of Mathematics, Southwest Jiaotong University

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: What is mirror symmetry? Mirror symmetry is a relation between generating function of Gromov-Witten invariants (A-model) and period integrals (B-model). From viewpoint of gauge theory and instanton

counting, it is a duality between Nekrasov partition function and Seiberg-Witten prepotential. In this talk, I will discuss new dualities appearing in 5d $N = 1Sp(N)$ gauge theory with $N_f(\leq 2N + 3)$ flavors and explain the computations about Nekrasov partition function based on topological vertex algorithm of 5-brane web with O5-plane which corresponds to non-toric geometry. With the help of random partition technique, Nekrasov partition function can be rewritten in terms of profile function, after taking thermodynamic limit and functional derivatives, the saddle point equation can be derived for the profile function. By introducing the resolvent, the corresponding Seiberg-Witten geometry and boundary conditions are derived and the relations with the prepotential in terms of the cycle integrals are discussed. They coincide with those directly obtained from the dual graph of the 5-brane web with O5-plane. This agreement gives further evidence for mirror symmetry which relates Nekrasov partition function with Seiberg-Witten curve in the case with orientifold plane and shed light on the non-toric Calabi-Yau 3-folds including D-type singularities. This is joint work with Futoshi Yagi.

101 LI Yuxiang: Well-posedness of Keller-Segel systems with tensor-valued sensitivity

School of Mathematics, Southeast University

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: Since the classical Keller-Segel systems were proposed in 1970, they were extensively studied by mathematicans from PDE community. Recently, motivated by biological considerations, Keller-Segel systems with tensor-valued sensitivity have attracted interests of parabolic PDE research groups. To the speaker's knowledge, almost all the existing results on KS systems with tensor-valued sensitivity are on global existence, and the main idea is that one first considers KS systems with zero-on-the-boundary tensor-valued sensitivity, and then limiting processes lead to global existence results as required. However due to the nonlinear characteristic of the

boundary conditions, up to now, there is no local well-posedness theorem for KS systems with tensor-valued sensitivity. In this talk, we shall present a well-posedness result by constructing a contraction map with novel ideas, and we also shall give some regularity estimates.

102 LIU Weihua: Operator valued random matrices and asymptotic freeness

Zhejiang University

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: Free probability is invented by Voiculescu for solving free group von Neumann algebras(vNa) isomorphism problem which is still open. Compare to classical probability, the independence relation is replaced by a noncommutative one which is called freeness and is based on a construction of free group algebras. Later, Voiculescu found that the relation between distributions of eigenvalues of independent Wigner matrices is getting closer to freeness when the sizes of random matrices are tending to infinity (asymptotic freeness). Consequently, people can apply methods from RMT and vNa to each other. In this talk, I will briefly introduce free probability theory and asymptotic freeness, and then I will introduce a generalization of them. The talk is based on my work (a preliminary version) https://arxiv.org/abs/1806.04848.

103 ZHU Zuonong: Connection between integrable nonlinear differential-difference hierarchy and integrable nonlinear PDE hierarchy

School of Mathematical Sciences, Shanghai Jiao Tong University

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: In this talk, we will address the topic that the connection between integrable nonlinear differential-difference hierarchy and integrable

nonlinear PDE hierarchy including equation hi- erarchy, linear spectral problem, and Hamiltonian structures. We will take the Hirota equation as an example. We will show how to get the integrability of the Hirota equation from an integrable spatial discrete Hirota equation. This is a joint work with A. Pickering and H.Q. Zhao.

14:10-14:55

104 HOU Jianfeng: Hypergraphs with infinitely many extremal constructions

Center for Discrete Mathematics, Fuzhou University, Fujian

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: We give the first exact and stability results for a hypergraph Turán problem with infinitely many extremal constructions that are far from each other in edit-distance. This includes an example of triple systems with Turán density 2/9, thus answering some questions posed by the third and fourth authors and Reiher about the feasible region of hypergraphs.
Our novel approach is to construct certain multilinear polynomials that attain their maximum (in the standard simplex) on a line segment and then use these polynomials to define an operation on hypergraphs that gives extremal constructions (Join work with Heng Li, Xizhi Liu, Dhruv Mubayi and Yixiao Zhang).

105 HUNG Ling-Yan: From tensor networks for p-adic CFT to 1+1 D real CFTs

Tsinghua University

Lily Magnolia 木兰厅
Tencent Meeting: 826-641-7263, Password: 2022

Abstract: We review the lessons that we have learned from constructing holographic tensor networks for p-adic CFTs. The bulk is described by a

Frobenius algebra and an Einstein equation emerges. This story admits a generalization fo 1+1 D real CFTs if we upgrade the bulk to $6j$-symbols of fusion categories. We show some preliminary results that features of the AdS/CFT correspondence can also be encoded in this generalized holographic tensor network.

106 LI Fengling: On H'-splittings of 3-manifolds

Dalian University of Technology

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: In this talk, we introduce the H'-splittings for compact connected orientable 3-manifolds, and discuss the properties of H'-splittings.

107 MA Jiming: Schwartz's complex hyperbolic surface

School of Mathematical Sciences, Fudan University

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: Let $G(4,7)$ be an abstract group with the presentation

$$G(4,7)=\left\langle \iota_1,\iota_2,\iota_3 \middle| \begin{array}{c} \iota_1^2=\iota_2^2=\iota_3^2=id, \\ (\iota_1\iota_2)^4=(\iota_2\iota_3)^4=(\iota_3\iota_1)^4=id, \\ (\iota_1\iota_3\iota_2 i_3)^7=(\iota_2\iota_1\iota_3\iota_1)^7=(\iota_3\iota_2\iota_1\iota_2)^7=id \end{array} \right\rangle.$$

R. Schwartz considered a representation $\rho_{4,7}: G(4,7)\to \mathbf{PU}(2,1)$, the image group $\Gamma(4,7)$ is an arithmetic, geometrically finite, discrete subgroup of $\mathbf{PU}(2,1)$. R. Schwartz determined the 3-manifold at infinity of $\mathbf{H}^2_{\mathbb{C}}/\Gamma(4,7)$ via a sophisticated method. More precisely, the 3-manifold at infinity is a closed hyperbolic 3-orbifold with underlying space the 3-sphere and whose singularity locus is a two-components link equipped with a $\mathbb{Z}_2$-cone structure. This orbifold is the unique explicit closed hyperbolic 3-orbifold admitting uniformizable spherical CR-structures even today.

We show the representation $\rho_{4,7} : G(4,7) \to \Gamma(4,7)$ is faithful, and determine the 4-dimensional topology of the complex hyperbolic surface $\mathbf{H}^2_{\mathbb{C}}/\Gamma(4,7)$ via the handle structure. More precisely, let $\Sigma(4,7)$ be the index two even subgroup of $\Gamma(4,7)$, then $\mathbf{H}^2_{\mathbb{C}}/\Sigma(4,7)$ is a 2-dimensional complex hyperbolic orbifold with six isolated singularities, small closed neighborhoods of these singularities are cones on lens spaces $L(4,-1)$ and $L(7,-1)$ respectively. We prove that $\mathbf{H}^2_{\mathbb{C}}/\Sigma(4,7)$ can be obtained from the small neighborhoods of the six isolated singularities by attaching nine 1-handles and eight 2-handles.

108 QIAN Zicheng: Moduli of Fontaine-Laffaille modules and a mod p local-global compatibility result

Morningside center (AMSS)

Green Willow 绿柳厅

Tencent Meeting: 807-924-4670, Password: 2022

Abstract: Let p be a prime number, F be a totally real field, G be a certain unitary group over F (compact at infinity) and v be a place of F dividing p. One important problem of mod p Langlands program is to understand the space Π of mod p automorphic forms on $G(F)\backslash G(\mathbf{A}_F^\infty)$ with a fixed prime to v level. This space naturally carries the action of a Hecke algebra $\mathbf{T}$ and the p-adic group $G(F_v)$ which we assume to be $\mathrm{GL}_n(F_v)$. If a maximal ideal $\mathfrak{m}$ of $\mathbf{T}$ corresponds to a representation $\overline{r}$ of $\mathrm{Gal}(\overline{F}/F)$ valued in the $\overline{\mathbf{F}}_p$-dual group of G, then one conjectures that the eigenspace $\Pi[\mathfrak{m}]$, as a $\mathrm{GL}_n(F_v)$-representation, determines $\overline{\rho} := \overline{r}|_{\mathrm{Gal}(\overline{F_v}/F_v)}$ up to isomorphism. We prove this conjecture when F_v is unramified and $\overline{\rho}$ is Fontaine-Laffaille (a mod p analogue of crystalline), assuming Kisin-Taylor-Wiles conditions used in Caraiani-Emerton-Gee-Geraghty-Paškūnas-Shin (for the construction of the patched module M_∞). This is a joint work with Bao Viet Le Hung, Daniel Le, Stefano Morra and Chol Park.

109 SU Qingtang: The nonlinear modulational instability of the Stokes waves in 2d water waves

Chinese Academy of Sciences

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: The Stokes waves are periodic symmetric steady water waves travelling at a constant speed, which plays a fundamental role in the study of water waves. It was observed by Benjamin and Feir in 1967 that the Stokes waves are subject to the modulational instability. However, the rigorous mathematical proof was missing for a long time. In this talk, we will discuss how to prove the nonlinear modulational instability of the Stokes waves in the context of 2d full water waves. This is joint work with Gong Chen.

110 XIE Chunjing: Analysis on steady compressible subsonic jet flows with general far field condition

Shanghai Jiao Tong University

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: In this talk, we discuss the recent progress on subsonic steady jet flows with general far field condition. One of the key ingredients for the analysis is exploration of the variational structure of quasilinear linear equations for the stream function even when there is general vorticity. Then the free boundary problem is solved by adapting the framework developed by Alt, Caffarelli, and Friedman for Bernoulli type free boundary problem together with the delicate analysis for the blowup problem near the free boundary.

111 XIE Ziqing: Several local minimax methods for finding saddle points and their applications

LCSM, School of Mathematics and Statististics, Hunan Normal University

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: In this talk, we will present a series of Local Minimax methods for finding saddle points. The feasibility and global convergence of them will be proved. Then the Local Minimax Algorithms are used to solve some singularly perturbed semilinear ellipitic PDEs with some interesting numerical findings obeserved. Further, some of them will be verified strictly.

112 YE Qi: Machine learning in Banach spaces: a black-box or white-box method?

South China Normal University

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: In this talk, we study the whole theory of regularized learning for generalized data in Banach spaces including representer theorems, approximation theorems, and convergence theorems. Specially, we combine the data-driven and model-driven methods to study the new algorithms and theorems of the regularized learning. Usually the data-driven and model-driven methods are used to analyze the black-box and white-box models, respectively. With the same thought of the Tai Chi diagram, we use the discrete local information of the black-box and white-box models to construct the global approximate solutions by the regularized learning. Our original ideas are inspired by the eastern philosophy such as the golden mean. The work of the regularized learning for generalized data provides another road to study the algorithms of machine learning including

- the interpretability in approximation theory,
- the nonconvexity and nonsmoothness in optimization theory,
- the generalization and overfitting in regularization theory.

Moreover, based on the theory of the regularized learning, we will construct the composite algorithms combining support vector machines, artificial neural networks, and decision trees for our current research projects of the big data analytics in education and medicine.

113 ZHENG Kai: Singular scalar curvature equations

University of Chinese Academy of Sciences, Tongji University

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: We will summarize our recent progress on the singular scalar curvature equations. We will further present some, but not all, applications on the existence/uniqueness problems of constant scalar curvature Kaehler metrics on singular varieties.

15:10-15:55

114 PALCOUX Sebastien: The quest of a finite purely quantum group

BIMSA

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: A well-known open problem is whether there exists a finite quantum group which cannot be cooked up from finite groups, or more generally, an integral fusion category which is not weakly group-theoretical. A way to investigate this problem is to look for simple integral fusion rings, and see whether a non group-like one can be categorified. In joint works with Zhengwei Liu, Yunxiang Ren, Jinsong Wu and Huang Linzhe, we developed several categorification criteria, coming from quantum Fourier analysis or localization strategies of the pentagon equations, and we applied them as efficient filters for above investigation.

