代数图论研讨会
Workshop on Algebraic Graph Theory

会议手册
Program

2026 年 01 月 25 日–31 日
January 25–31, 2026

天元数学国际交流中心
Tianyuan Mathematical Research Center

中国 · 昆明
Kunming, China

目录

一、   会议信息

本次研讨会旨在邀请图论、组合、群论等领域国内外知名专家学者齐聚天元数学国际交流中心，以分享他们各自在上述主题上取得的最新成就和技术，挖掘领域交叉问题，探讨本领域需长期攻关问题的最新研究动态和可能突破，推动深入合作；为青年研究人员提供一个与大师交流学习的机会，激励青年研究人员投身科研，推动本领域研究的长期持续发展。会议的主题将包含 (但不限于)：代数图论、拓扑图论、极值图论等

会议时间：

2026 年 01 月 25 日下午报到，26 日-30 日学术报告，31 日离会。

会议地点：

云南省昆明市宜良县天元数学国际交流中心

费用说明：

本次会议不收取注册费。会议期间食宿、会务服务，以及昆明机场/火车站至会议中心的往返交通，将由天元数学国际交流中心统一安排并承担。其他费用自理。

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二、 会议日程安排

2.1 1 月 26 日 (January 26)

时间 Time	内容 Content	报告人 Speaker	主持人 Chair
08:40-09:00	开幕致辞 Opening Remarks		
09:00-09:30	Genera of smooth quotients of triangle groups via uniform hypermaps	Jozef Širáň	范更华 Genghua Fan
09:30-10:00	Simple groups, symmetrc graphs, and geometries	李才恒 Caiheng Li	
10:00-10:15	拍照 Photo		
10:15-10:30	茶歇 Coffee Break		
10:30-11:00	Smooth skew-morphisms of abelian groups	Young Soo Kwon	冯衍全 Yan-Quan Feng
11:00-11:30	Edge version of the inducibility	陆玫 Mei Lu	
11:30-12:00	Localized and weighted versions of extremal problems	宁博 Bo Ning	
12:00-14:00	午餐 Lunch		
14:00-14:30	The spectra of covering simplicial complexes	范益政 Yizheng Fan	冯涛 Tao Feng
14:30-15:00	A spectral counterpart of the problem of Erdős and Simonovits	彭岳建 Yuejian Peng	
15:00-15:15	茶歇 Coffee Break		
15:15-15:45	Some progress on the determinants of tournaments	尤利华 Lihua You	于广龙 Guanglong Yu
15:45-16:15	The matching polynomials of hypergraphs	汪毅 Yi Wang	
16:15-16:30	茶歇 Coffee Break		
16:30-17:00	有拟半正则自同构的有向图	路在平 Zaiping Lu	周胜林 Shenglin Zhou
17:00-17:30	Turán number of books in non-bipartite graph	刘瑞芳 Ruifang Liu	
18:00-20:00	晚餐 Dinner		

2.2 1 月 27 日 (January 27)

时间 Time	内容 Content	报告人 Speaker	主持人 Chair
09:00-09:30	On flag-transitive generalized quadrangles	冯涛 Tao Feng	王杰 Jie Wang
09:30-10:00	Toughness in regular graphs from eigenvalues	束金龙 Jinlong Shu	
10:00-10:20	茶歇 Coffee Break		
10:20-10:50	On the existence of splitter sets	冯荣权 Rongquan Feng	李才恒 Caiheng Li
10:50-11:20	On strongly regular signed graphs	侯耀平 Yaoping Hou	
11:20-11:50	Extremal distance spectral radius of graphs with fixed size	周波 Bo Zhou	
12:00-14:00	午餐 Lunch		
14:00-14:30	Recent progress on the Bollobás-Nikiforov conjecture	张晓东 Xiaodong Zhang	范益政 Yizheng Fan
14:30-15:00	A unified approach to some extremal graph problems	李书超 Shuchao Li	
15:00-15:15	茶歇 Coffee Break		
15:15-15:45	Extremal problems on Threshold graphs and Ferrers graph	龚世才 Shicai Gong	彭岳建 Yuejian Peng
15:45-16:15	Stability of graph pairs	秦艳丽 Yan-Li Qin	
16:15-16:30	茶歇 Coffee Break		
16:30-17:00	The classification of complete regular dessins with underlying graph $K_{p,n}$	范文文 Wenwen Fan	潘江敏 Jiangmin Pan
17:00-17:30	A new construction of vertex-primitive 2-arc-transitive digraphs	吴辞旋 Cixuan Wu	
18:00-20:00	晚餐 Dinner		

2.3 1 月 28 日 (January 28)

