



# 2023 年天元数学 Ramsey-Turan 以及相关图论问题 研讨会

## 会 议 程 序 册

福建 福州

2023 年 3 月 24 日--3 月 26 日

为了加强国内图论与组合数学学者之间的学术交流，促进同行之间学术研究水平的提升，福州大学数学与统计学院/离散数学研究中心于 2023 年 3 月 24 日-26 日在福州大学举办“2023 年天元数学 Ramsey-Turan 以及相关图论问题研讨会”。本次会议旨在就 Ramsey-Turan 以及相关图论前沿问题进行学术报告及交流讨论。议题围绕相关 Ramsey 问题、Turan 问题、Ramsey-Turan 问题、色临界图超饱和问题、彩虹团、谱极值等相关问题以及工业软件中的图论问题，邀请国内外知名专家学者就相关领域的热点前沿做学术报告，并进行学术交流。

**联合主办单位** 离散数学及其应用教育部重点实验室

福州大学数学与统计学院

福建省应用数学中心

**经费资助** 国家自然科学基金委员会

福州大学数学与统计学院

## 会议报到

地 址：福州梅园酒店（旗山店），福州市闽侯县国宾大道 350 号

（上街地铁站 A 出口）。

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## 研讨会日程

3 月 25 日（星期六）上午			
会议地点：梅园酒店 2 楼闽侯厅			
时间	报告题目	报告人	主持人
09:00-09:30	Supersaturation beyond color-critical graphs	马杰	常安
09:30-10:00	工业软件中的图论问题	张维熹	白铂
10:00-10:30	Ramsey number for nontrivial Berge cycle	聂家熹	刘西之
10:30-11:00	茶歇（拍照）		
11:00-11:30	Spanning trees in graphs without large bipartite holes	王光辉	鲁红亮
11:30-12:00	Rainbow Clique Subdivisions	汪彦	林启忠
午餐 12:00-14:00 地点：梅园酒店 F 楼全日制餐厅（全体参会老师和学生）			
3 月 25 日（星期六）下午：自由讨论。			
3 月 26 日（星期日）上午			
会议地点：梅园酒店 2 楼闽侯厅			
09:00-09:30	A Ramsey Type problem for highly connected subgraphs	吴河辉	侯建锋
09:30-10:00	Spectral Turan problem on bipartite /non-bipartite graphs	翟明清	宁博
10:00-10:30	Some extremal problems on t-intersecting hypergraphs	吴彪	史永堂
10:30-11:00	茶歇		
11:00-11:30	Clique-factors in graphs with sublinear-independence number	胡平	彭兴
11:30-12:00	Some exact results of the generalized Turan numbers	侯新民	李佳傲
午餐 12:00-14:00 地点：梅园酒店 F 楼全日制餐厅（全体参会老师和学生）			
3 月 26 日（星期日）下午：自由讨论。			

## 报告题目摘要及个人简介

报告题目: Some exact results of the generalized Turan numbers

报告人: 侯新民

报告摘要: For graphs  $H$  and  $F$  with chromatic number  $\chi(F)=k$ , we call  $H$  strictly  $F$ -Tur'an-good (or  $(H, F)$  strictly Tur'an-good) if the Tur'an graph  $T_{k-1}(n)$  is the unique  $F$ -free graph on  $n$  vertices containing the largest number of copies of  $H$  when  $n$  is large enough. Let  $F$  be a graph with chromatic number  $\chi(F)\geq 3$  and a color-critical edge and let  $P_\ell$  be a path with  $\ell$  vertices. Gerbner and Palmer (2020, arXiv:2006.03756) showed that  $(P_3, F)$  is strictly Tur'an good if  $\chi(F)\geq 4$  and they conjectured that (a) this result is true when  $\chi(F)=3$ , and, moreover, (b)  $(P_\ell, K_k)$  is Tur'an-good for every pair of integers  $\ell$  and  $k$ . In the present talk, we show that  $(H, F)$  is strictly Tur'an-good when  $H$  is a bipartite graph with matching number  $\nu(H)=\lfloor \frac{|V(H)|}{2} \rfloor$  and  $\chi(F)=3$ , as a corollary, this result confirms the conjecture (a); we also prove that  $(P_\ell, F)$  is strictly Tur'an-good for  $2\leq \ell\leq 6$  and  $\chi(F)\geq 4$ , this also confirms the conjecture (b) for  $2\leq \ell\leq 6$  and  $k\geq 4$ .