115 CHEN Youmin: Quantization for biharmonic maps and Yang-Mills fields on non-collapsing degenerating Einstein 4-manifolds and applications

School of Mathematical Sciences, Shanghai Jiao Tong University

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: In this talk we will introduce the blow up analysis of biharmonic maps and Yang-Mills fields on non-collapsing degenerating Einstein 4-manifolds. We can prove a new kind of energy identity for biharmonic maps and Yang-Mills fields on a sequence of non-collapsing degenerating Einstein 4-manifolds, and that the no neck property holds for biharmonic maps in this case. And we got some interesting applications from the energy identity for Yang-Mills fields. In particular in the Kähler case, we obtained a quantization for holomorphic Euler number of holomorphic vector bundles over a sequence of Kähler- Einstein surfaces. Furthermore, we proved a quantization of $\dim H^0(X, L)$ for ample line bundle L_i over a sequence of Kähler-Einstein surfaces Xi with nonzero scalar curvature. If we take L to be the (anti-)canonical line bundle, we can prove a new equality for the convergence of a sequence of Kähler-Einstein surfaces with nonzero scalar curvature. It indicates that we can know the Euler number of X_i provided some topological information of the limit orbifold X_∞ for large i.
It is based on joint works with Prof. Miaomiao Zhu.

116 FENG Xinlong: Difference finite element method for 3D steady incompressible Navier-Stokes equations

Xinjiang University

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: In this work, a difference finite element (DFE) method for 3D steady Navier-Stokes (N-S) equations is presented. This new method consists of transmitting the FE solution of 3D steady N-S equations into a series of the FE solution of 2D steady Oseen iterative equations, which are solved by using the FE pair (P1b,P1b,P1)×P1 satisfying the discrete inf-sup condition in 2D domain. In addition, we use FE pair ((P1b,P1b,P1)×P1)×(P1×P0) to solve 3D steady Oseen iterative equations, where the velocity-pressure

pair satisfies the discrete inf-sup condition in 3D domain under the quasi-uniform mesh condition. Moreover, we provide the existence and uniqueness of the DFE solutions of 3D steady Oseen iterative equations and deduce the first order convergence of the DFE solutions to the exact solution of 3D steady N-S equations. Finally, numerical tests are presented to show the accuracy and effectiveness of the proposed method.

117 HU Haoyu: Wild ramification of nearby cycles

Nanjing University

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: In this talk, I focus on a study of the wild ramification of each cohomology of the nearby cycles complex of an l-adic sheaf on a semistable scheme over an Henselian trait, which answers a conjecture of I. Leal in the geometric situation. If time permits, I will talk its D-modules variant due to J.-B. Teyssier and the application on the boundedness of Betti numbers of meromorphic connections on complex surfaces with restricted irregularities and ranks.

118 SUN Yingte: Construct of quasi-periodic solutions via Nash-Moser iteration

Yangzhou University

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: For the nonlinear PDEs, we can apply the modified Nash-Moser iteration to search the non-trivial quasi-periodic solutions. To achieve the task, there are two methods have been developed :

- the reducibility approach;
- the multiscale approach.

In this talk, we introduce the two methods and some recent progress.

119 WEN Qiang: Balanced partial entanglement and mixed state correlations

Southeast University

Lily Magnolia 木兰厅
Tencent Meeting: 826-641-7263, Password: 2022

Abstract: The balanced partial entanglement entropy (BPE) is a special partial entanglement entropy satisfying certain balance conditions. It is conjectured to be independent from the purifications, and captures exactly the same class of mixed state correlations as the reflected entropy. Consider a mixed state A B in two-dimensional theories, we will show that the BPE exactly gives the length of the entanglement wedge cross-section in both AdS/CFT and 3d flat holography. The BPE reduces to the reflected entropy in canonical purifications, but can be calculated in general purifications.

120 XIA Yinhua: Hybrid WENO schemes for Euler equations

School of Mathematical Sciences, University of Science and Technology of China

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: In this talk, we will present a hybrid WENO scheme for Euler equations, including the steady and unsteady simulations. Unlike the usual hybrid approach, we introduce a transition zone in the stencil recognition. Thus, the hybrid scheme can resolve more details in the region containing multi-scale structures and achieve higher resolution in the smooth region; meanwhile, the essentially oscillation-free solution could also be obtained. For strong shock waves in the steady-state simulations, the hybrid WENO scheme performs better steady-state convergence property with less dissipative and dispersive errors. In this hybrid strategy, the stencil is distinguished into smooth, non- smooth, or transition regions, which is realized by a simple smoothness detector based on the smoothness indicators

in the classic WENO method. The linear reconstruction and the specific WENO reconstruction are applied to the smooth and non-smooth regions, respectively. In the transition region, the mixture of the linear and WENO reconstructions is adopted. Besides the sharp and oscillation-free resolution near shocks, numerical experiments demonstrate that the hybrid schemes could achieve more accurate performance than the original schemes in the smooth region, better resolution in the complex fluid field, and especially the robust performance of steady-state convergence.

121 YANG Di: Enumerative invariants in the large genus

School of Mathematical Sciences, University of Science and Technology of China

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: In this talk, I would like to report the recent progress on the large genus asymptotics of various enumerative invariants, including Witten-Kontsevich correlators, BGW correlators, Hodge integrals, Masur-Veech volumes of quadratic differentials, ordinary graphs and ribbon graphs. The methods that we use mainly come from the theory of integrable systems. The talk is based on joint works with Jindong Guo, Don Zagier, Youjin Zhang, and Jiayi Zhao.

122 YANG Sen: Bloch-Ogus theorem, cyclic homology and deformation of Chow groups

Southeast University

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: Using Bloch-Ogus theorem and Chern character from K-theory to cyclic homology, we answer a question of Green and Griffiths on extending Bloch formula. Moreover, we construct a map from local Hilbert functor to

local cohomology. With suitable assumptions, we use this map to answer a question of Bloch on constructing a natural transformation from local Hilbert functor to cohomological Chow groups.

123 ZHU Maochun: New progress on existence, non-existence and uniqueness of the maximizers for Trudinger-Moser type inequalities

Jiangsu university

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: In this talk, I will introduce our recent work on the Existence and non-existence of the maximizers for Trudinger-Moser type inequalities on bounded or unbounded domains, we show that the lower perturbation term can affect the existence and nonexistence of the maximizers. Furthermore, we will give an uniqueness results for positive solutions of a class elliptic equations with critical exponential growth on the two-dimensional disc, this kind of equations can cover the most interesting equations such as, the Euler-Lagrange equation of the Trudinger-Moser inequalities on the two-dimensional disc. Our uniqueness results can be see as an important step for the uniqueness of maximizers of Trudinger-Moser inequalities on disc. Finally, a critical Trace type inequalities and the existence of maximizers will be discussed. This is a joint work with Lu Chen (Beijing Institute of Technology) and Guozhen Lu (University of Connecticut).

16:00-16:45

124 GAO Laiyuan: Some results on Yau's problem of the curve flow

Jiangsu Normal University

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: Professor S. T. Yau in 2007 (J. Differential Equations Vol. 247 (2009), 2620-2636.) asked that whether one can use a parabolic curvature flow method to evolve one curve to another. An answer to Yau's question is a realization of Whitney-Graustein differential homotopy for closed curves via a curvature flow. In this talk, we present two models of curvature flows to answer Yau's above question for locally convex curves.

125 GENG Jun: Weighted positivity, $W^{\ell,p}$ solvability for higher order elliptic equations on nonsmooth domains

School of Mathematics and Statistics, Lanzhou University

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: For higher order inhomogeneous elliptic systems (polyharmonic equations and biharmonic equations) with real constant coefficients on a bounded Lipschitz domain, we investigate sufficient conditions that the ranges of p must satisfy in order for the $W^{\ell,p}$ estimates for weak solutions of Dirichlet problems to be true.

Specifically, in any Lipschitz domain, we prove that the uniform $W^{\ell,p}$ estimates for solutions to the higher order inhomogeneous elliptic systems hold for

$$\frac{2d}{d+1}-\delta<p<\frac{2d}{d-1}+\delta.$$

The ranges are sharp for $d=2,3$.

For the polyharmonic equation $\Delta^\ell u=F$, $\ell\geq 3$, in Lipschitz domain, we proved that the L^p Dirichlet problem is uniquely solvable for

$$\begin{cases} 4/3-\varepsilon<p<4+\varepsilon & \text{if } d=2,\\ 3/2-\varepsilon<p<3+\varepsilon & \text{if } d=3,\\ \dfrac{2d}{d+1}-\varepsilon<p<\dfrac{2d}{d-1}+\varepsilon & \text{if } 4\leq d\leq 2\ell+1 \quad or \quad d\geq 2\ell+3,\\ 2-\dfrac{1}{\ell}-\varepsilon<p<\dfrac{2\ell-1}{\ell-1}+\varepsilon & \text{if } d=2\ell+2. \end{cases}$$

The ranges of p are sharp for $2\leq d\leq 2\ell+2$.

For the biharmonic equation $\Delta^2 u=F$ in Lipschitz domain, the L^p Dirichlet

problem is uniquely solvable for

$$\begin{cases} 4/3-\varepsilon<p<4+\varepsilon & \text{if } d=2,\\ 8/5-\varepsilon<p<8/3+\varepsilon & \text{if } d=4,\\ 3/2-\varepsilon<p<3+\varepsilon & \text{if } d=3,5,6,7,\\ 2-\dfrac{2}{d-\lambda_d+2}-\varepsilon<p<2+\dfrac{2}{d-\lambda_d}+\varepsilon & \text{if } d\geq 8. \end{cases}$$

The ranges of p are sharp for $d=2,3,5,6$ and 7.

Finally, for the biharmonic equation $\Delta^2 u = F$ in convex domain, the L^p Dirichlet problem is uniquely solvable for $1<p<\infty$ for $d\geq 4$. The ranges of p are sharp.

126 HAGHIGHAT Babak: Rozansky-Witten theory and KZ-equations

YMSC, Tsinghua University

Lily Magnolia 木兰厅

Tencent Meeting: 826-641-7263, Password: 2022

Abstract: Rozansky-Witten theory is a 3d TQFT which is formulated in terms of a sigma model with a hyperkähler target space. We focus on the case where the Hyperkähler manifold is a K_3 surface and analyze the corresponding TQFT with regard to a braided tensor category struc- ture. To this end we formulate KZ-equations from which we extract the associator of the tensor category. This then gives rise to a non-Abelian representation of the braid group which we discuss.

127 HU Yueke: Subconvexity problem for Rankin-Selberg and triple product L-functions within conductor dropping range

YMSC, Tsinghua University

Golden Thread 红杉厅

Tencent Meeting: 393-944-9975, Password: 2022

Abstract: In this talk we discuss the subconvexity problem for the Rankin-Selberg L-function and triple product L-function, allowing joint ramifications and conductor dropping range. We follow and extend the method of Michel-Venkatesh, reducing the problem to a conjecture on existence of local test vectors satisfying certain conditions, and then verify these conditions under some circumstances.

128 HUANG Minxin: Modular anomaly equation for Schur index of $N = 4$ super-Yang-Mills

Department of Modern Physics, University of Science and Technology of China

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: We propose a novel modular anomaly equation for the unflavored Schur index in the $N = 4, SU(N)$ super-Yang-Mills theory. The vanishing conditions overdetermine the modular ambiguity ansatz from the equation, thus together they are sufficient to recursively compute the exact Schur indices for all $SU(N)$ gauge groups. Using the representations as MacMahon's generalized sum-of-divisors functions and Jacobi forms, we then prove our proposal as well as elucidate a general formula conjectured by Pan and Peelaers.

129 LIU Taishun: Geometric function theory of several complex variables

Huzhou University

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: In the talk I will survey our recent progress on geometric function theory of several complex variables. This involves the following respects: the growth, covering, distortion, decomposition theorems, the

estimation of expansion coefficients for some subclasses of normalized biholomorphic mappings; the Schwarz lemma and rigidity property at the boundary for holomorphic self-mappings. We will also propose some open problems in this realm.

130 WANG Zhiwei: Linear invariants of complex manifolds

Beijing Normal University

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: In this talk, we will first give a survey of the theory of linear invariants of complex manifolds and then present our recent work on this topic. These are joint work with Professors Fusheng Deng, Liyou Zhang, Jiafu Ning and Xiangyu Zhou.