时间 Time	内容 Content	报告人 Speaker	主持人 Chair
09:00-09:30	Isomorphisms of m-Cayley digraphs	冯衍全 Yan-Quan Feng	刘伟俊 Weijun Liu
09:30-10:00	Finite s-geodesic transitive graphs	靳伟 Wei Jin	
10:00-10:20	茶歇 Coffee Break		
10:20-10:50	Constructions of covers for vertex-transitive graphs	陈继勇 Jiyong Chen	王燕 Yan Wang
10:50-11:20	Monodromy representation of graphs	袁凯 Kai Yuan	
11:20-11:50	Large subgroups of almost simple groups and semisymmetric graphs of large valency	尹富纲 Fu-Gang Yin	
12:00-14:00	午餐 Lunch		
14:00-18:00	专题研讨 Special Session		
18:00-20:00	晚餐 Dinner		

2.4 1 月 29 日 (January 29)

时间 Time	内容 Content	报告人 Speaker	主持人 Chair
09:00-09:30	A new characterisation of the five types of locally finite arc-transitive maps	宋淑娇 Shujiao Song	郝荣霞 Rongxia Hao
09:30-10:00	Precise classifications of edge-transitive graphs of given orders and small valencies	郭松涛 Song-Tao Guo	
10:00-10:20	茶歇 Coffee Break		
10:20-10:50	Characterization of minimum restricted arc-cuts of unidirectional networks	化小会 Xiaohui Hua	李靖建 Jingjian Li
10:50-11:20	Enumerating regular graph coverings whose covering transformation groups are Z_p-extensions of a cyclic group	刘建兵 Jianbing Liu	
11:20-11:50	Saturation type problems for cycles	何臻 Zhen He	
12:00-14:00	午餐 Lunch		
14:00-18:00	专题研讨 Special Session		
18:00-20:00	晚餐 Dinner		

2.5 1 月 30 日 (January 30)

时间 Time	内容 Content	报告人 Speaker	主持人 Chair
09:00-09:30	Finite locally-quasiprimitive abelian Cayley graphs	娄本功 Bengong Lou	靳伟 Wei Jin
09:30-10:00	The classification of vertex-transitive elementary abelian and cyclic regular coverings of the complete bipartite graph $K_{3,3}$	凌波 Bo Ling	
10:00-10:20	茶歇 Coffee Break		
10:20-10:50	The existence of m-Haar graphical representations	杜佳丽 Jia-Li Du	范文文 Wenwen Fan
10:50-11:20	Transitive groups of rank 3 and related topics	朱砚舟 Yanzhou Zhu	
11:20-11:50	A characterization of tetravalent half-arc-transitive graphs of girth 5	周进鑫 Jin-Xin Zhou	
12:00-14:00	午餐 Lunch		
14:00-18:00	专题研讨 Special Session		
18:00-20:00	晚餐 Dinner		

三、 报告摘要 (Abstracts)

3.1 1 月 26 日 (January 26)

Genera of smooth quotients of triangle groups via uniform hypermaps

Jozef Širáň, Slovak University of Technology

Edmonds, Ewing and Kulkarni (1982) determined, for every (m, n) with $1/m + 1/n < 1/2$ the genera of all smooth finite quotients of a $(2, m, n)$-triangle group. We generalise this to determination of the genera of all smooth finite quotients of a (ℓ, m, n)-triangle group for every given triple (ℓ, m, n) such that $1/\ell + 1/m + 1/n < 1$. The method relies on constructions of families of uniform hypermaps of arbitrary hyperbolic type. (Joint work with Š. Gyürki, R. Nedela and J. Šiagiová.)

Simple groups, symmetrc graphs, and geometries

李才恒 (Caiheng Li), 南方科技大学 (Southern University of Science and Technology)

Viewing incidence geometries as graphs, methods in symmetric graph theory can be more efficiently applied to analyze flag transitive geometries, such as block designs, hypermaps, generalized polygons. I shall explain some recent significant achievements in this direction, in which finite simple groups and their properties play crucial roles.

Smooth skew-morphisms of abelian groups

Young Soo Kwon, Yeungnam University

In this talk, we will consider smooth skew-morphisms of abelian groups. We will show that for an abelian 2-group G, every skew-morphism of G is smooth if and only if G is isomorphic to Z_2^m, $Z_2^m \times Z_4^n$ or $Z_2^m \times Z_8$. For other abelian 2-groups, we will construct non-smooth skew-morphisms of such groups. This is joint work with Istvan Kovács and Kan Hu.

Edge version of the inducibility

陆玫 (Mei Lu), 清华大学 (Tsinghua University)

The inducibility of a graph H is about the maximum number of induced copies of H in a graph on n vertices. We consider its edge version, that is, the maximum number of induced copies of H in a graph with m edges. Let $c(G, H)$ be the number of induced copies of H in G and $\rho(H, m) = \max\{c(G, H) \mid |E(G)| = m\}$. In this talk, I give our results of $\rho(H, m)$ when H is a cycle or path.

