天元數學國際交流中心
Tianyuan Mathematics Research Center

# 图论与组合研讨会

# Symposium on Graph Theory and Combinatorics

# 会议手册

**召集人:**

陈旭瑾（中国科学院数学与系统科学研究院，研究员）

马杰（中国科学技术大学，教授）

王光辉（山东大学，教授）

云南·昆明　宜良柴石滩水库库区内

2025 年 10 月 19 日- 2025 年 10 月 25 日

# 图论与组合研讨会日程

（地点：华罗庚报告厅）

（每天下午 13:30-17:30，如无特殊安排可在各个小教室内进行小组讨论）

| 时间 | | 活动内容 | 主持人 |
|---|---|---|---|
| 10-19 | | 报到 | |
| 10-20 | 8:50-9:00 | 开幕式 | |
| | 9:00-9:50 | The maximal size and the stable result of $t$-intersecting multisets<br>曹梦雨（中国人民大学） | |
| | 9:50-10:40 | On the extremal problems for complete bipartite graph and its extensions<br>高国荣（福州大学） | |
| | 10:50-11:40 | Vertex degree sums for rainbow matchings in 3-uniform hypergraphs<br>张义（北京邮电大学） | |
| 10-21 | 9:00-9:50 | 4-cycle tilings in a digraph<br>马富红（山东理工大学） | |
| | 9:50-10:40 | Perfectly 2-edge-connected graphs and c-minor minimal 3-connected graphs<br>陶容川（香港大学） | |
| | 10:50-11:40 | Integral biflow maximization<br>杨梦溪（中国科学技术大学） | |
| 10-23 | 9:30-10:20 | Perfect tilings with the generalised triangle in $k$-graphs<br>张林朋（山东大学） | |
| | 10:30-11:20 | Ramsey-Turán density of Hypergraphs<br>江素云（江汉大学） | |

# 报告摘要与报告人简介

**1. 题目：**The maximal size and the stable result of t-intersecting multisets

**报告人：**曹梦雨（中国人民大学）

**报告摘要：**F is called an $m$-bounded multiset of $[n]$ (denoted by $F \subseteq [n]_m$), if F is a sequence $(m(1, F), m(2, F), \ldots, m(n, F)) \in \mathbf{R}_n$ of $n$ integers with $1 \leq m(i, F) \leq m$ for $1 \leq i \leq n$ (the $\infty$-bounded multiset of $[n]$ is abbreviated as multiset of $[n]$). $m(i, F)$ is the multiplicity of $i$ in F and $|F| = \sum_{i=1}^{n} m(i, F)$ is the cardinality of F. Using shifting (compression) operations and generating set method we gave the maximal size and a stable result of $t$-intersecting multisets. This is joint work with Mei Lu and Haixiang Zhang.

**报告人简介：**曹梦雨，中国人民大学副教授，2020年6月在北京师范大学取得理学博士学位。2020年9月至2022年9月在清华大学进行博士后研究工作。近五年研究兴趣主要为相交族问题及其应用，在 J. Combin. Theory Ser A，SIAM J. Discrete Math., European J. Combin. 等期刊发表 SCI 学术论文10余篇，主持青年基金一项。

**2. 题目：**On the extremal problems for complete bipartite graph and its extensions.

**报告人：**高国荣（福州大学）

**报告摘要：**It is well known that extremal problems for complete bipatite graph play an important role in extremal graph theory. In this talk, I will introduce some results and problems on complete bipartite graph and its extensions in hypergraphs, including our recent work.

**报告人简介：**高国荣，2021年博士毕业于福州大学(导师常安教授)，于2021至2023在中国科学技术大学任博士后研究员(合作导师马杰教授)，而后入职福州大学数学与统计学院. 主要研究图与超图极值问题，VC维理论，以及图与超图谱问题等，主持国家自然科学基金青年项目 1 项，主持福建省青年创新基金项目1项.