131 WANG Zhaojun: Activation discovery with FDR control: Application to fMRI data

Nankai University

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: Data arriving in"streams" from a large number of sources is ubiquitous, a portion of which usually incurs structural changes during the time-course of data acquisition. For example, in fMRI analysis, some brain regions become active associated with task-related stimuli or even in resting-states. Such a region corresponds to an activated data stream.
We are aiming to measure the uncertainty of discovering data streams in activation via the tool of the false discovery rate (FDR).
Borrowing ideas from recent developments of the FDR control methodologies, we propose a simple yet effective method to achieve this purpose meanwhile taking unknown asynchronous change patterns and spatial dependence into consideration.

Its validity on controlling the FDR is justified by asymptotic analysis. Numerical experiments indicate that the proposed method is both accurate and powerful. It is also applied in a real fMRI data analysis.
A R package SLIP is developed to implement the proposed method.

132 XIA Limeng: The twisted Whittaker modules over quantum group $U_q(\mathfrak{gl}_{n+1})$

Jiangsu University

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: As known, the classical nonsingular Whittaker modules over quantum groups can not be defined for non A_1-type. In this talk, we introduce and study the twisted Whittaker modules over quantum group $U_q(\mathfrak{gl}_{n+1})$. We classify all simple twisted Whittaker modules with nonsingular Whittaker functions. This agrees Kostant's results on Whittaker modules for the simple complex Lie algebras $\mathfrak{sl}_{n+1}$ as q approaches 1.

133 YU Bin: Anosov flows on Dehn surgeries on the figure-eight knot

Tongji University

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: We will talk about classifying Anosov flows on the 3-manifolds obtained by Dehn surgeries on the figure-eight knot. This set of 3-manifolds is denoted by $M(r), r \in \mathbb{Q}$, which contains the first class of hyperbolic 3-manifolds admitting Anosov flows in history, discovered by Goodman. Combining with the classification of Anosov flows on the sol-manifold $M(0)$ due to Plante, we have:

1.if $r \in \mathbb{Z}$, up to topological equivalence, $M(r)$ exactly carries a unique Anosov flow, which is constructed by Goodman;

2.if $r \notin \mathbb{Z}$, $M(r)$ does not carry any Anosov flow.

As a consequence of the second result, we get infinitely many closed orientable hyperbolic 3-manifolds which carry taut foliations but do not carry any Anosov flow.

16:50-17:35

134 HU Xing-Biao: Toda-type equations and their links to numerical algorithms and orthogonal polynomials

AMSS, Chinese Academy of Sciences

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: As is known, there have been some links between discrete integrable equations and numerical algorithms and orthogonal polynomials. It is shown that Toda-type equations play a key role in this direction. In the talk, we will show some recent results on Toda-type equations and their links to numerical algorithms and orthogonal polynomials. This is joint work with X.K. Chang, Y. He, S.H. Li, J.Q. Sun and Y.N. Zhang.

135 JI Kui: Geometry of holomorphic vector bundles and similarity of commuting tuples of operators

Hebei Normal University

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: In this paper, a new criterion for the similarity of commuting tuples of operators on Hilbert spaces is introduced. As an application, we obtain a geometric similarity invariant of tuples in the Cowen-Douglas class which gives a partial answer to a question raised by R.G. Douglas about the similarity of quasi-free Hilbert modules. Moreover, a new subclass of commuting tuples of Cowen-Douglas class is obtained.

136 JIANG Kai: Numerical mathematics of quasiperiodic systems

Xiangtan University

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: Quasiperioidc problems widely exist in mathematics, physics, astronomy, material science, and so on.
The most noticeable feature of quasiperiodic systems is related to irrational numbers. This may result in quasiperiodic systems being space-filling structures without decay. How to accurately compute the quasiperiodic systems is a challenge in numerical mathematics.
In this talk, we will present recent advances in numerical computing quasiperiodic systems, both from algorithmic and theoretical levels.
Results demonstrate that our proposed projection method has high accuracy and the almost optimal computational complexity by using FFT.
We also give some quasiperiodic applications, including soft-matter quasicrystals, order-order phase transition, grain boundaries and quasiperiodic quantum systems.

137 LIANG Bingbing: On the existence and coexistence of expansivity

Soochow University

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: Expansivity is an important property in dynamical systems. Given a discrete group G on a compact metric space X, it is a basic question to ask whether G can act on X expansively. A classical result due to Kato shows that the integer group can NOT expansively act on Suslinian continua (including the unit interval). We extend this result to the action by finitely generated group of subexponential growth. The proof is built upon

a delicate characterization of expansivity due to Meyerovitch-Tsukamoto and Kato's characterization of Suslinian continua.
In regard to the coexistence of expansivity with other dynamical properties, we show that if a continuous action of a finitely generated group on a compact metric space is both distal and expansive, then the phase space must be finite. A counterexample is constructed to show that the condition of finite generation is indispensable.
These results are joint works with Enhui Shi, Zhiwen Xie, and Hui Xu.

138 SONG Wei: TsT, black holes, and irrelevant deformations

Tsinghua University

Lily Magnolia 木兰厅
Tencent Meeting: 826-641-7263, Password: 2022

Abstract: The AdS/CFT correspondence has unveiled deep connections among many different research directions in physics. I will describe a class of toy models of holographic duality beyond the AdS/CFT correspondence. The starting point is IIB string theory on AdS3 with NS-NS three form flux, which is holographically dual to a two dimensional CFT. Performing TsT transformations (T-duality, shift, and T-duality) in the bulk, we can obtain black hole solutions which interpolate BTZ black holes in the IR and linear dilaton background in the UV. The holographic dual is conjectured to be a single trace TTbar deformed CFT. As supporting evidence, we find a matching of the deformed spectrum, the thermodynamics, and a critical value of the deformation parameter. Similarly, TsT transformations can also be used to generate the holographic dual for the single trace version of JTbar, and TTbar+JTbar+TJbar deformations.

139 SUN Hao: Tame parahoric nonabelian Hodge correspondence on curves

South China University of Technology

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: Simpson established the nonabelian Hodge correspondence on noncompact curves in 1990s. By introducing the parabolic bundles, the correspondence is given among parabolic Higgs bundles, parabolic D_X-modules and filtered local systems. In this talk, I will review this story and show the difficulties to use the parabolic stuffs to establish the nonabelian Hodge correspondence for G-bundles on noncompact curves. If time permits, I will talk about how to establish the nonabelian Hodge correspondence for G-bundles on noncompact curves, where we introduce the language of parahoric torsors to overcome the difficulties. This work is joint with P. Huang, G. Kydonakis and L. Zhao.

140 WU Enxin: An invitation to diffeological spaces

Shantou University

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: By concrete sheaf theory instead of local model, diffeology provides a uniform framework for classical smooth manifolds, infinite-dimensional spaces (eg. function spaces and diffeomorphism groups) and singular spaces (eg. orbifolds and irrational tori). This talk will focus on the basic ideas and current state of art for the theory of diffeology from geometrical and topological aspects.

141 WU Bin: Carleman estimates for stochastic degenerate/singular differential equations and its applications

Nanjing University of Information Science & Technology

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: Degenerate and singular partial differential equations are widely used in physics, economics, biology and so on. In this talk, we mainly give some Carleman estimates of several stochastic degenerate and singular partial differential equations, and apply these Carleman estimates to controllability theory and stochastic inverse problems. Firstly, we establish two Carleman estimates for a stochastic degenerate parabolic equation. These two Carleman estimates are then applied to the null controllability and a stochastic inverse problem of the stochastic degenerate parabolic equation, respectively. Secondly, we study the cost of null controllability for a backward stochastic degenerate parabolic equation in the vanishing viscosity by means of Carleman estimates. Finally, we construct a special weight function to prove a new Carleman estimate for backward stochastic Grushin operator with singular potential by a weighted identity method. As applications, we further study the null controllability for the stochastic Grushin equation. This is a joint work with Yan Lin, Chen Qun and Wang Zewen.

142 XIONG Ge: Sharp affine isoperimetric inequalities for the volume decomposition functionals of polytopes

School of Mathematical Sciences, Tongji University

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: In this talk, I will introduce our very recent work on the geometry of polytopes. We prove that the n-th power of the volume functional V_n of polytopes P in $\mathbb{R}^n$, according to dimensions of the spaces spanned by any n outer normal unit vectors of P, is naturally decomposed into n homogeneous polynomials with degree n. Several new sharp affine isoperimetric inequalities for these functionals are established, which essentially characterize the geometric and algebraic structures of polytopes.

143 YIN Hao: Neck analysis for harmonic map and Yang-Mills field and its applications

University of Science and Technology of China

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: In this talk, we discuss the blow-ups of harmonic maps in dimension two and Yang-Mills fields in dimension four. Classical results show that there is no energy loss when blow-up occurs. The proofs are based on uniform decay estimates in the neck region. We improve these well known estimates and discuss some consequences of these new estimates in the variational problem.

Thursday, August 4th

08:00-09:00

144 HUANG Xiangdi: On existence and blowup behavior of the compressible Navier-Stokes equations and related models: from Nash's conjecture to front edge

Institute of Mathematics, Academy of Mathematics and Systems Science, Chinese Academy of Sciences

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: In this talk, we investigate the weak and strong solution of the compressible Navier-Stokes equations and related models with constant viscosity coefficients in the presence of vacuum. It starts from the Nash's conjecture for the full compressible Navier-Stokes equations and many important applications were made subsequently, especially local and global existence of weak and strong solutions of various compressible models were established based on Nash's conjecture. Moreover, we present two recent progress on the existence and blowup of solutions for the compressible Navier-Stokes equations and MHD equations.

145 YU Tony Yue: Non-archimedean quantum K-theory and Gromov-Witten invariants

California Institute of Technology

Purple Palace Chamber 紫金会见厅
Zoom: 687 513 9542, Password: YMSC

Abstract: Motivated by mirror symmetry and the enumeration of curves with boundaries, it is desirable to develop a theory of Gromov-Witten invariants in the setting of non-archimedean geometry. I will explain some recent works in this direction. Our approach differs from the classical one in algebraic geometry via perfect obstruction theory. Instead, we build on our previous works on the foundation of derived non-archimedean geometry, the representability theorem and Gromov compactness. We obtain numerical invariants by passing to K-theory or motivic cohomology. We prove a list of natural geometric relations between the stacks of stable maps, directly at the derived level, with respect to elementary operations on graphs, namely, products, cutting edges, forgetting tails and contracting edges. They imply the corresponding properties of numerical invariants. The derived approach produces highly intuitive statements and functorial proofs. Furthermore, its flexibility allows us to impose not only simple incidence conditions for marked points, but also incidence conditions with multiplicities. Joint work with M Porta.

146 LIAN Bong: Periods of singular cyclic covers

Brandeis University

Golden Thread 红杉厅
Zoom: 892 226 4912, Password: YMSC

Abstract: We will consider a class of (typically) singular Calabi-Yau varieties given by cyclic branched covers of a fixed semi Fano manifold. The first prototype example goes back to Euler, Gauss and Legendre, who considered 2-fold covers of $\mathbb{P}^1$ branched over 4 points. Two-fold covers of $\mathbb{P}^2$ branched over 6 lines have been studied more recently by many authors, including Matsumoto, Sasaki, Yoshida and others, mainly from the viewpoint of their moduli spaces and their comparisons. I will outline a higher dimensional generalization from the viewpoint of mirror symmetry, and discuss the Riemann-Hilbert problem for periods of these singular varieties. We

will introduce a new compactification of the moduli space cyclic covers, using the idea of 'abelian gauge fixing' and 'fractional complete intersections'. This produces a moduli problem that is amenable to tools in toric geometry, particularly those that we have developed jointly in the mid-90's with S. Hosono and S.-T. Yau in our study of toric Calabi-Yau complete intersections. In dimension 2, this construction gives rise to new and interesting identities of modular forms and mirror maps associated to certain K3 surfaces. We also present an essentially complete mirror theory in dimension 3, and discuss generalization to higher dimensions. The lecture is based on on-going joint work with S. Hosono, T.-J. Lee, H. Takagi, S.-T. Yau.

147 WANG Mu-Tao: Angular momentum and supertranslation in general relativity

Columbia University in the City of New York

Curling Dragon 龙蟠厅
Zoom: 276 366 7254, Password: YMSC

Abstract: Two black holes rotate about each other and eventually merge into a single black hole. How does one measure the angular momentum carried away by gravitational radiation during this merger? This has been a subtle issue since the 1960's due to the existence of "supertranslation ambiguit": the angular momentums recorded by two observers of the same system may not be the same.
In this talk, I shall describe how the theory of quasilocal mass and optimal isometric embedding identifies a new definition of angular momentum that is free of any supertranslation ambiguity. This is based on joint work with Po-Ning Chen, Jordan Keller, Ye-Kai Wang, and Shing-Tung Yau.