Localized and weighted versions of extremal problems

宁博 (Bo Ning), 南开大学 (Nankai University)

In this talk, we discuss various extensions of Turán-type problems, including localized, weighted, and their connections. First, we provide short and new proofs for recent theorems by Malec–Tompkins (EUJC, 2023) and Zhao–Zhang (JGT, 2025). We also give a short proof of a weighted localized Turán-type result for paths, which relies on the *Small Path Double Cover Conjecture*. Furthermore, we present localized versions of the Balister–Bollobás–Riordan–Schelp theorem on paths and the Erdős–Gallai theorem on matchings.

Our second focus is on local versions of spectral Turán theorems. We first show that for any graph G, $\lambda(G)^2 \leq 2 \sum_{e \in E(G)} \frac{\mathrm{cl}(e)-1}{\mathrm{cl}(e)}$, where $\mathrm{cl}(e)$ denotes the order of the largest clique containing edge e. We then extend this inequality to weighted graphs: $\lambda(G)^2 \leq 2 \sum_{e \in E(G)} \frac{\mathrm{cl}(e)-1}{\mathrm{cl}(e)} w(e)^2$. This main theorem leads to several new results, including two vertex-based andvertex-degree-based local Turán theorems, weighted generalizations of the Edwards–Elphick and Cvetković theorems, and two localized versions of Wilf's theorem. Notably, one of the localized Wilf-type results confirms a conjecture from probability and operator algebras, independently posed by R. Tripathi. Additionally, our theorem unifies and implies many earlier results from spectral andextremal graph theory.

References:

[1]Lele Liu, Bo Ning, Local properties of the spectral radius and Perron vector in graphs, J. Combin. Theory Ser. B 176 (2026), 241‑253.

[2]Binlong Li, Bo Ning, Localized and weighted versions of extremal problems, arXiv:2509.17055.

[3]Lele Liu, Bo Ning, A new spectral Turán theorem for weighted graphs and consequences, arXiv:2510.26410.

The spectra of covering simplicial complexes

范益政 (Yizheng Fan), 安徽大学 (Anhui University)

In this talk I will introduce some basic notions on simplicial complexes, including coverings and Laplacian operators. By the representation of permutation groups and incidence-signed complexes, we give a decomposition of the Laplacian operator of a covering complex in terms of the Laplacian operator of the underlying complex and other matrix forms. We prove the Laplacian spectrum of a 2-fold covering complex is the union of the Laplacian spectrum of the underlying complex and that of an incidence-signed complex, which generalizes a known result on the spectra of simple graphs.

A spectral counterpart of the problem of Erdős and Simonovits

彭岳建 (Yuejian Peng), 湖南大学 (Hunan University)

Erdős and Simonovits (1973) proposed the following problem: For an integer $r \geq 2$ and a family $\mathcal{F}$ of non-bipartite graphs, what is the maximum of minimum degree $\delta(G)$ among all n-vertex $\mathcal{F}$-free graphs G with chromatic number at least r? The spectral counterpart of this problem is to determine the maximum spectral radius $\lambda(G)$ among all n-vertex $\mathcal{F}$-free graphs G with chromatic number at least r. All previously known results are limited to the case $r \leq \chi(\mathcal{F})$, where $\chi(\mathcal{F})$ is defined as the minimum $\chi(F)$ over all $F \in \mathcal{F}$. In this paper, we give a solution to all $r \geq 3$ and $\mathcal{F} = \{C_{2k+1}\}$, where $2k \geq r$. Our result provides the first solution to the spectral extremal problem for $\mathcal{F}$-free graphs with high chromatic number. Let $T_{n,2}$ be an n-vertex complete bipartite graph whose part sizes are as equal as possible. A result of Zhai and Lin (2023) implies that if $n \geq 14k$ and G is an n-vertex C_{2k+1}-free graph, then $\lambda(G) \leq \lambda(T_{n,2})$, with equality if and only if $G = T_{n,2}$. Let $T_{n-r+1,2} \circ K_r$ be the graph obtained by identifying a vertex of K_r and a vertex of the smaller partite set of $T_{n-r+1,2}$. Guo, Lin and Zhao (2021), and Zhang and Zhao (2023) proved that for $k \geq 2$ and $n \geq 21$, or $k \geq 3$ and sufficiently large n, if G is a non-bipartite C_{2k+1}-free graph on n vertices, then $\lambda(G) \leq \lambda(T_{n-2,2} \circ K_3)$, with equality if and only if $G = T_{n-2,2} \circ K_3$. Extending the above result, we prove that if $r \geq 3$, $2k \geq r$, $n \geq 712k$, and G is an n-vertex C_{2k+1}-free graph with $\chi(G) \geq r$, then $\lambda(G) \leq \lambda(T_{n-r+1,2} \circ K_r)$, with equality if and only if $G = T_{n-r+1,2} \circ K_r$. This is a joint work with Zou Lantao and Li Yongtao.