个人简介: 侯新民, 中国科学技术大学数学科学学院教授、博士生导师。感兴趣研究领域包括结构图论、极值图论、组合优化等, 已发表学术论文 60 余篇, 主持完成国家自然科学基金 4 项, 省部级项目 2 项。

报告题目: Clique-factors in graphs with sublinear  $\ell$ -independence number

报告人: 胡平

报告摘要: Given a graph  $G$  and an integer  $\ell \geq 2$ , we denote by  $\alpha_\ell(G)$  the maximum size of a  $K_\ell$ -free subset of vertices in  $V(G)$ . A recent question of Nenadov and Pehova asks for determining the best possible minimum degree conditions forcing clique-factors in  $n$ -vertex graphs  $G$  with  $\alpha_\ell(G) = o(n)$ , which can be seen as a Ramsey-Turán variant of the celebrated Hajnal-Szemerédi theorem. In this paper we find the asymptotical sharp minimum degree threshold for  $K_r$ -factors in  $n$ -vertex graphs  $G$  with  $\alpha_\ell(G) = n^{1-o(1)}$  for all  $r \geq \ell \geq 2$ .

报告人简介: 胡平, 中山大学副教授, 于 2014 年在美国伊利诺伊大学香槟分校获得数学博士学位, 之后在英国华威大学任研究员, 2017 年入职中山大学任副教授。其研究方向是极值组合, 主要包括 Ramsey 理论, Turan 理论及染色问题。

报告题目: Supersaturation beyond color-critical graphs

报告人: 马杰

报告摘要: A fundamental theorem of Rademacher from 1941 led to the study of supersaturation problems of graphs, which aim to count the minimum number of copies of a given graph  $F$  among all graphs with  $n$  vertices and  $m$  edges. This is closely related to a central concept in Extremal Graph Theory -- the Turán number of  $F$ , which denotes the maximum number of edges in an  $n$ -vertex graph which does not contain  $F$  as a subgraph. Famous results of Erdős, and Lovász and Simonovits determine the minimum number of cliques  $K_r$  in graphs whose number of edges exceed the Turán number of  $K_r$ . Subsequent works of Mubayi as well as Pikhurko and Yilma extend these classical results from cliques to color-critical graphs, a rich family playing important roles in extremal problems. In this talk, we will discuss supersaturation problems beyond color-critical graphs and investigate natural enumerative parameters.

Our results go beyond the previous results and show that supersaturation problems for general graphs can be rather complicate. Among others, we disprove a conjecture of Mubayi. Joint work with Long-Tu Yuan.

报告人简介: 马杰, 中国科技大学教授, 2011 年获得美国佐治亚理工学院数学学院博士学位, 师从郁星星教授。在此之前于 2007 年毕业于中国科技大学数学科学学院并获学士学位。曾是加州大学洛杉矶分校数学系的 Hedrik 助理教授, 卡内基梅隆大学数学科学系的博士后助理。SIAM J. Discrete Math. 编辑。入选国家“青年千人”计划, 2016 年获国家自然科学基金委优秀青年基金, 2021 年获国家杰出青年基金。2017 年获安徽省青年数学奖, 2018 年获教育部霍英东青年教师奖, 2018 年获中国工业与应用数学学会应用数学青年科技奖。