148 HUANG Hao: On a non-uniform extension of Baranyai's theorem

National University of Singapore

Crouching Tiger 虎踞厅

Zoom: 271 534 5558, Password: YMSC

Abstract: One of the central themes in Combinatorics is to study whether or when a discrete object can be decomposed into smaller pieces of given shape. A celebrated theorem of Baranyai states that when k divides n, the family of all k-subsets of an n-element set can be partitioned into perfect matchings. In this talk, I will discuss an extension of Baranyai's Theorem to the non-uniform setting. Our study shows that for fixed k and sufficiently large n, the family consisting of subsets of an n-element set of size at most k has such a decomposition if and only if $n \equiv 0 or -1 (\mathrm{mod} k)$.
Joint work with Jinye He and Jie Ma.

09:00-10:00

149 LI Weiping: A road map to Gromov-Witten invariants on Calabi-Yau quintic threefolds

The Hong Kong University of Science and Technology

International Reporting Office 国际会议报告厅
Zoom: 455 260 1552, Password: YMSC

Abstract: Enumerative geometry of counting number of curves on projective manifolds has a long history. It became a hot topic again since physicists computed the number of genus zero curves on the Calabi-Yau quintic hypersurface in $\mathbb{P}^4$ using mirror symmetery. By studying of genus zero and genus one cases, mathematicians introduced various concepts and methods, and successfully proved the predictions by the physicists. However, those methods cannot be applied to high genus Gromov-Witten invariants on Calabi-Yau quintic threefolds. I will discuss a recent method, mixed spin p-fields (MSP for short) and its variant NMSP, to study the Gromov-Witten invariants of the quintic Calabi-Yau three- folds. This new method can be used to solve several key conjectures such as Yamaguchi- Yau and BCOV conjectures. It is a joint work with H.L. Chang, Guo Shuai, J. Li, and Melissa Liu.

150 CAO Huai-Dong: Singularities of Ricci flow and Ricci solitons

Lehigh University

Purple Palace Chamber 紫金会见厅
Zoom: 687 513 9542, Password: YMSC

Abstract: Ricci solitons are self-similar solutions to Hamilton's Ricci flow and a natural extension of Einstein manifolds. Ricci solitons are important because they occur as singularity models of Ricci flow. In this talk, I shall survey some recent progress on Ricci solitons.

151 CHEN Bing-Long: Lorentzian geometry and Einstein equations

Sun Yat-sen University

Golden Thread 红杉厅
Zoom: 892 226 4912, Password: YMSC

Abstract: The purpose of the talk is to investigate the regularity of spacetimes, from the viewpoint of developing geometric analysis on Lorentzian manifolds. We will survey some aspects of Lorentzian geometry, including isometric embedding theorem, construction of optimal coordinate systems, and some recent works on local regularity of Einstein equations.

152 YU Chia-Fu: Mass formulas and the basic locus of unitary Shimura varieties

Academia Sinica

Curling Dragon 龙蟠厅
Zoom: 276 366 7254, Password: YMSC

Abstract: The supersingular locus of modular varieties has been playing an important role in geometry, arithmetic and the theory of automorphic forms. The geometry and arithmetic has been studied by Deuring,

Ibukiyama, Katsura, Li and Oort. In this talk we shall discuss the geometry and arithmetic of the basic locus (that is, the unique smallest Newton stratum) of the Shimura variety attached to $GU(r,s)$. These have been investigated by Vollaard, Wedhorn and very recently by X. He, Z. Rong, Y. Zhou, X. Zhu, and the geometry of its p-adic variant (basic affine Deligne-Lusztig varieties) by He, Gortz, M. Chen, Hamacher, Viehman and Nie. We shall report explicit formulas for the number of irreducible components, the size of the zero-dimensional EO stratum, and the number of irreducible components of each basic EO stratum for $(r,s) = (1, n-1)$. This is based on the joint work with Yasuhiro Terakado.

153 YU Guoliang: Higher index theory at infinity and Gromov's compactness

Texas A&M University

Crouching Tiger 虎踞厅
Zoom: 271 534 5558, Password: YMSC

Abstract: In this talk we will introduce a higher index theory at infinity and discuss its application to Gromov's compactness conjecture on scalar curvature. This is joint work with Shmuel Weinberger and Zhizhang Xie.

10:15-11:00

154 CAO Jin: Some cases for the project GMCD

YMSC, Tsinghua University

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: The project of Gauss-Manin connection in disguise is initiated by Hossein Movasati, which aims to give a systematic way of understanding classical modular forms or even automorphic forms by studying moduli spaces with extra data. In this talk, I will describe some cases for this project.

155 LI Yi: Boundedness and monotonicity in Ricci-type flows

Southeast University

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: In this talk, I present recent results about boundedness and monotonicity in three Ricci-type flows, which include the classical Ricci flow, Kahler-Ricci flow coupled with heat equation, and Laplacian G_2-flow. Partial results are joint with Yuan Yuan, Yuguang Zhang, and also Chuanyuan Li, Kairui Xu.

156 LIN Zhigui: Model analysis and risk assessment of four-tier emergency response and dynamic zeroing

Yangzhou University

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: This talk extends the classic SEAIR and delay IJR epidemic systems to study two models of covid-19 prevention and control. A staged and weighted network system is firstly formulated, and five stages have been taken into consideration according to four-tier response to Public Health Crisis. Staggered basic reproduction number has been derived and we evaluate the effectiveness of lockdown and social distancing policies under different scenarios among 19 cities/regions in mainland China. Secondly, a new model is proposed to mimic the Zero-COVID strategy applied in Yangzhou, a Chinese city with a population of nearly 1.7 million. The novel dynamic model with time-delays describing isolation and large-scale detection is established by distinguishing infected persons in communities and centralized isolation areas. Using numerical simulations, we compare the scenarios under different control modes and levels. The qualitative and quantitative results provide insightful reference for decision-making if the Zero-COVID policy and trace-test-quarantine strategy is adopted.

157 MA Xiaoling: On hamiltonicity of line graphs

Xinjiang University

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: For an integer $s \geq 0$, a graph G of order $n \geq s+3$ is s-Hamiltonian (s-Hamiltonian connected, respectively), if for any $X \subset V(G)$ with $|X| \leq s$, $G-X$ is Hamiltonian ($G-X$ is Hamiltonian-connected, respectively). Thomassen in 1984 conjectured that every 4-connected line graph is Hamiltonian, and Kužel and Xiong in 2004 conjectured that every 4-connected line graph is Hamiltonian-connected. In this topic, we continue the Hamiltonicity of line graphs. Joint work with Profs. Hong-Jian Lai (West Virginia University), Lan Lei (Chongqing Technology and Business University), Yang Wu (Macau University of Science and Technology), Mingquan Zhan (Millersville University).

158 MIAO Shuang: Some free boundary problems in the study of two-body motion

Wuhan University

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: In this talk we introduce some free boundary problem models in the study of two-body motion. The first model is the Newtonian incompressible inviscid fluid. For this model we prove that the energy cost by the deformation of the free boundary can be arbitrarily larger than the conserved total energy of the entire system, signaling a qualitative change in the orbit of the center of mass motion of the bodies. The second model is the hard phase model in relativity. We shall introduce some recent progress on well-posedness for this model.

159 QIU Chunhui: A Schwarz lemma for complete complex Finsler manifolds

School of Mathematical Sciences, Xiamen University

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: In this paper, we generalize a Schwarz lemma to complete complex Finsler mani- folds, and prove a Schwarz lemma from a complete complex Finsler manifold into a complex Finsler manifold.
This work is joint with Jinling Li and Qixin Zhang.

160 SHAO Sihong: Computational quantum mechanics in phase space

School of Mathematical Sciences, Peking University

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: The Wigner function has provided an equivalent and convenient way to render quantum mechanics in phase space. It allows one to express macroscopically measurable quantities, such as currents and heat fluxes, in statistical forms as usually does in classical statistical mechanics, thereby facilitating its applications in nanoelectronics, quantum optics and etc. Distinct from the Schrödinger equation, the most appealing feature of the Wigner equation, which governs the dynamics of the Wigner function, is that it shares many analogies to the classical mechanism and simply reduces to the classical counterpart when the reduced Planck constant vanishes. Despite the theoretical advantages, numerical resolutions for the Wigner equation is notoriously difficult and remains one of the most challenging problems in computational physics, mainly because of the high dimensionality and nonlocal pseudo-differential operator. On one hand, the commonly used finite difference methods fail to capture the highly oscillatory structure accurately. On the other hand, all existing stochastic algorithms, including the affinity-based Wigner Monte Carlo and signed particle

Wigner Monte Carlo methods, have been confined to 2D phase space. Few results have been reported for higher dimensional simulations. My group has made substantial progress in both aspects.

We attempted to solve the Wigner equation in 4-D and 6-D phase space with gird-based deterministic methods by exploiting its intriguing mathematical structure. For 4-D simulations, we succeeded to detail the quantum dynamics of a Helium-like system and the quantum interference fringes in the double-slit experiment. For the 6-D Wigner-Coulomb system, we proposed a massively parallel solver, termed the characteristic-spectral-mixed scheme (CHASM), which utilizes the locally distributed cubic B-spline basis to interpolate the local spatial advection and the truncated kernel method to approximate the pseudodifferential operator with weakly singular symbol under the Coulomb interaction. Several typical numerical experiments demonstrate the accuracy and efficiency of CHASM, as well as its scalability up to 16000 cores.

On the other hand, we built the bridge between the Wigner equation and a stochastic particle method in a rigorous manner and proposed a SPA (Stationary Phase Approximation) + SPADE (Sequential-clustering Particle Annihilation via Discrepancy Estimation) strategy to overcome the sign problem where the curse of dimensionality which causes the unattainable exponential wall is translated into the NP-hard problems that may have approximate solutions. SPADE follows a divide-and-conquer strategy: Adaptive clustering of particles via controlling their number-theoretic discrepancies and independent random matching in each group, and it may learn the minimal amount of particles that can accurately capture the nonclassicality of the Wigner function. A thorough performance benchmark of SPADE is provided with the reference solutions in 6-D phase space produced by CHASM under a $73^3 \times 80^3$ uniform grid, which fully explores the limit of grid-based deterministic Wigner solvers. Simulations of the proton-electron couplings in 6-D and 12-D phase space demonstrate the accuracy and the efficiency of our particle-based stochastic methods.

As a permanent goal and a tireless direction of computational mathematics, developing an accurate and stable high-dimensional solver has been attract-

ing more and more attentions in recent years due to the urgent need in e.g., quantum science and high energy density physics. This talk represents our recent attempts to break the curse of dimensionality which poses a fundamental obstacle to high-dimensional numerical simulations.

161 WANG Zhenfu: Recent progress in mean field limit for interacting particle systems.

Peking University

Lily Magnolia 木兰厅
Tencent Meeting: 826-641-7263, Password: 2022

Abstract: We study the mean field limit of large systems of interacting particles. Classical mean field limit results require that the interaction kernels be essentially Lipschitz. To handle more singular interaction kernels is a longstanding and challenging question but which now has some successes. Joint with P.-E. Jabin, we use the relative entropy between the joint law of all particles and the tensorized law at the limit to quantify the convergence from the particle systems towards the macroscopic PDEs. This method requires to prove large deviations estimates for non-continuous potentials modified by the limiting law. But it leads to explicit convergence rates for all marginals. This in particular can be applied to the Biot-Savart law for 2D Navier-Stokes. To treat more general and singular kernels, joint with D. Bresch and P.-E. Jabin, we introduce the modulated free energy, combination of the relative entropy that we had previously developed and of the modulated energy introduced by S. Serfaty. This modulated free energy may be understood as introducing appropriate weights in the relative entropy to cancel the most singular terms involving the divergence of the kernels. Our modulated free energy allows to treat gradient flows with singular potentials which combine large smooth part, small attractive singular part and large repulsive singular part. As an example, a full rigorous derivation (with quantitative estimates) of some chemotaxis models, such as the Patlak-Keller-Segel system in the subcritical regimes, is obtained. More recent progresses and open problems will also be discussed.