Some progress on the determinants of tournaments

尤利华 (Lihua You), 华南师范大学 (South China Normal University)

The determinant of a tournament T is the determinant of the skew-adjacency of T. It is well-known that the determinant of a tournament T with n vertices is 0 if n is odd, and the square of an odd integer if n is even. For odd $k > 0$, the tournament set $\mathcal{D}_k$ consists of tournaments whose all subtournaments have determinant at most k^2. In 2000, Babai and Cameron [L. Babai, P.J. Cameron, Automorphisms and enumeration of switching classes of tournaments, The electronic journal of combinatorics, 7 (1) (2000) R38] proved that a tournament is switching equivalent to a transitive tournament if and only if it contains no diamonds, which implies $T \in \mathcal{D}_1$ if and only if T is switching equivalent to a transitive tournament. In 2023, Boussaïri et al. [A. Boussaïri, S. Ezzahir, S. Lakhlifi, S. Mahzoum, Skew-adjacency matrices of tournaments with bounded principal minors, Discrete Mathematics, 346 (10) (2023) 113552] characterized $\mathcal{D}_3$ as follows: $T \in \mathcal{D}_3$ if and only if T is switching equivalent to a transitive tournament or a transitive blowup of a diamond. The above results reveal interesting structural properties of tournaments in $\mathcal{D}_1$, $\mathcal{D}_3$. Naturally, we are motivated to further explore the relationship between the structural properties of tournaments and the determinants of their skew-adjacency matrices. In this talk, we introduce some progress on the determinants of tournaments and $\mathcal{D}_k$, propose some questions for further questions.

The matching polynomials of hypergraphs

汪毅 (Yi Wang), 安徽大学 (Anhui University)

To investigate the spectral radius of adjacency tensor of k-uniform hypertrees, Su, Kang, Li, and Shan introduced the matching polynomial of a k-uniform hypergraph . The maximum modulus of all zeros of the matching polynomial of a hypergraph is closely related to its second largest eigenvalue. In this talk, we will introduce some new results on the zeros of matching polynomials of hypergraphs.

有拟半正则自同构的有向图

路在平 (Zaiping Lu), 南开大学 (Nankai University)

非恒等置换称为是拟半正则的如果它有唯一一个稳定点并且在剩余点上具有等长的轨道。本报告介绍一类允许拟半正则自同构的局部本原弧传递有向图。这类有向图可归约到两类：一类是幂零群上的 Cayley 有向图，另一类是自同构群包含唯一极小正规子群的弧传递有向图。

Turán number of books in non-bipartite graph

刘瑞芳 (Ruifang Liu), 郑州大学 (Zhengzhou University)

Let $\mathrm{ex}(n, H)$ be the Turán number of H for a given graph H. A graph is color-critical if it contains an edge whose removal reduces its chromatic number. Simonovits' chromatic critical edge theorem states that if H is color-critical with $\chi(H) = k+1$, then there exists an $n_0(H)$ such that $\mathrm{ex}(n, H) = e(T_{n,k})$ and the Turán graph $T_{n,k}$ is the only extremal graph provided $n \geq n_0(H)$. A book graph B_{r+1} is a set of $r+1$ triangles with a common edge, where $r \geq 0$ is an integer. Note that B_{r+1} is a color-critical graph with $\chi(B_{r+1}) = 3$. Simonovits' theorem implies that $T_{n,2}$ is the only extremal graph for B_{r+1}-free graphs of sufficiently large order n. Furthermore, Edwards and independently Khadžiivanov and Nikiforov completely confirmed Erdős' booksize conjecture and obtained that $\mathrm{ex}(n, B_{r+1}) = e(T_{n,2})$ for $n \geq n_0(B_{r+1}) = 6r$. Note that the extremal graph $T_{n,2}$ is bipartite. Motivated by the above elegant results, we in this paper focus on the Turán problem of non-bipartite B_{r+1}-free graphs of order n. For $r = 0$, Erdős proved a nice result: If G is a non-bipartite triangle-free graph on n vertices, then $e(G) \leq \lfloor \frac{(n-1)^2}{4} \rfloor + 1$. For general $r \geq 1$, we determine the exact value of Turán number of B_{r+1} in non-bipartite graphs and characterize all extremal graphs provided n is sufficiently large.

3.2　1 月 27 日 (January 27)

On flag-transitive generalized quadrangles

冯涛 (Tao Feng), 浙江大学 (Zhejiang University)

Generalized polygons are spherical buildings of rank 2, and they include projective planes as a special case. The classification of flag-transtive generalized polygons is a long-standing problem, and Kantor conjectures that such quadrangles are classical except two sporadic examples. I will briefly summarize some recent progress on Kantor's conjecture and give an overview of the techniques involved.