**3. 题目：**Ramsey-Turán density of Hypergraphs

**报告人：**江素云（江汉大学）

**报告摘要：**Let the Turán number $ex(n, F)$ be the maximum number of edges in an $n$-vertex $F$-free $r$-graph, and let the Ramsey-Turán number $RT(n, F, l)$ be the maximum number of edges in an $n$-vetex $F$-free $r$-graph $H$ with independence number $\alpha(H)< l$. In this talk, we investigate the relationship between the Turán density $\pi(F)$ and the Ramsey-Turán density $\varrho(F)$. We also provide sufficient conditions for $\varrho(F)=\pi(F)$ and $\varrho(F)=0$, respectively, and give some constructions based on high-dimensional complex spheres.

**报告人简介：**江素云，江汉大学人工智能学院助理研究员，2018年博士毕业于山东大学，2016年9月-2017年9月访问佐治亚州立大学，2022年11月至2024年8月访问韩国基础科学研究院，主持完成国家自然科学基金青年基金1项，主持湖北省自然科学基金一般面上1项。研究方向主要包括结构图论和极值图论，在Forum of Mathematics, Sigma, Journal of Combinatorial Theory, Series B, Journal of Graph Theory, Discrete Mathematics等期刊上发表论文十余篇。

**4. 题目：**4-cycle tilings in a digraph

**报告人：**马富红(山东理工大学)

**报告摘要：**For a positive integer t, a t-cycle is a cycle of length t. A tiling of a graph G is a set of disjoint subgraphs (called tiles) contained in G. A tiling is a factor, if its union spans G. The main purpose of this paper is to explore the minimum semi-degree condition to guarantee a directed 4-cycle factor in a digraph. To do this, we first need a structural result which shows that every standard multigraph on 4k vertices with minimum degree 16k/3 contains a tiling of size k-4 such that any orientation of every tile has a directed 4-cycle. The degree condition is sharp up to an additive constant. Then using the absorbing method and the above result, we show that every digraph of sufficiently large order with minimum semi-degree at least (2/3+\varepsilon)n contains a directed 4-cycle factor, where 0< \varepsilon< 1 and n\equiv0\pmod {4}.

**报告人简介：**马富红，山东理工大学数学与统计学院讲师，中国科学技术大学博士后，导师马杰，山东大学博士，导师颜谨、吴建良，主要研究方向为图与有向图中的圈问题，论文发表在JCTB, European J. Combin., Discrete Math., Electc. J. Combin等期刊，主持国家自然科学基金1项，山东省自然科学基金1项。

**5. 题目：**Perfectly 2-edge-connected graphs and c-minor minimal 3-connected graphs

**报告人：**陶容川（香港大学）

**报告摘要：**A perfectly 2-edge-connected (PTEC) graph is a graph G=(V,E) such that the polytope determined by linear inequalites $0 \leqslant x(e) \leqslant 1, \forall e \in E, x(\delta(S)) \geqslant 2, \forall S \subset V$ is integral. Related work on PTEC graphs has shown that a c-minor of a PTEC graph is PTEC, where a c-minor of a graph G is a graph obtained from G by repeatedly deleting an edge or contracting a cycle. We show that any 3-connected simple graph has a c-minor isomorphic to a wheel or K3,n, and it follows that any planar 3-connected graph is not PTEC.

**报告人简介：**香港大学博士，现为香港大学博士后，研究兴趣主要为组合优化，多面体组合，结构图论。

**6. 题目：**Integral biflow maximization

**报告人：**杨梦溪（中国科学技术大学）

**报告摘要：**Let $G=(V,E)$ be a graph with two sources $s_1, s_2$, two sinks $t_1, t_2$, and a non-negative integral capacity function $c$ on $E$. A biflow in $G$ is a collection of simple paths (repeats allowed) either from $s_1$ to $t_1$ or from $s_2$ to $t_2$ such that each edge $e \in E$ is used at most $c(e)$ times. In 1977 Seymour characterized, in terms of forbidden structures, all graphs $G$ for which the maximum value of an integral biflow is equal to the minimum capacity of a bicut for every capacity function $c$; such a graph $G$ is referred to as a Seymour graph. In this talk, we first characterize the global structure of Seymour graphs. Using the characterization, we give a combinatorial algorithm in polynomial time for finding maximum integral biflows in Seymour graphs. This is a joint work with Guoli Ding, Rongchuan Tao, and Wenan Zang.