162 WANG Zuoqin: Semiclassical oscillating functions of isotropic type and their applications

University of Science and Technology of China

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: Rapidly oscillating functions associated with Lagrangian submanifolds play a fundamental role in semiclassical analysis. In this talk I will describe how to associate classes of semiclassical oscillating functions to isotropic submanifolds in phase space, and show that these classes are invariant under the action of Fourier integral operators (modulo the usual clean intersection condition). We will also discuss some special classes (coherent states, Hermite states) and their applications. The talk is based on joint works with V. Guillemin (MIT) and A. Uribe (U. Michigan).

163 YU Shilin: Coadjoint orbit method via deformation quantization

Xiamen University

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: The coadjoint orbit method of A. Kirillov and B. Kostant suggests that irreducible unitary representations of a Lie group can be constructed as "quantizations" of coadjoint orbits of the group. In the (still open) case of a noncompact semisimple Lie group, it is reformulated by D. Vogan in terms of quantization of vector bundles on nilpotent coadjoint orbits equivariant with respect to a maximal compact subgroup. In this talk, I will propose a new scheme to quantize nilpotent orbits using deformation quantization of symplectic varieties and their Lagrangian subvarieties. Our method works uniformly for any semisimple group, classical or exceptional, linear or non-linear. This is partially based on a joint paper with Conan Leung and ongoing project with Ivan Losev.

11:05-11:50

164 DUAN Haibao: Making schubert calculus calculable

Institute of Mathematics, Chinese Academy of Sceinces

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: Hilbert's 15th problem asked for a rigorous foundation of Schubert's calculus, where the most challenging and durable part is Schubert's problem of characteristics. In the course of securing the foundation of algebraic geometry, Van der Wearden and Andre Weil attributed the problem to the determination of the intersection theory of flag manifolds.
This talk surveys the background, content, and resolution of Hilbert's 15th problem. Our main results is a unified formula computing Schubert's characteristics, and a system description for solving Weil's problem. We illustrate the effectiveness of both the formula and the algorithm with Examples.

165 GENG Xianguo: Algebraic curves and algebro-geometric solutions to soliton equations

School of Mathematics and Statistics, Zhengzhou University

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: On the basis of the characteristic polynomials of Lax matrixes for the soliton hierarchies, we introduce the corresponding algebraic curves, including the hyperelliptic curve, trigonal curve, and tetragonal curve. We study the calculations of genus for these algebraic curves, their properties at infinity, and the construction of three kinds of Abel differentials. We establish the corresponding Baker-Akhiezer functions and meromorphic functions. The straightening out of various soliton flows is exactly given through the Abel map and Abel-Jacobi coordinates. Using the theory of algebraic curves, we obtain the explicit Riemann theta function representations of

the Baker–Akhiezer functions, the meromorphic functions, and in particular, that of solutions for the Sawada-Kotera hierarchy and Hirota-Satsuma coupled KdV hierarchy.

166 HUANG Xuehai: Finite element complexes: BGG or not

Shanghai University of Finance and Economics

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: Finite element complexes with various smoothness, including the de Rham complex, the Stokes complex, the curldiv complex, the elasticity complex, and the divdiv complex, are systematically constructed in this work. First smooth scalar finite elements are developed based on a non-overlapping decomposition of the simplicial lattice and the Bernstein basis of the polyno- mial space. Smoothness at vertices and on edges are more than doubled than those on edges and on faces, respectively. Then the finite element de Rham complexes with various smoothness are devised using smooth finite elements with smoothness parameters satisfying certain relations. Finally, finite element elasticity complexes and finite element divdiv complexes are derived from finite element de Rham complexes by using the Bernstein-Gelfand-Gelfand (BGG) framework. Additionally, some finite element divdiv complexes are constructed without BGG framework. Dimension count and div stability play an important role for verifying the exactness of finite element complexes.

167 LIN Qizhong: Fan-complete Ramsey numbers

Fuzhou University

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: We consider Ramsey numbers $r(G,H)$ with tight lower bounds, namely,

$$r(G,H) \geq (\chi(G)-1)(|H|-1)+1,$$

where $\chi(G)$ denotes the chromatic number of G and $|H|$ denotes the number of vertices in H.

We say H is G-good if the equality holds.

In this paper, we prove that the fan-graph $F_n = K_1 + nK_2$ is K_p-good if $n \geq 27p^2$, improving previous tower-type lower bounds for n due to Li and Rousseau (1996). The join graph $G+H$ is defined by adding all edges between the disjoint vertex sets of G and H.

Let nH denote the union graph of n disjoint copies of H. We show that $K_1 + nH$ is K_p-good if n is sufficiently large.

We give a stronger lower bound inequality for Ramsey number $r(G, K_1+F)$ for the case of $G = K_p(a_1, a_2, \ldots, a_p)$, the complete p-partite graph with $a_1 = 1$ and $a_i \leq a_{i+1}$.

In particular, using a stability-supersaturation lemma by Fox, He and Wigderson (2021), we show that for any fixed graph H,

$$r(G, K_1+nH) = \begin{cases} (p-1)(n|H|+a_2-1)+1 & \text{if } n|H|+a_2-1 \text{ or } a_2-1 \text{ is even,} \\ (p-1)(n|H|+a_2-2)+1 & \text{otherwise,} \end{cases}$$

where $G = K_p(1, a_2, \ldots, a_p)$ with a_i's satisfying some mild conditions and n is sufficiently large.

The special case of $H = K_1$ gives an answer to Burr's question (1981) about the discrepancy of $r(G, K_{1,n})$ from G-goodness for sufficiently large n.

Joint work with Fan Chung.

168 LIN Wensong: Packing paths into subcubic graphs

School of Mathematics, Southeast University

Green Willow 绿柳厅

Tencent Meeting: 807-924-4670, Password: 2022

Abstract: Let H be a fixed graph. An H-packing in a graph G is a collection of vertex-disjoint subgraphs of G in which each subgraph is isomorphic

to H. The maximum H-packing problem is to find an H-packing containing the maximum number of vertices. If a maximum H-packing contains all vertices of G, it also known as an H-factor. For a positive integer k, let P_k denote the path on k vertices. Kelmans [A. Kelmans, Packing 3-vertex paths in claw-free graphs and related topics, Discrete Applied Mathematics 159 (2011) 112-127] proposed the following problem: Is the P_3-packing problem NP-hard in the class of claw-free graphs? In this talk, we present a result that solves this problem by proving that the P_3-factor problem in claw-free cubic planar graphs is NP-complete. In addition, we show that for any connected claw-free cubic graph G with $v(G) \geq 14$, the maximum P_3-packing of G covers at least $\lceil \frac{9v(G)-6}{10} \rceil$ vertices, where $v(G)$ denotes the order of G, and the bound is sharp. The proofs imply polynomial-time algorithms. We also prove that the maximum P_4-packing of any cubic graph covers at least two-thirds of its vertices. And there is a quadratic-time algorithm for finding such a P_4-packing. (The above results are joint works with Wenying Xi.)

169 WANG Chao: Equivariant embeddings of closed surfaces in spheres

East China Normal University

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: It is known that every finite group action on a closed surface can extend over some m-dimensional sphere with respect to an equivariant embedding. So it is natural to ask what is the minimum possible dimension for a given action. I will discuss some results about this question, and mainly focus on two cases, where the minimum dimension is three or the group action is cyclic.

170 WANG Haibing: A new approach to an inverse source problem for the wave equation

Southeast University

Lily Magnolia 木兰厅
Tencent Meeting: 826-641-7263, Password: 2022

Abstract: Consider an inverse problem of reconstructing a source term from boundary measurements for the wave equation. We propose a novel approach to recover the unknown source through measuring the wave fields after injecting small particles, enjoying a high contrast, into the medium. For this purpose, we first derive the asymptotic expansion of the wave field, based on the time-domain Lippmann-Schwinger equation. The dominant term in the asymptotic expansion is expressed as an infinite series in terms of the eigenvalues of the Newtonian operator (for the pure Laplacian). Such expansions are useful under a certain scale between the size of the particles and their contrast. Second, we observe that the relevant eigenvalues appearing in the expansion have non-zero averaged eigenfunctions. By introducing a Riesz basis, we reconstruct the wave field, generated before injecting the particles, on the center of the particles. Finally, from these (internal values of these) last fields, we reconstruct the source term (by numerical differentiation for instance). A significant advantage of our approach is that we only need the measurements for a single point away from the support of the source.

171 WU Zhiqiang: Categories of operator algebras and generalied topological spaces

Chern Institute of Mathematics, Nankai University

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: It is well-known that the assignment "$X \xrightarrow{\varphi} Y \ \mapsto \ \mathcal{P}(Y) \xrightarrow{\varphi^{-1}} \mathcal{P}(X)$" induces an equivalence of categories from the category of sets to the category of complete atomic Boolean algebras. Moreover, "$X \xrightarrow{\varphi} Y \ \mapsto \ \ell^\infty(Y) \xrightarrow{\circ\varphi} \ell^\infty(X)$" induces an equivalence of categories from the category of sets to the category of commutative atomic von Neumann algebras. Furthermore, "$\Sigma \xrightarrow{\varphi} \Lambda \ \mapsto \ C(\Lambda) \xrightarrow{\circ\varphi} C(\Sigma)$" induces a functor from the

category of topological spaces to the category of commutative unital C^*-algebras, which is the left inverse of the Gelfand functor.

We will show that, in the case when we remove the word "commutative" and replace "Boolean algebras" with "orthomodular lattices", the analogues of the above functorial statements are almost unchanged (under mild assumptions) if one replaces "sets" and "topological spaces" with "generalized sets" and "generalized topological spaces" (with appropriate notion of morphisms on them).

What we meant by "generalized sets" is the notion of ortho-sets. An *ortho-set* is a "set" in which two elements are either "the same", "distinct" or "their distinctness cannot be determined" (mathematically, it is an "ordinary set" equipped with a symmetric and anti-reflexive relation). Moreover, our "generalized topological spaces" are ortho-topological spaces. An *ortho-topological space* is an ortho-set equipped with a collection of subsets satisfying some requirements similar to those for closed subsets of an ordinary topological space.

For the analogous functorial statements of the above, there are two possibilities for morphisms between operator algebras; namely, *-homomorphisms and Jordan *-homomorphisms. We will consider both of them. In the case when the morphisms are Jordan *-homomorphisms, the corresponding morphisms between ortho-sets and between ortho-topological spaces are what we called, respectively, "ortho-maps" and "continuous ortho-maps". In the case when the morphisms between operator algebras are *-homomorphisms, we need to introduce extra structures called "specifications" and "signs", and consider ortho-maps and continuous ortho-maps that preserve them.

We will construct a JB-algebra $C^{\mathrm{q}}_{b,\mathbb{R}}(\Sigma)$ for every ortho-topological space Σ, and we also construct a unital C^*-algebra $C^*_\sigma(\Sigma)$ when Σ is equipped with a sign σ. These constructions extend the ordinary construction that produces $C(\Sigma;\mathbb{R})$ and $C(\Sigma;\mathbb{C})$ from a topological space Σ.

On our way to the functorial results concerning categories of ortholattices, operator algebras, ortho-sets and ortho-topological spaces, we also obtain that if A is any unital C^*-algebra with no 2-dimensional irreducible *-representation and Σ_A is the Gelfand spectrum of A (i.e., the set of pure

states of A, equipped with a canonical ortho-topological space structure), then $C^{\mathrm{q}}_{b,\mathbb{R}}(\Sigma_A)$ is canonically Jordan isomorphic to A_{sa}. Moreover, if σ_A is the canonical sign on Σ_A, then $C^*_{\sigma_A}(\Sigma_A)$ is canonically *-isomorphic to A.

172 XIONG Xiao: Quantum differentiability–the analytical perspective

IASM, Harbin Institute of Technology

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: The core ingredients of the quantized calculus, introduced by A. Connes, are a separable Hilbert space H, a unitary self-adjoint operator F on H and a C^*-algebra $\mathcal{A}$ represented on H such that for all $a \in \mathcal{A}$ the commutator $[F, a]$ is a compact operator on H. Then the quantized differential of $a \in \mathcal{A}$ is defined to be the operator $da = i[F, a]$. Focusing on the most typical example of noncommutative space–quantum tori $\mathbb{T}^d_\theta$, I will talk about the characterizations of the Schatten properties of quantum derivatives by Sobolev or Besov spaces.