Toughness in regular graphs from eigenvalues

束金龙 (Jinlong Shu), 上海师范大学 (Shanghai Normal University)

The toughness $\tau(G) = \min\{\frac{|S|}{c(G-S)} : S$ is a vertex cut in $G\}$ for $G \ncong K_n$, which was initially proposed by Chvátal in 1973. A graph G is called t-tough if $\tau(G) \geq t$. Let $\lambda_i(G)$ be the i-th largest eigenvalue of the adjacency matrix of a graph G. In 1996, Brouwer conjectured that $\tau(G) \geq \frac{d}{\lambda} - 1$ for a connected d-regular graph G, where $\lambda = \max\{|\lambda_2|, |\lambda_n|\}$. Gu [SIAM J. Discrete Math. 35 (2021) 948-952] completely confirmed this conjecture. From Brouwer and Gu's result $\tau(G) \geq \frac{d}{\lambda} - 1$, we know that if G is a connected d-regular graph and $\lambda \leq \frac{bd}{b+1}$, then $\tau(G) \geq \frac{1}{b}$ for an integer $b \geq 1$. Inspired by the above result and adopting typical spectral techniques and graph construction methods from Cioabă et al. [J. Combin. Theory Ser. B 99 (2009) 287-297], we prove that if G is a connected d-regular graph and $\lambda_2(G) < \phi(d, b)$, then $\tau(G) \geq \frac{1}{b}$. Meanwhile, we construct graphs implying that the upper bound on $\lambda_2(G)$ is best possible. Our theorem strengthens the result of Chen et al. [Discrete Math. 348 (2025) 114404]. Finally, we also prove an upper bound of $\lambda_{b+1}(G)$ to guarantee a connected d-regular graph to be $\frac{1}{b}$-tough.

On the existence of splitter sets

冯荣权 (Rongquan Feng), 北京大学 (Peking University)

In this talk, the existence of perfect splitter sets in finite cyclic groups is studied, motivated by their applications in coding theory for flash memory storage. By using cyclotomic polynomials we derive a general condition for the existence of such splittings under certain circumstances. We further give a necessary and sufficient condition for the existence of nonsingular perfect B[-1,5](q) splitter sets

On strongly regular signed graphs

侯耀平 (Yaoping Hou), 湖南师范大学 (Hunan Normal University)

The signed graph version of strongly regular graphs is introduced. All strongly regular signed graphs with small degrees are determined and some constructions of strongly regular signed graphs by Cayley signed graphs are given.

Extremal distance spectral radius of graphs with fixed size

周波 (Bo Zhou), 华南师范大学 (South China Normal University)

Let m be a positive integer. Brualdi and Hoffman proposed the problem to determine the (connected) graphs with maximum adjacency spectral radius in a given graph class and they posed a conjecture for the class of graphs with given size m. After partial results due to Friedland and Stanley, Rowlinson completely confirmed the conjecture. The distance spectral radius of a connected graph is the largest eigenvalue of its distance matrix. We investigate the problem to determine the connected graphs with minimum distance spectral radius in the class of graphs with size m. Given m, there is exactly one positive integer n such that $\binom{n-1}{2} < m \le \binom{n}{2}$. We establish some structural properties of the extremal graphs for all m and solve the problem for $\binom{n-1}{2} + \max\{\frac{n-6}{2}, 1\} \le m \le \binom{n}{2}$. By existing results and experiments, the graphs with maximum adjacency spectral radius happen to be the graphs with minimum distance spectral radius over many classes of graphs, including trees and graphs with given parameters such as order, connectivity, clique number, etc. However, this is not the case in the class of connected graphs with size m for $s < n - 2$, where $s = m - \binom{n-1}{2}$. This is joint work with Hongying Lin.

Recent progess on the Bollobás-Nikiforov conjecture

张晓东 (Xiaodong Zhang), 上海交通大学 (Shanghai Jiaotong University)

In 2007, Bollobás and Nikiforov proposed the following conjecture that for any non-complete graph G on $v_1, \ldots, v_n$ vertices with m edges and the clique number ω, the following inequality holds:

$$\lambda_1^2 + \lambda_2^2 \le \left(1 - \frac{1}{\omega}\right) 2m,$$

where λ_1 and λ_2 are the two largest eigenvalues of the $n \times n$ adjacency matrix $A(G) = (a_{ij})$ with $a_{ij} = 1$ if and only if v_i is adjacent to v_j. In this talk, we introduce some recent results and new methods. In particular, we prove that the conjecture holds for both line graphs and graphs with at most $\frac{\sqrt{6}}{27} m^{\frac{3}{2}}$ triangles, which extends and strengthens some known results.