**报告人简介：**杨梦溪，2024年博士毕业于香港大学，目前在中国科学技术大学从事博士后工作。研究方向为图论和组合优化，研究问题主要是组合优化中多面体的整性以及图上组合优化问题的算法设计。

**7. 题目：**Perfect tilings with the generalised triangle in $k$-graphs

**报告人：**张林朋（山东大学）

**报告摘要：**Denote by $T_k$ the generalised triangle, a $k$-uniform hypergraph on vertex set $\{1,2,\ldots,2k-1\}$ with three edges $\{1,\ldots,k-1,k\}, \{1,\ldots,k-1,k+1\}$ and $\{k,k+1,\ldots,2k-1\}$.

Recently, Bowtell, Kathapurkar, Morrison and Mycroft [arXiv: 2505.05606] established the exact minimum codegree threshold for perfect $T_3$-tilings in 3-graphs. In this paper, we extend their result to all $k \geq 3$, determining the optimal minimum codegree threshold for perfect $T_k$-tilings in $k$-graphs. Our proof uses the lattice-based absorption method, as is usual, but develops a unified and effective approach to build transferrals for all uniformities, which is of independent interest. Additionally, we establish an asymptotically tight minimum codegree threshold for a rainbow variant of the problem.

**报告人简介：**张林朋，山东大学博士后，合作导师为王光辉教授。2024年9月获得荷兰特文特大学博士学位，2025年3月获得西北工业大学博士学位，导师为Hajo Broersma教授和王力工教授。主要研究方向为超图中的极值问题，在Electron. J. Combin, Discrete Math.等期刊发表多篇文章。

**8. 题目：**Vertex degree sums for rainbow matchings in 3-uniform hypergraphs

**报告人：**张义（北京邮电大学）

**报告摘要：**Let n ∈ 3Z be sufficiently large. Zhang, Zhao and Lu proved that if $H$ is a 3-uniform hypergraph with $n$ vertices and no isolated vertices, and if $deg(u) + deg(v) > 2n^2/3 - 8n/3 + 2$ for any two vertices $u$ and $v$ that are contained in some edge of $H$, then $H$ admits a perfect matching. In this paper, we prove that the rainbow version of Zhang, Zhao and Lu's result is asymptotically true. More specifically, let $\delta > 0$ and $F_1, F_2, \ldots, F_{n/3}$ be 3-uniform hypergraphs on a common set of $n$ vertices. For each $i \in [n/3]$, suppose that $F_i$ has no isolated vertices and $deg_{F_i}(u) + deg_{F_i}(v) > (2/3 + \delta)n^2$ holds for any two vertices $u$ and $v$ that are contained in some edge of $F_i$. Then $\{F_1, F_2, \ldots, F_{n/3}\}$ admits a rainbow matching. Note that this result is asymptotically tight.

**报告人简介：**张义，北京邮电大学讲师，本科毕业于兰州大学，博士毕业于清华大学。2016-2017年访问佐治亚理工学院郁星星教授。2023-2024年访问新加坡国立大学黄浩教授。研究超图的结构性质。

主持过国家自然科学青年基金项目1项，中国博士后面上基金项目1项，参与2项国家自然科学基金面上项目，以第一作者或者通讯作者在SIAM Discrete Mathematics, Electronic Journal of Combinatorics等主要图论SCI杂志上发表论文10多篇。