173 ZHANG Min: Numerical solution of Minkowski problem and its applications on medical imaging

Zhejiang University

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: A general surface in $\mathbb{R}^3$ is fully determined by its first fundamental form (Riemannian metric) and the second fundamental form, unique up to a rigid motion. Closed convex surfaces are solely determined by their Riemann metrics. According to Gauss' s Theorema Egregium, the Gaussian curvature is intrinsically determined by the Riemannian metric. Mathematically, the Minkowski problem (type II) asks how to reconstruct a convex

shape that fulfils a given Gaussian curvature measure. The Minkowski problem is equivalent to the spherical Monge-Ampere equation, which is equivalent to the spherical optimal transport map. In this talk, we will introduce a rigorous and efficient algorithm to compute the spherical optimal mass transportation map and its applications on medical imaging, especially for neurodegeneration diseases.

13:20-14:05

174 CHENG Wei: Measure theoretic aspect of Hamilton-Jacobi equation

Department of mathematics, Nanjing University

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: We will discuss the commutators of Hamilton-Jacobi equations and discuss the controllability issue. This makes us observe some measure theoretic aspect of HJ equation from mass transport point of view. As an application, I will also discuss the Young measure obtained from the variational vector field given by the intrinsic propagation of singularities. This is based on recent joint work with Piermarco Cannarsa and Jiahui Hong.

175 MOK Chung Pang: Pseudorandom vectors generation using elliptic curves and applications to Wiener processes

Soochow University

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: Using the arithmetic of elliptic curves over finite fields, we present an algorithm for the efficient generation of sequence of uniform

pseudorandom vectors in high dimension with long period, that simulates sample sequence of a sequence of independent identically distributed random variables, with values in the hypercube $[0,1]^d$ with uniform distribution. As an application, we obtain, in the discrete time simulation, an efficient algorithm to simulate, uniformly distributed sample path sequence of a sequence of independent standard Wiener processes. Applications include Monte Carlo numerical computations of high dimensional integrals and Feynman-Kac formulas.

176 NING Bo: Longest cycles in highly-connected graphs

College of Computer Science

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: Let G be a graph and C be a cycle of G. The cycle C is called a dominating cycle of G if $G-V(C)$ consists of isolated vertices and any vertex of $G-V(C)$ is incident to C. A classical theorem due to Nash-Williams states that for any 2-connected graph G on n vertices, every longest cycle of G is dominating if minimum degree $\delta(G) \geq \frac{n+2}{3}$. Generalizing Nash-Williams' theorem, Bondy proposed a longstanding conjecture in 1980, which says that for any k-connected graph G on n vertices where $k \geq 2$, the longest path outside any longest cycle in G is of length at most $k-2$ if $\sigma_{k+1}(G) \geq n + k(k-1)$, where $\sigma_{k+1}(G)$ is defined as the minimum degree sum of $k+1$ pairwise nonadjacent vertices. This conjecture was confirmed by Bondy himself for $k = 3$ and by C.Q. Zhang for claw-free graphs. Till now, it is wide open.

In this paper, we prove that the minimum degree version of Bondy ' s conjecture is true for graphs with order $n = \Omega(k^2)$, which generalizes Nash-Williams' theorem to the settings of k-connected graph case. To attack the minimum degree conjecture, we prove a result on the estimate of the length of a longest cycle in k-connected graphs, which confirms a conjecture of Jung (2000) with restrictions on minimum degree.

177 XUE Bo: Integrable dynamic systems with N-peakon

Zhengzhou University

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: Since the discovery of Camassa-Holm equation, because of the special properties that the peaked soliton solution (dubbed as peakon) gets, it has received considerable attention in modern Mathematics and Physics. Many new integrable dynamic systems with N-peakon have been obtained, for instance, the DP equation, the Novikov equation, the Geng-Xue equation, etc. In this talk, we will introduce the basic definition and characters of peakon, and then some newly derived integrable dynamic systems with N-peakon will be presented. Meanwhile, new developments and hot points in the associated field are discussed.

178 YIN Zhaoyang: On a two dimensional nonlocal shallow-water model

Sun Yat-sen Uinversity

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: In this talk, we first review some related progresses on one dimensional shallow water models. Then we introduce the derivation of a new nonlocal shallow water model from the 3D Euler system with free boundary conditions. Next, we present local well-posed results and several blow-up results. Finally, we state several open problems. This is a joint work with Guilong Gui, Yue Liu and Wei Luo.

179 YU Hui: Self-organized hydrodynamic models for alignment and the application to myxobacteria

Tsinghua University

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: A continuum model for a population of self-propelled particles interacting through alignment is derived from an individual-based model. The methodology consists of introducing a hydrodynamic scaling of the corresponding mean field kinetic equation. The resulting perturbation problem is solved thanks to the concept of generalized collision invariants. It yields a hyperbolic but nonconservative system of equations for the mean direction of the flow and the densities of particles flowing parallel or antiparallel to this mean direction. An application to myxobacteria will be presented.

180 ZHANG Deng: Multi-bubble blow-up solutions and multi-solitons to (stochastic) nonlinear Schrödinger equations

Shanghai Jiao Tong University

Lily Magnolia 木兰厅
Tencent Meeting: 826-641-7263, Password: 2022

Abstract: In this talk we are mainly concerned with the dynamics of a general class of focusing mass-critical nonlinear Schrödinger equations (NLS) with lower order perturbations, for which the pseudo-conformal symmetry and the conservation law of energy can be absent. Two canonical examples are stochastic NLS driven by linear multiplicative noise and deterministic NLS. We show the construction of multi-bubble Bourgain-Wang type blow-up solutions, and the uniqueness in the energy class where the convergence rate is of the order $(T-t)^{4+}$. In the case of mass-critical NLS, the corresponding existence and conditional uniqueness of non-pure multi-solitons (including dispersive part) also will be presented. These results in particular provide new examples of mass quantization conjecture and soliton resolution conjecture. If time permits, I will also show the recent results on the refined uniqueness of multi-bubble blow-ups and multi-solitons for the mass-critical NLS, and the pathwise construction of multi-solitons for the mass-subcritical stochastic NLS.

181 ZHANG Leihong: Eigenvector-dependent nonlinear eigenvalue problems in data science

Soochow University

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: Some recent applications of multivariate statistical analysis in data science need to optimize certain trace-related objective functions over the orthogonal constraints. In this talk, we shall first present some recent applications in data science and show that solving the optimization problems can be converted to eigenvector-dependent eigenvalue problems (NEPv) for which the self-consistent filed (SCF) iteration can be effectively applied. We then discuss recent developments of the general SCF on the local convergence rate and the level-shifted technique.

182 ZHOU Jian: Moments, lattice paths, and KP hierarchy

Tsinghua University

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: The three subjects in the title belong to three different areas: probability theory, combinatorics, and integrable systems. We will explain how any moment sequence leads to a sequence of tau-functions of the KP hierarchy, which can be interpreted in terms of weighted counts of nonintersecting lattice paths. We also explain how various lattice counting leads to different probability measures on the real line. If time allows we will explain connections to Grothendieck's dessins d'enfants, associahedra, and cluster algebras.

14:10-14:55

183 CHEN Yifei: The Jordan property of Cremona groups

Chinese Academy of Sciences

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: In 1878, Jordan proves general linear algebraic group has Jordan property. Roughly, a group G has Jordan property if every its finite subgroup is almost abelian. In 2009, Serre proves that Crenoma groups of rank 2 has Jordan property. His proof applies minimal model program. Recently, as the BAB conjecture is solved, Prokhorov, Shramov, Birkar prove Cremona group of any rank has Jordan property. In the talk, we will survey the Jordan property of Crenoma groups, and introduce some results of the Jordan property of Crenoma groups in positive characteristic. This is a joint work with Shramov.

184 GUI Guilong: Global stability of the compressible viscous surface waves in an infinite layer

Xiangtan University

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: We investigate in the talk the global stability of the compressible viscous surface waves in the absence of surface tension effect with a steady-state violating Rayleigh-Taylor instability and with the reference domain being the horizontal infinite layer. The fluid dynamics are governed by the 3-D gravity-driven isentropic compressible Navier-Stokes equations. This is a joint work with Prof. Zhifei Zhang.

185 JIANG Yunfeng: Rational $\mathbb{Q}$-system and quiver gauge theory

Shing-Tung Yau Center and School of Physics, Southeast University

Lily Magnolia 木兰厅
Tencent Meeting: 826-641-7263, Password: 2022

Abstract: I will first explain what is a rational $\mathbb{Q}$-system – an alternative formulation of Bethe ansatz equations which exhibit a number of advantages. After showing the main features of the rational $\mathbb{Q}$-systems, I will present the construction of rational $\mathbb{Q}$-system for Bethe equations corresponding to generic A-type Dynkin diagrams. Finally, I will discuss the meaning of Higgsing and mirror symmetry for the rational $\mathbb{Q}$-system in view of Bethe/Gauge duality.

186 LEI Fengchun: Invariants of 3-manifolds from Heegaard splittings

School of Mathematical Sciences, Dalian University

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: Let M be a compact connected orientable 3-manifold, and $\Sigma = (V_1, V_2; S)$ a Heegaard splitting of M. For $j = 1, 2$, let $i_j : S \hookrightarrow H_j$ be the inclusion map, $i_{j*} : \pi_1(S) \to \pi_1(H_j)$ the homomorphism induced by the inclusion, and $K_j = \mathrm{Ker}(i_{j*})$. $K(\Sigma) = K_1 \cap K_2$ is called the intersecting kernel of the Heegaard splitting Σ. The SCC subgroup $\Lambda(\Sigma)$, which is the normal closure of all the elements of $K(\Sigma)$ that are represented by simple closed curves on S, is a normal subgroup of $K(\Sigma)$. In the talk, we will review some properties of $K(\Sigma)$, and introduce an invariant of 3-manifold M from the quotient group $K(\Sigma)/\Lambda(\Sigma)$ by Reidmester-Singer theorem, and discuss some properties of $K(\Sigma)/\Lambda(\Sigma)$.

187 LI Hanfeng: TBD

State University of New York at Buffalo

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract:

188 LIANG Jin: Free boundary problems for measuring credit rating migration risks

Tongji University

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: In this talk, we summarize the establishment and development of structural models for measuring credit rating migration risks in recent years, especially in the case of assuming that the asset-debt ratio is used to divide the high and low ratings, where the different stochastic processes of different ratings are satisfied. According different assumptions, these problems can be translated into free boundary problems. The theoretical research results, computational and empirical methods of these models are shown, as well as some generalizations and prospects of the models are presented.

189 NING Jiafu: The extension of (quasi-)plurisubharmonic functions on complex manifolds

Central South University

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: In this talk, we will report some results about the extension of (quasi-)plurisubharmonic functions on complex manifolds. In particular, we will introduce a partial solution of Coman-Guedj-Zeriahi problem under the assumption of the existence of the holomorphic retraction structure, which is the case of a joint work with Prof. Zhiwei Wang and Prof. Xiangyu Zhou.

190 SHENG Zhiqiang: The nonlinear finite volume scheme preserving maximum principle on distorted meshes

Laboratory of Computational Physics, Institute of Applied Physics and Computational Mathematics

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: The maximum principle is one of the key requirements to discretization schemes, and can ensure that there is no spurious oscillations for the numerical solution and preserve physical bounds of problem. In this talk, we first introduce a nonlinear finite volume scheme preserving the discrete maximum principle for the anisotropic diffusion equation on distorted meshes, and then introduce the corresponding theoretical analysis including the coercivity and existence. Numerical results are presented to demonstrate the properties of our scheme.

191 WANG Guanghui: Embeddings in "random lik" (hyper)graphs

School of Mathematics, Shandong University

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: An archetype problem in extremal combinatorics is to study the structure of subgraphs appearing in different classes of (hyper)graphs. We will focus on such embedding problems in "random lik" (hyper)graphs. In practice, we will mention ramsey-turan problems and structures in quasirandom hypergraphs.

192 XU Hongwei: On geometry and topology for certain Riemannian submanifolds

Zhejiang University

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: In this talk, we will discuss some recent results on geometry and topology for submanifolds in certain Riemannian manifolds. Based on discussions about uniqueness and finiteness results for certain Riemannian submanifolds (c.f. Liu-Xu-Zhao [arXiv:1204.0107], Shiohama-Xu [Kyushu J. Math. 54 (2000)]), we present the following finiteness theorem for immersions: let $\mathcal{L}_{\Lambda,v}$ be the set of immersions from compact manifolds into the Euclidean space with L^p-norm of the second fundamental form bounded by Λ and volume bounded above by v, then $\mathcal{L}_{\Lambda,v}$ contain only finitely many isotopy classes.