A unified approach to some extremal graph problems

李书超 (Shuchao Li), 华中师范大学 (Central China Normal University)

In this talk we will introduce some results of ours to tackle some Turán-type problems, vertex-Turán-type problems, and edge-Turán-type problems in a unified approach, respectively. If time permits, we propose some further research issues along this line. This is a joint work with Guantao Chen, Xingyu Lei, Yuantian Yu, et al.

Extremal problems on Threshold graphs and Ferrers graph

龚世才 (Shicai Gong), 浙江科技大学 (Zhejiang University of Science and Technology)

In this report, we will introduce some extremal problems related to threshold graphs and Ferrers graphs, including several our results.

Stability of graph pairs

秦艳丽 (Yan-Li Qin), 首都经济贸易大学 (Capital University of Economics and Business)

A pair of graphs (Γ, Σ) is called unstable if their direct product $\Gamma \times \Sigma$ admits automorphisms not from $\mathrm{Aut}(\Gamma) \times \mathrm{Aut}(\Sigma)$, and such automorphisms are said to be unexpected. The stability of a graph Γ refers to that of (Γ, K_2). While the stability of individual graphs has been relatively well studied, much less is known for graph pairs. In this talk, I will present some of the latest developments and open problems on stability of graph pairs.

The classification of complete regular dessins with underlying graph $K_{p,n}$

范文文 (Wenwen Fan), 云南师范大学 (Yunnan Normal University)

A complete dessin is an orientable map with underlying graph being a complete bipartite graph, which is said to be regular if all edges are equivalent under the group of color- and orientation-preserving automorphisms. Regular dessins possess excellent geometric and algebraic properties, which have been involved in numerous interdisciplinary problems, including finite groups, Riemann surfaces, algebraic curves, and Galois theory, attracting significant attention in recent years. The classification problem of complete regular dessins was proposed as an open question by British mathematician Gareth Jones in 2007. In this talk, I will present the classification and enumeration results of regular dessins and regular circular dessins of $K_{p,n}$ with p a prime and $n \geq 2$ being an integer.

A new construction of vertex-primitive 2-arc-transitive digraphs

吴辞旋 (Cixuan Wu), 云南财经大学 (Yunnan University of Finance and Economics)

The existence of vertex-primitive 2-arc-transitive digraphs was a long-standing open problem. It remained unresolved until 2017, when Giudici, Li, and Xia discovered an infinite family associated with the action of $\mathrm{PSL}_3(q)$ on the cosets of A_6. Such objects appear to be extremely rare; indeed, no further examples have been found since then.

In this talk, we present two new infinite families of vertex-primitive 2-arc-transitive digraphs. These families admit $\mathrm{PSL}_3(p)$ (where $p \equiv 1, 4 \pmod{15}$) and $\mathrm{PSU}_3(p)$ (where $p \equiv 11, 14$

(mod 15)) as their automorphism groups, respectively, both having vertex stabilizers A_6. Furthermore, we show that these two new families, together with the original Giudici–Li–Xia family, share a uniform construction. We prove that these three families complete the classification of vertex-primitive 2-arc-transitive digraphs whose automorphism group is almost simple with socle $PSL_3(q)$ or $PSU_3(q)$.

Notably, we provide a number-theoretic criterion for their existence: such a digraph with automorphism group $PSL_3(p)$ or $PSU_3(p)$ exists if and only if the element $\sqrt{5} + \sqrt{-3}$ is a cube in the underlying field $\mathbb{F}_p$ or $\mathbb{F}_{p^2}$, respectively. This is joint work with Fu-Gang Yin.

3.3　1 月 28 日 (January 28)

Isomorphisms of m-Cayley digraphs

冯衍全 (Yan-Quan Feng), 北京交通大学 (Beijing Jiaotong University)

The isomorphism problem for digraphs is a fundamental problem in graph theory. This problem for Cayley digraphs has been extensively investigated over the last half a century. In this talk, we consider this problem for m-Cayley digraphs which are generalization of Cayley digraphs. Let m be a positive integer. A digraph admitting a group G of automorphisms acting semiregularly on its vertices with exactly m orbits is called an m-Cayley digraph of G (1-Cayley digraph is just the Cayley digraph). We characterize the normalizer of G in the full automorphism group of an m-Cayley digraph of a finite group G. This generalizes a similar result for Cayley digraph achieved by Godsil in 1981. Then we use this to study the isomorphisms of m-Cayley digraphs. The CI-property of a Cayley digraph (CI stands for 'Cayley isomorphism') and the DCI-groups (whose Cayley digraphs are all CI-digraphs) are two key topics in the study of isomorphisms of Cayley digraphs. We generalize these concepts into m-Cayley digraphs by defining mCI- and mPCI-digraphs, and correspondingly, mDCI- and mPDCI-groups. Analogues to Babai's criterion for CI-digraphs are given for mCI- and mPCI-digraphs, respectively. With these we classify finite mDCI-groups for each $m > 1$, and finite mPDCI-groups for each $m > 3$. Similar results are also obtained for m-Cayley graphs, and in particular, structural theorems are given for 2PCI-groups and K2PCI-groups.