报告题目: Ramsey number for nontrivial Berge cycle。

报告人: 聂家熹

报告摘要: we consider an extension of cycle-complete graph Ramsey numbers to Berge cycles in hypergraphs: for  $k \geq 2$ , a {non-trivial Berge  $k$ -cycle} is a family of sets  $e_1, e_2, \dots, e_k$  such that  $e_1 \cap e_2, e_2 \cap e_3, \dots, e_k \cap e_1$  has a system of distinct representatives and  $e_1 \cap e_2 \cap \dots \cap e_k = \emptyset$ . In the case that all the sets  $e_i$  have size three, let  $\mathcal{B}_k$  denotes the family of all non-trivial Berge  $k$ -cycles. The Ramsey numbers  $R(t, \mathcal{B}_k)$  denote the minimum  $n$  such that every  $n$ -vertex 3-uniform hypergraph contains either a non-trivial Berge  $k$ -cycle or an independent set of size  $t$ . We prove  $R(t, \mathcal{B}_{2k}) \leq t^{1 + \frac{1}{2k-1} + \frac{4}{\sqrt{\log t}}}$  and moreover, we show that if a conjecture of Erdős and

Simonovits on girth in graphs is true, then this is tight up to a factor  $t^{o(1)}$  as  $t \rightarrow \infty$ .

报告人简介：聂家熹，复旦大学上海数学中心博士后。2022 年于加州大学圣地亚哥分校（University of California, San Diego）获得数学博士学位，导师为 Jacques Verstraëte。2016 年本科毕业于南开大学数学伯苓班。主要研究兴趣为极值组合，包括 Ramsey 问题，Turán 问题，图的分解问题等。目前，已在 Random Structures Algorithms, SIAM J. Discrete Math, J. Graph Theory, European J. Combin. 等期刊发表多篇论文。

报告题目：Spanning trees in graphs without large bipartite holes

报告人：王光辉

报告摘要：We show that for any  $\varepsilon > 0$  and  $\Delta \in \mathbb{N}$ , there exists  $\alpha > 0$  such that for sufficiently large  $n$ , every  $n$ -vertex graph  $G$  satisfying that  $\delta(G) \geq \varepsilon n$  and  $e(X, Y) > 0$  for every pair of disjoint vertex sets  $X, Y \subseteq V(G)$  of size  $\alpha n$  contains all spanning trees with maximum degree at most  $\Delta$ . This strengthens a result of Bottcher et al.

报告人简介：王光辉，山东大学数学学院教授、党委书记，主要从事组合数学基础理论及其在数据科学等领域的应用研究，在 J. London Mathematical Society、ACM-SIAM Symposium on Discrete Algorithms (SODA)、JCTB、J. Graph Theory、European J. Combin.、CPC 等期刊会议发表论文 40 余篇。主持负责国家自然科学基金四项，并承担国家自然科学基金重点项目子课题，获得了 2017 年山东省青年科技奖和 2018 年中国运筹学会青年科技奖。

报告题目：Rainbow Clique Subdivisions。

报告人：汪彦

报告摘要：In this talk, we show that for any integer  $t \geq 2$ , every properly edge colored  $n$ -vertex graph with average degree at least  $(\log n)^{2+o(1)}$  contains a rainbow subdivision of a complete graph of size  $t$ . Note that this bound is within a log factor of the lower bound. This also implies a result on the rainbow Turán number of cycles.

报告人简介：汪彦，上海交通大学数学科学学院的长聘副教授。2017 年博士毕业于美国佐治亚理工学院，师从国际著名图论专家郁星星教授。研究方向是图论，在 Journal of Combinatorial Theory, Series B, Journal of Graph Theory, SIAM Discrete Mathematics 等杂志发表论文。

报告题目：A Ramsey Type problem for highly connected subgraphs

报告人：吴河辉

报告摘要：Bollobas and Gyarfias conjectured that for any integers  $k, n$  with  $n > 4(k-1)$ , every 2-edge-coloring of the complete graph on  $n$  vertices leads to a  $k$ -connected monochromatic subgraph with at least  $n-2k+2$  vertices. We find a counterexample with  $n = \lfloor 5k - 2.5\sqrt{8k - \frac{31}{4}} \rfloor$ , thus disproving the conjecture, and we show the conclusion holds for  $n > 5k - 2.5\sqrt{8k - \frac{31}{4}}$  when  $k \geq 16$ . This is joint work Chunlok Lo and Qiqin Xie.