15:10-15:55

193 GAO Hongjun: Wong-Zakai type approximations of rough random dynamical systems by smooth noise

Southeast University

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: This paper is devote to the Wong-Zakai approximations for a class of rough differential equations driven by fractional Brownian rough path $\boldsymbol{\omega}$ with Hurst index $H \in (\frac{1}{3}, \frac{1}{2})$. We first construct the approximation $\boldsymbol{\omega}_\delta$ of $\boldsymbol{\omega}$ by probabilistic arguments, and then using the rough path theory to obtain the Wong-Zakai approximation for the solution on any finite interval. Finally, both the original system and approximated system generate a random dynamical system φ and φ^δ. As a consequence of the Wong-Zakai approximation of the solution, φ^δ converges to φ as $\delta \to 0$.

194 HAN Huhe: From spherical center set to the upper bound theorem and the lower bound theorem

Northwest A&F University

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: Let $\{W_i\}_{i=1}^m$ be a finite closed set of S^n such that $W_i \cap W_j =$ for any $i, j \in \{1, \cdots, m\}$. The separation center set of $\{W_i\}_{i=1}^m$ is defined as the set consisting of separation center of $\{W_i\}_{i=1}^m$. In this talk, we first show that for any nonempty spherical closed convex set $\mathcal{X}$, the union $\mathcal{X} \cup -\mathcal{X}$ can be regarded as the separation center set of certain two nonempty disjoint spherical convex sets, where the largest convex sets pair is presented. We also presented a condition of two spherical convex set pairs sharing a separation center set. Finally, combining the upper bound theorem and the lower bound theorem we present the upper bound and the lower bound of the number of the spherical convex polytopes pairs face-separated by a given spherical convex polytope. (This is a joint work with Takashi Nishimura.)

195 JIANG Jianping: Movement of Lee-Yang zeros

YMSC, Tsinghua University

Lily Magnolia 木兰厅
Tencent Meeting: 826-641-7263, Password: 2022

Abstract: For the Ising model with ferromagnetic pair interactions and a uniform complex external field, we consider the zeros of its partition function. In this talk, we discuss the movement of those zeros as the underlying interactions are varied.

196 LI Haizhong: Curvature flows for hypersurfaces in hyperbolic space and their geometric applications

Tsinghua University

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: Isoperimetric inequality is one of the oldest problems in mathematics, which relates with convex geometry, differential geometry and ge-

ometric PDES, ect. Recently, the isoperimetric type inequalities in hyperbolic space have been investigated by using various curvature flows. In this talk, I will survey the recent progress in this topics, which is based on my joint works with Ben Andrews (ANU), Yingxiang Hu (Beihang U.) , Yong Wei (USTC), Changwei Xiong (SCU).

197 LI Tiexiang: Novel algorithms for measure-preserving parameterizations of 3-manifolds with applications

School of Mathematics, Southeast University

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: Manifold parameterization is one of the fundamental operations in computer graphics and has been widely used in digital geometry processing tasks. Combined with it, computational optimal mass transport (OMT) has gradually become a hot spot in the field of artificial intelligence in recent years, especially in medical imaging and other aspects. In this work, we develop a series of novel algorithms for computing spherical spherical area-preserving, volume-preserving parameterizations of genus zero closed surfaces, respectively. We further develop area- and volume measure-preserving OMT algorithms for finding the optimal maps to transform an irregular 3D image into a regular 3D canonical domain, such as a ball, a cube or a cuboid, such that the transport cost is minimized and the local mass ratios preserved. Applications of manifold partitions and data preprocessing for 3D brain tumor segmentation are demonstrated thereafter to show the robustness of the proposed algorithms.

198 LIANG Xin: Stochastic algebraic Riccati equations are almost as easy as deterministic ones

YMSC, Tsinghua University

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: Stochastic algebraic Riccati equations, a.k.a. rational algebraic Riccati equations, arising from stochastic optimal control, were considered to be not easy to solve. The-state-of-art numerical methods most rely on differetiability or continuity, such as Newton-type method or homotopy method. In this talk, we will build a novel theoretical framework and reveal the intrinsic algebraic structure appearing in this kind of algebraic Riccati equations. This structure guarantees that to solve it is almost as easy as a deterministic/classical one, which will shed light on the theoretical analysis and numerical algorithm design.
This is a joint work with Zhen-Chen Guo (Nanjing University).

199 SUN Hejun: The Morse index, rigidity and classification of self-shrinkers and ξ-submanifolds

Nanjing University of Science and Technology

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: Self-shrinkers play an important role in the study of the mean curvature flow because they describe all possible blow-ups at a given type I singularity of the mean curvature flow. ξ-submanifold is a natural generalization of self-shrinkers and also an extension of λ-hypersurfaces to the higher codimension. In this talk, we focus on gap properties of self-shrinker's Morse index, the rigidity and classification of self-shrinking surfaces in $\mathbb{R}^4$, and the rigidity of ξ-submanifolds.

200 WANG Wei: k-Cauchy-Fueter complexes in quaternionic analysis of several variables

Zhejiang University

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: k-Cauchy-Fueter complexes, as quaternionic counterpart of the $\bar{\partial}$-complex in complex analysis, play very important roles in quaternionic

analysis of several variables. I will talk about the Neumann problem associated to these complexes on k-pseudoconvex domains, their applications to pluripotential theory for quaternionic plurisubharmonic functions and quaternionic Monge-Ampère equation, and the construction of their boundary complexes on quadratic hypersurfaces as nilpotent Lie groups of step two, corresponding to $\bar{\partial}_b$-complex on CR hypersurfaces. I will also discuss the generalization of quaternionic analysis to some nilpotent Lie groups of step two.

201 XU Xindong: Quasi-periodic solutions of NLS with Liouvillean Frequencies

Southeast University

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: We prove the existence of time quasi-periodic solutions with Liouvillean frequencies for the forced nonlinear Schrödinger equation (NLS). The tool utilized here is a new infinite dimensional KAM theorem that applies to Liouvillean frequencies. This is a joint work with Prof. Jiangong You and Qi Zhou.

202 ZHANG Xin: Mean-variance asset-liability management with affine diffusion factor process and a reinsurance option

School of Mathematics, Southeast University

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: This paper considers an optimal asset-liability management (ALM) problem for an insurer under the mean-variance criterion. It is assumed that the value of liabilities is described by a geometric Brownian motion (GBM). The insurer's surplus process is modeled by a general jump

process generated by a marked point process. The financial market consists of one risk-free asset and n risky assets with the risk premium relying on an affine diffusion factor process. By transferring a proportion of insurance risk to a reinsurer and investing the surplus into the financial market, the insurer aims to max- imize the expected terminal net wealth and, at the same time, minimize the corresponding variance of the terminal net wealth. By using a backward stochastic differential equation (BSDE) approach, closed-form expressions for both the efficient strategy and efficient frontier are derived. To illustrate the main results, we study an example with the Heston stochastic volatility (SV) model and numerically analyze the economic behavior of the efficient frontier. Finally, a generalization of the Mutual Fund Theorem is obtained.

16:00-16:45

203 DU Jie: High order bound preserving methods for compressible multi-species flow with chemical reactions

Tsinghua University

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: In this talk, we develop third-order conservative sign-preserving and steady-state preserving time integrations and seek their applications in multispecies and multireaction chemical reactive flows. In this problem, the density and pressure are nonnegative, and the mass fraction should be between 0 and 1. There are four main difficulties in constructing high-order bound-preserving techniques for multispecies and multireaction detonations. First of all, most of the bound-preserving techniques available are based on Euler forward time integration. Therefore, for problems with stiff source, the time step will be significantly limited. Secondly, the mass fraction does not satisfy a maximum principle and hence it is not easy to preserve the

upper bound 1. Thirdly, in most of the previous works for gaseous denotation, the algorithm relies on second-order Strang splitting methods where the flux and stiff source terms can be solved separately, and the extension to high-order time discretization seems to be complicated. Finally, most of the previous ODE solvers for stiff problems cannot preserve the total mass and the positivity of the numerical approximations at the same time. In this work, we will construct third order conservative sign-preserving Rugne-Kutta and multistep methods to overcome all these difficulties. The time integrations do not depend on the Strang splitting, i.e. we do not split the flux and the stiff source terms. Moreover, the time discretization can handle the stiff source with large time step and preserves the steady-state. Numerical experiments will be given to demonstrate the good performance of the bound-preserving technique and the stability of the scheme for problems with stiff source terms.

204 GONG Rongfang: Bioluminescence tomography : modelling and reconstruction

College of Mathematics, Nanjing University of Aeronautics and Astronautics

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: In this talk, we consider inverse problems arising in bioluminescence tomography (BLT). In the BLT problem, one constructs quantitatively the bioluminescence source distribution inside a small animal from optical signals detected on the animal's body surface. The BLT problem is typically ill-posed and thus regularization strategies are needed for obtaining a reasonable approximate solution. Several BLT models and reconstruction methods are proposed for this purpose. In addition, mathematically, BLT is an under-determined inverse source problem which leads to no solution uniqueness. Particularly, one cannot distinguish between a strong source over a small region and a weak source over a large region. Therefore, it is particularly important to know the support of the underlining

light source so that its strength could be reconstructed accurately. Practically, we only know a rough approximation of the support. In this talk, a new time-dependent coupled model is proposed motivated by the solution uniqueness. Some theoretical and numerical results are reported.

205 MENG Xiankui: A Kählerness criterion for real $(1,1)$-classes on projective manifolds through extendibility of singular potentials.

Beijing University of Posts and Telecommunications

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: Let X be a projective manifold and let $\{\theta\} \in H^{1,1}(X,\mathbb{R})$ be a nonzero pseudo-effective (transcendental) class, where θ is a smooth closed real $(1,1)$-form. We prove that, if for any one dimensional complex submanifold $C \subset X$ and $\varphi \in \mathrm{SPsh}(C, \theta|_C)$ with a single analytic singularity at some point $p \in C$, there exists a function $\widetilde{\varphi} \in \mathrm{Psh}(X,\theta)$ such that $\widetilde{\varphi}|_C = \varphi$ and $\widetilde{\varphi}$ is continuous at points of $C \setminus \{p\}$, then $\{\theta\}$ is a Kahler class.

206 NIE Xin: Cyclic Higgs bundles and minimal surfaces in pseudo-hyperbolic spaces

Shing-Tung Yau Center, Southeast University

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: Spacelike minimal surfaces in the signature $(2,q)$ pseudo-hyperbolic space are known as maximal surfaces and are useful in higher Teichmüller theory through the works of Bonsante-Schlenker and Collier-Tholozan-Toulisse. Their results can hardly be generalized to arbitrary signature (p,q) due to the loss of maximality when $p > 2$. Inspired by the works of Chern and Bryant, we introduce a particular type of spacelike

minimal surface for signature (n, n) with n even or $(n+1, n-1)$ with n odd, which has the remarkable property of being infinitesimally rigid, and discuss its applications in higher Teichmüller theory.

207 QIAO Huijie: Efficient filtering for multiscale McKean-Vlasov stochastic differential

Southeast University

Lily Magnolia 木兰厅
Tencent Meeting: 826-641-7263, Password: 2022

Abstract: In this paper, the average principle and the nonlinear filtering problem of slow-fast McKean-Vlasov stochastic differential equations are concerned. First of all, we prove that the slow part of the original system converges to an average system in the L^p $(p \geq 2)$ sense. Then, given an observation process which depends on the distribution of the slow part, we show that the nonlinear filtering of the slow part converges to that of the average system in the L^p $(p \geq 1)$ sense.

208 WANG Xiaoliu: The evolution of area-preserving and length-preserving inverse curvature flows for immersed locally convex closed plane curves

Southeast Univeristy

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: In this talk, we investigate an area-preserving inverse curvature flow and a length-preserving inverse curvature flow for immersed locally convex closed plane curves with rotation number $m \in \mathbb{N}^+$. The global-in-time flows are shown to converge smoothly to m-fold round circles as time goes to infinity. The sufficient conditions on initial curve are also found to guarantee the occurrence of the flow's singularity at finite time.

209 WU Jinsong: Quantum Fourier analysis

BIMSA

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: In this talk, we introduce various positivities in quantum symmetries through the dual of convolutions. Mixed and local positivities for quantum symmetries are also defined to reduce the complexity of computation. They are turned out to be powerful obstructions of unitray categorification. We also introduce the potential connections between quantum error corrections and quantum Fourier analysis.