Finite s-geodesic transitive graphs

靳伟 (Wei Jin), 湘潭大学 (Xiangtan University)

In a finite graph Γ, a geodesic from a vertex u to a vertex v is one of the shortest paths from u to v, and this geodesic is called an i-geodesic if the distance between u and v is i. The graph Γ is said to be s-geodesic transitive if the graph automorphism group is transitive on the set of s-geodesics. In this talk, I will survey the results of s-geodesic transitive graphs.

Constructions of covers for vertex-transitive graphs

陈继勇 (Jiyong Chen), 厦门大学 (Xiamen University)

Let Σ be a regular normal cover of a graph Γ with transformation group T. The cover Σ is said to be minimal if T is a minimal normal subgroup of the normalizer $N_{\mathrm{Aut}}(\Sigma)(T)$. In this talk, I will present new constructions of connected vertex-transitive minimal covers for arbitrary vertex-transitive graphs via coset graphs. This is joint work with Cai Heng Li, Ci Xuan Wu, and Yan Zhou Zhu.

Monodromy representation of graphs

袁凯 (Kai Yuan), 烟台大学 (Yantai University)

It is well-known that every vertex-transitive graph admits a representation as a coset graph. In this talk, we extend this construction by introducing monodromy graphs defined through double cosets. Our main result establishes that every connected graph is isomorphic to a monodromy graph, providing a new combinatorial framework for graph representation. Moreover, we show that every connected graph gives rise to an arc-transitive graph through its monodromy representation. As an application, we prove an enumeration theorem for orientable maps with a given monodromy group. This is a joint work with Yan Wang.

Large subgroups of almost simple groups and semisymmetric graphs of large valency

尹富纲 (Fu-Gang Yin), 北京交通大学 (Beijing Jiaotong University)

A proper subgroup H of a finite group G is called large if $|H|^3 \geq |G|$. A finite group G is almost simple if $T \leq G \leq \mathrm{Aut}(T)$ for some nonabelian simple group T. Alavi and Burness (JA, 2015) classified all large maximal subgroups of finite simple groups. Their classification has been widely applied in various areas, as it provides a relatively concise yet useful list of maximal subgroups of simple groups. Recently, we characterized the large maximal subgroups of almost simple classical groups. We then applied this result to characterize vertex-biprimitive semisymmetric graphs of large valency (where the valency is at least $1/4$ of the order of the graph) whose automorphism group is almost simple. In this talk, I will focus on two aspects: 1. Techniques for estimating the orders of maximal subgroups of almost simple classical groups; 2. A necessary condition for constructing semisymmetric graphs with large valency.

3.4 1 月 29 日 (January 29)

A new characterisation of the five types of locally finite arc-transitive maps

宋淑娇 (Shujiao Song), 烟台大学 (Yantai University)

An arc-regular map is said to be vertex-reversing if the stabiliser of a vertex is dihedral so that each of the non-central involution reverses the local orientation of the supporting surface surrounding the vertex, and such a map falls into two types, called reversing or bi-reversing, according to the action of an edge stabiliser. In this talk I will introduce two new algebraic constructions of vertex-reversing maps.

Precise classifications of edge-transitive graphs of given orders and small valencies

郭松涛 (Song-Tao Guo), 河南科技大学 (Henan University of Science and Technology)

A graph is edge-transitive if its automorphism group acts transitively on the set of edges of the graph. In this talk, we will primarily present some of our recent results concerning edge-transitive graphs of given orders and small valencies. Let p be a prime. We classify the hexavalent edge-transitive graphs of order $9p$ and $3p^2$, and then extend the classification of edge-transitive graphs of such orders to the 8-valent case. Especially, we obtain some infinite families of half-arc-transitive non-metacirculant or non-edge-regular graphs in this classification. Finally, we present a precise classification of tetravalent graphs admitting some non-abelian simple groups as an edge-transitive automorphism group.

Characterization of minimum restricted arc-cuts of unidirectional networks

化小会 (Xiaohui Hua), 河南师范大学 (Henan Normal University)

For a strongly connected digraph D, the restricted arc-connectivity $\lambda'(D)$ is defined as the minimum cardinality of an arc-cut over all arc-cuts F satisfying that $D - F$ has a non-trivial strong component D' such that $D - V(D')$ contains an arc. A restricted arc-cut F of D is called a minimum restricted arc-cut if $|F| = \lambda'(D)$. Super-λ and hyper-λ' properties of a digraph serves as an indicator of network reliability and can be quantified using the concept of restricted arc-connectivity. We show that unidirectional Cayley graphs generated by transposition trees $\overrightarrow{\Gamma}_n(S)$ is super-λ for all $n \geq 5$, and unidirectional hypercube $\overrightarrow{Q}_n$ is hyper-λ' for $n \geq 3$, and unidirectional star graph $\overrightarrow{S}_n$ is hyper-λ' for $n \geq 4$.