报告人简介：吴河辉，复旦大学上海数学中心青年研究员。2011 年在伊利诺伊大学获博士学位，师从 Douglas West 教授，2011 年至 2013 在 McGill 大学做博士后，指导教师是加拿大皇家院士 Bruce Reed 教授 2013-2014 在 Simon Fraser 大学任 PIMS 博士后，指导教师为 Bojan Mohar 教授。2014-2016 年任密西西比大学助理教授(Tenure Track)。2014 年入选“青年千人”计划，2019 年入选上海市教委曙光学者计划。主要研究结构图论与极值组合，在 JCTB, Combinatorica, Forum of Mathematics-Sigma, SODA 等高水平杂志或会议上发表多篇文章。现承担国家自然科学基金重点项目子项目 1 项。

报告题目：Some extremal problems on  $t$ -intersecting hypergraphs

报告人：吴彪

报告摘要：A hypergraph  $\mathcal{A} \subset 2^{[n]}$  is called  $t$ -intersecting if  $|A \cap B| \geq t$  for all  $A, B \in \mathcal{A}$ . Two hypergraphs  $\mathcal{A}, \mathcal{B} \subset 2^{[n]}$  are called cross  $t$ -intersecting if  $|A \cap B| \geq t$  for all  $A \in \mathcal{A}, B \in \mathcal{B}$ . In this talk, I will introduce some progress on the maximum product-size of two cross  $t$ -intersecting  $k$ -uniform hypergraphs, the third largest size of  $t$ -intersecting hypergraphs, and the maximum Lagrangian of  $t$ -intersecting (or  $t$  matching-free)  $k$ -uniform hypergraphs.

报告人简介：吴彪，湖南师范大学讲师，主要研究兴趣为超图的拉格朗日、Turán 等极值图论问题，论文(主要与导师彭岳建教授合作)发表期刊有 European Journal of Combinatorics, Science China Mathematics, Discrete Applied Mathematics, Graphs and Combinatorics, Journal of Combinatorial Designs, Acta Mathematica Sinica (English Series), Order 等，主持国家自然科学基金青年项目 1 项，湖南省自然科学基金青年项目 1 项。

报告题目: Spectral Turan problem on bipartite/non-bipartite graphs

报告人: 翟明清

报告摘要: Spectral extremal problem was firstly proposed by Brualdi and Solheid in 1986. In 2010, a combination of spectral extremal problem and  $Tur\{a\}$ -type problem was proposed by Nikiforov, who asked what is the maximum spectral radius of an  $n$ -vertex  $H$ -free graph? In the past decades, much attention has been paid to this spectral  $Tur\{a\}$  problem. Nice results were consecutively presented and spectral extremal techniques were greatly developed. In this talk, we give a survey of current progress on bipartite  $H$  and non-bipartite  $H$ , respectively. Finally, some questions are introduced for further research.

报告人简介: 翟明清, 滁州学院教授, 2010 年博士毕业于华东师范大学运筹学与控制论专业, 2012 年获评教授, 2013 年获评安徽省学术技术带头人后备人选, 2022 年入选安徽师范大学外聘博士生导师。近年来在 JCTB, LAA, DM, LMA, EUJC, EJC 等期刊发表学术论文 40 余篇, 主持国家自然科学基金 2 项。研究方向: 图谱理论, 谱极值图论。

报告题目: 工业软件中的图论问题

报告人: 张维熹

报告摘要: Graph theory and algorithms have widespread use in industry, as many problems naturally have a graph structure or can be transformed into graph-based models. They are utilized in fields such as graph databases, coding, communication, and electronic design automation (EDA). This topic presents our practical experience in solving industrial problems using graph theory and algorithms, and highlights some of the challenging problems encountered.

报告人简介: 张维熹, 2020 年毕业于北京大学数学科学学院, 获理学博士学位。现任华为中央研究院理论部理论研究员。