210 ZHANG Hao: The p-adic Gelfand-Kapranov-Zelevinsky hypergeometric complex.

Yau Center of Southeast University

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: To a torus action on a complex vector space, Gelfand, Kapranov and Zelevinsky introduce a system of differential equations, which are now called the GKZ hypergeometric system. Its solutions are GKZ hypergeometric functions. In this talk, We study the p-adic counterpart of the GKZ-hypergeoemtric system. It is an over-holonomic object in the derived category of arithmetic D- modules with Frobenius structures. Traces of Frobenius on fibers at Techmu¨ller points of the GKZ hypergeometric complex define the hypergeometric function over the finite field introduced by Gelfand and Graev.

211 ZHANG Ying: Shifted trace polynomials for closed geodesics on most symmetric hyperbolic tori: Positivity, log-concavity and monotonicity

Soochow University

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: In joint work with Xiangfei Li, we study the shifted trace polynomials for closed geodesics on most symmetric hyperbolic tori. We prove positivity and partial monotonicity, and make conjectures on log-concavity of the polynomials.

212 ZHENG Tao: Parabolic Monge-Ampeère equations on almost Hermitian manifolds

Beijing Institute of Technology

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: In this talk, we will talk about the properties of the Chern-Ricci flow, equivalent to parabolic Monge-Ampeère equations, on Inoue surfaces, and its generalization including the continuity equations of almost Hermitian metrics and almost Gauduchon metrics on almost Hermitian manifolds. This is based on the joint work with S. Fang, K. Feng, C. Li, V. Tosatti and B. Weinkove.

16:50-17:10

213 DONG Rui: Assessing the transmissibility of the new SARS-CoV-2 variants: from Delta to Omicron

Tsinghua University

Lily Magnolia 木兰厅
Tencent Meeting: 826-641-7263, Password: 2022

Abstract: Omicron, the latest SARS-CoV-2 Variant of Concern (VOC), first appeared in Africa in November 2021. At present, the question of whether a new VOC will out-compete the currently predominant variant

is important for governments seeking to determine if current surveillance strategies and responses are appropriate and reasonable. Based on both virus genomes and daily-confirmed cases, we compare the additive differences in growth rates and reproductive numbers (R_0) between VOCs and their predominant variants through a Bayesian framework and phylodynamics analysis. Faced with different variants, we evaluate the effects of current policies and vaccinations against VOCs and predominant variants. The model also predicts the date on which a VOC may become dominant based on simulation and real data in the early stage. The results suggest that the overall additive difference in growth rates of B.1.617.2 and predominant variants was 0.44 (95% confidence interval, 95% CI: −0.38, 1.25) in February 2021, and that the VOC had a relatively high R_0. The additive difference in the growth rate of BA.1 in the United Kingdom was 6.82 times the difference between Delta and Alpha, and the model successfully predicted the dominating process of Alpha, Delta and Omicron. Current vaccination strategies remain similarly effective against Delta compared to the previous variants. Our model proposes a reliable Bayesian framework to predict the spread trends of VOCs based on early-stage data, and evaluates the effects of public health policies, which may help us better prepare for the upcoming Omicron variant, which is now spreading at an unprecedented speed.

214 KAMTUE Supanat: Bakry-Emery curvature on graphs as an eigenvalue problem

YMSC

Crouching Tiger 虎踞厅
Tencent Meeting: 754-098-6380, Password: 2022

Abstract: Bakry-Emery curvature is a Ricci-type curvature motivated from Bochner's formula in Riemannian geometry.
It has been introduced and developed in the setting of weighted graphs by Elworthy (1989), Schmuckenschlager (1996) and Lin-Yau (2010).
Here, we propose the method of computing the Bakry-Emery curvature as

the smallest eigenvalue of a real symmetric matrix, which we called "curvature matrix".
We then use this formulation to analyze Bakry-Emery curvature as a function of the dimension parameter. As an application, we could also derive the curvature of Cartesian products.
This talk is based on a joint work with David Cushing (Newcastle), Shiping Liu (USTC) and Norbert Peyerimhoff (Durham).

215 KIKUCHI Ken: Emergent SUSY in two dimensions

YMSC

Ginkgo 银杏厅
Tencent Meeting: 683-915-7137, Password: 2022

Abstract: We propose a renormalization group flow with emergent supersymmetry in two dimensions from a non-Lagrangian theory. The ultraviolet theory does not have supersymmetry while the infrared theory does. The flow is constrained analytically by topological defect lines including a new spin constraint, and further supported by numerics from the truncated conformal space approach.

216 ADAMI Hamed: Null boundary phase space in diverse dimensions

YMSC Tsinghua University & BIMSA

Lilac 丁香厅
Tencent Meeting: 377-008-8284, Password: 2022

Abstract: We construct the boundary phase space in D-dimensional Einstein gravity with a generic given co-dimension one null surface as the boundary. The associated boundary symmetry algebra is a semi-direct sum of diffeomorphisms of null surface and Weyl rescalings. It is generated by D towers of surface charges that are generic functions over the null surface.

These surface charges can be rendered integrable for appropriate slicings of the phase space, provided there is no graviton flux through the null surface. In one particular slicing of this type, the charge algebra is the direct sum of the Heisenberg algebra and diffeomorphisms of the transverse space, for any fixed value of the advanced time.

217 BEST Andrew James: The Furstenberg–Sárközy theorem and asymptotic total ergodicity

BIMSA

Beautiful Bamboo 秀竹厅
Tencent Meeting: 740-028-2085, Password: 2022

Abstract: The Furstenberg–Sárközy theorem asserts that the difference set $E-E$ of a subset E of the natural numbers with positive upper density contains a (nonzero) square. Furstenberg' s approach relies on a correspondence principle and a version of the Poincaré recurrence theorem along squares; the latter is shown via the result that for any measure-preserving system $(X, \mathcal{B}, \mu, T)$ and set A with positive measure, the ergodic average $\frac{1}{N}\sum_{n=1}^{N} \mu(A \cap T^{-n^2})A$ has a positive limit $c(A)$ as N tends to infinity. Motivated - by what? we shall see –to optimize the value of $c(A)$, we define the notion of asymptotic total ergodicity in the setting of modular rings $\mathbb{Z}/N\mathbb{Z}$. We show that a sequence of modular rings $(\mathbb{Z}/N_m\mathbb{Z})$ is asymptotically totally ergodic if and only if the least prime factor of N_m grows to infinity. From this fact, we derive some combinatorial consequences. These results are based on joint work with Vitaly Bergelson.

218 WARAKKAGUN Sangsan: Connectivity of the Space of Pointed Hyperbolic Surfaces

BIMSA

Silver Birch 白桦厅
Tencent Meeting: 779-007-6479, Password: 2022

Abstract: We consider the space of all complete hyperbolic surfaces with basepoint equipped with the pointed Gromov-Hausdorff topology. In this short talk, I will motivate this topology and describe certain concrete geometric constructions which are used to show that the space is globally path-connected and is locally path-connected at points whose underlying surfaces are hyperbolic surfaces of the first kind.

219 RASOOL Ghulam: Rheological behavior of nanofluids and Recent trends in applied Mathematics

Beijing University of Technology

Maple 丹枫厅
Tencent Meeting: 384-281-4895, Password: 2022

Abstract: The advanced classification of heat transferring materials is known as nanofluids. A high saturation/suspension of nanoparticles of diameter within 1-100 nanometers are dispersed in some typical base fluids to formulate nanofluids. The classification is further classified as hybrid nanofluids when two or more types of nanoparticles are mixed in one base fluid, say water (in this case). Plenty of liquids can be used as base fluids for hybrid nanofluid formulation; however, water, ethylene, organic liquids, engine oil, bio-fluids, and polymeric solutions are best known. A similar classification is extended with the type of nanoparticles involved in this procedure. Usually, carbon nanotubes, diamond, graphite, metals like gold, copper, silver, and metal oxides like zirconia and titania are commonly used. The governing equations strictly follow the Navier Stokes equations model in the form of highly nonlinear PDEs. Numerous numerical methods are used to solve the PDEs directly or convert them into ODEs using suitable transformations. The impact of volume fraction of nanoparticles, the type of medium, type of base fluid, and many other essential parameters are of significant importance to see the rheological behavior of the nanofluids. In addition, skin friction, heat, and mass transfer rates are analyzed. The findings are critical in many industrial and engineering applications of nanofluids such as pharmaceutical productions, bio-medicine, nuclear actor/reactors,

heat exchangers, modeling of geothermal procedures, oil-based reservoirs, and groundwater systems of water management, efficient mechanical devices, etc. Recently, the numerical results are also tested experimentally to validate the findings.

220 LUPU Cezar: Zagier's formula for multiple zeta values and its odd variant revisited

BIMSA

Green Willow 绿柳厅
Tencent Meeting: 807-924-4670, Password: 2022

Abstract: In this talk, we revisit the famous Zagier formula for multiple zeta values (MZV's) and its odd variant for multiple t-values which is due to Murakami. Zagier's formula involves a specific family of MZV's which we call nowadays the Hoffman family,

$$H(a,b) = \zeta(\underbrace{2,2,\ldots,2}_{a},3,\underbrace{2,2,\ldots,2}_{b}).$$

which can be expressed as a $\mathbb{Q}$-linear combination of products $\pi^{2m}\zeta(2n+1)$ with $m+n = a+b+1$. This formula for $H(a,b)$ played a crucial role in the proof of Hoffman's conjecture by F. Brown, and it asserts that all multiple zeta values of a given weight are $\mathbb{Q}$-linear combinations of MZV's of the same weight involving 2's and 3's.

Similarly, in the case of multiple t-values (the odd variant of multiple zeta values), very recently, Murakami proved a version of Brown's theorem (Hoffman's conjecture) which states that every multiple zeta value is a $\mathbb{Q}$-linear combination of elements $\{t(k_1,\ldots,k_r) : k_1,\ldots,k_r \in \{2,3\}\}$. Again, the proof relies on a Zagier-type evaluation for the Hoffman's family of multiple t-values,

$$T(a,b) = t(\underbrace{2,2,\ldots,2}_{a},3,\underbrace{2,2,\ldots,2}_{b}).$$

We show the parallel of the two formulas for $H(a,b)$ and $T(a,b)$ and derive elementary proofs by relating both of them to a surprising cotangent integral. This is a joint work with Li Lai and Derek Orr.

221 YUNUS Gulshadam: Grobner-Shirshov 基及 Drinfeld-Jimbo 量子群

Xinjiang University

Golden Thread 红杉厅
Tencent Meeting: 393-944-9975, Password: 2022

Abstract: Buchberger 创建的交换代数上的 Grobner 基理论为解决交换代数中的约化问题提供了非常有效的方法。Bergman 通过证明钻石合成引理把 Buchberger 的理论推广到结合代数上。在李代数上的类似理论由 Shirshov 创建。后来，Bokut 注意到 Shirshov 在李代数上的方法也适用于结合代数，因此我们现在把 Shirshov 在李代数及其包络代数上建立的理论称为 Grobner-Shirshov 基理论。现在 Grobner-Shirshov 基理论在数学的各个领域和其他相关学科中得到了广泛应用。

222 ESKAR Rena: Schrödinger 方程的高精度差分格式研究

Xinjiang University

Curling Dragon 龙蟠厅
Tencent Meeting: 459-858-4057, Password: 2022

Abstract: 在科学计算中常用有限差分法来求解各类偏微分方程，它是被广泛应用的数值方法之一。本报告主要介绍求解非线性 Schrödinger 方程和分数阶 Schrödinger 方程的具有高精度的数值方法，提出几种有限差分格式。非线性 Schrödinger 方程在物理应用方面起着很有力的作用，尤其是在流体力学、非线性光学、量子力学等方面被广泛应用。然而，多维非线性 Schrödinger 方程和分数阶 Schrödinger 方程的准确解很难得到。因此，建立一些守恒的有限差分格式来求解多维非线性 Schrödinger 方程和分数阶 Schrödinger 方程便成了一项重要任务。当前，高精度紧致差分格式由于有着高精度和高效率的优点，越来越受到国内外研究者的关注。本工作中，对于多维非线性 Schrödinger 方程，我们构造一些守恒的高精度紧致差分格式并分析差分格式的守恒性及稳定性。对于分数阶 Schrödinger 方程也构造出几种高精度紧致差分格式，并对所建立的格式进行了数值理论分析。

Name Index