Enumerating regular graph coverings whose covering transformation groups are Z_p-extensions of a cyclic group

刘建兵 (Jianbing Liu), 北京交通大学 (Beijing Jiaotong University)

Enumerating the isomorphism or equivalence classes of several types of graph coverings is one of the central research topics in enumerative topological graph theory. For regular graph coverings, Kwak et. al. enumerated the isomorphism classes of graph coverings when the covering transformation group is a finite abelian or a dihedral. As a continuous work, we enumerate the isomorphism classes of coverings of a graph when the covering transformation groups are Z_p-extensions of a cyclic group for a prime integer p.

Saturatrion type problems for cycles

何臻 (Zhen He), 北京交通大学 (Beijing Jiaotong University)

The Turán-type problems for even cycles are of great importance. As the dual of Turán-type problems, the saturation number problem has many results concerning cycles. This talk focuses on cycle saturation problems relative to complete graphs, complete multipartite graphs, and within the framework of rainbow saturation.

3.5 1 月 30 日 (January 30)

Finite locally-quasiprimitive abelian Cayley graphs

娄本功 (Bengong Lou), 云南大学 (Yunnan University)

A graph Γ is called G-locally quasiprimitive if the stabiliser G_v acts quasiprimitively on the neighbourhood $\Gamma(v)$, where $G \leq \text{Aut}(\Gamma)$. In this talk, we introduces a classification of the locally-quasiprimitive Cayley graphs on abelian groups.

The classification of vertex-transitive elementary abelian and cyclic regular coverings of the complete bipartite graph $K_{3,3}$

凌波 (Bo Ling), 云南民族大学 (Yunnan Minzu University)

A regular covering of a connected graph is called an elementary abelian or cyclic regular covering if its covering transformation group is an elementary abelian group or a cyclic group, respectively. It is called vertex-transitive if its fiber-preserving group acts vertex-transitively on the covering graph. Feng and Kwak previously classified the arc-transitive elementary abelian and cyclic regular coverings of the complete bipartite graph $K_{3,3}$ in their studies of cubic symmetric graphs. In this talk, I will introduce the work we extend these results to the vertex-transitive setting by classifying the vertex-transitive elementary abelian and cyclic regular coverings of $K_{3,3}$. As a result, we construct several new infinite families of vertex-transitive cubic graphs.

The existence of m-Haar graphical representations

杜佳丽 (Jia-Li Du), 南京师范大学 (Nanjing Normal University)

Extending the well-studied concept of graphical regular representations to bipartite graphs, a Haar graphical representation (HGR) of a group G is a bipartite graph whose automorphism group is isomorphic to G and acts semiregularly with the orbits giving the bipartition. The question of which groups admit an HGR was inspired by a closely related question of Estélyi and Pisanski in 2016, as well as Babai's work in 1980 on poset representations, and has been recently solved by Morris and Spiga. In this talk we introduce the m-Haar graphical representation (m-HGR) as a natural generalization of HGR to m-partite graphs for $m \geq 2$, and some related work about semi-regular representations of finite groups.

Transitive groups of rank 3 and related topics

朱砚舟 (Yanzhou Zhu), 厦门大学 (Xiamen University)

The rank of a transitive group is defined as the number of orbits of its point stabilizer. Transitive groups of rank 2 are precisely the 2-transitive groups. While the classification of primitive rank 3 groups was completed in the 1980s, the classification of general rank 3 groups remains an open problem. We will introduce the recent progress on the classification of rank 3 groups with some related topics such as 3-orbit groups and 2-automorphic 2-groups. Applications in combinatorics and graph theory will also be discussed. This is a joint work with Cai Heng Li.

A characterization of tetravalent half-arc-transitive graphs of girth 5

周进鑫 (Jin-Xin Zhou), 北京交通大学 (Beijing Jiaotong University)

A graph is said to be *half-arc-transitive* if its automorphism group is transitive on the vertices and the edges of the graph but not on its arcs. Tetravalent half-arc-transitive graphs of girth 3 were characterized by Marušič and Xu in 1997, while those of girth 4 were characterized by Marušič and Nedela in 2002 and by Potočnik and Wilson in 2007. The investigation of tetravalent half-arc-transitive graphs of girth 5 was initiated by Antončič and Šparl in 2023. In this talk, I will discuss the characterization of all tetravalent half-arc-transitive graphs of girth 5. This is a joint work with Primož Šparl.

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