

# Michael Tait

NSF Postdoctoral Fellow

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## Employment

**NSF Postdoctoral Fellow**, Carnegie Mellon University Current  
Mentor: Po-Shen Loh

## Education

**Ph.D. Mathematics**, University of California, San Diego 2016  
Advisor: Jacques Verstraëte

Thesis: *Connections between graph theory, additive combinatorics, and finite incidence geometry*

**M.S. Mathematics**, University of Delaware 2011

Advisor: Sebastian Cioabă

Thesis: *The Alon-Saks-Seymour and Rank-Coloring Conjectures*

**B.S. Mathematics and Economics**, University of Delaware 2010

## Academic Awards

*NSF Postdoctoral Fellowship* 2016 – 2019.

*ARCS (Achievement Rewards for College Scientists) Scholarship*: “The ARCS competitive scholarship rewards excellence in research. Selection is based primarily on the exceptional promise of the nominee to make a significant contribution to the advancement of science, and to the material and intellectual welfare of all people.”—from the ARCS website. 2014-2015

*David A. Sharp Academic Excellence Award for Men’s Track/Cross-Country*, 2011

*Clarks Award*: Presented only when a senior majoring in mathematics has unusual ability in the area, 2010

*Stephen J. Wolfe Memorial Scholarship*: Awarded to a student entering the senior year majoring in mathematics who has demonstrated both love and talent for the subject, 2009

*ESPN The Magazine Academic All-American Nominee*, 2009

## Teaching Experience

Instructor of Record				
Course			Term	
Carnegie Mellon University	Math 301	Combinatorics	Fall	2018
Carnegie Mellon University	Math 599	Undergraduate Reading and Research	Spring	2018
Carnegie Mellon University	Math 292	Operations Research 1	Spring	2018
Carnegie Mellon University	Math 301	Combinatorics	Fall	2017
UC San Diego	Math 10B	Calculus II	Summer	2015
University of San Diego	Math 150	Calculus 1	Fall	2012
San Diego Mesa Community College	Math 116	College Algebra	Spring	2012

Teaching Assistant				
Course			Term	
UC San Diego	Math 121B	Fundamentals of Math Teaching and Learning II	Spring	2016
UC San Diego	Math 121A	Fundamentals of Math Teaching and Learning I	Winter	2016
UC San Diego	Math 154A	Combinatorics	Spring	2015
UC San Diego	Math 20B	Calculus II	Fall	2014
UC San Diego	Math 20A	Calculus I	Fall	2013
UC San Diego	Math 142A	Real Analysis I	Summer	2013
UC San Diego	Math 183	Statistical Methods	Winter	2013
UC San Diego	Math 20C	Calculus III	Fall	2012
UC San Diego	Math 10A	Calculus I	Fall	2011
University of Delaware	Math 242	Calculus II	Spring	2011
University of Delaware	Math 241	Calculus I	Fall	2010

### Student Mentoring

**Supervision of graduate research:** *Graduate Research Workshop in Combinatorics, Summer 2017.*

I was a postdoc mentor at the GRWC in 2017. This workshop brings together about 40 graduate students with about 15 faculty and postdocs for a 2-week intensive problem solving workshop. Throughout the workshop, the faculty and postdocs provide guidance on research, navigating graduate school and the academic job search, and other topics to the graduate students.

### Supervision of undergraduate research:

- *Wake Forest University, Summer and Fall 2018:* Robert Won and I supervised Alice Huang, an undergraduate at Wake Forest University. We studied Sidon sets in vector spaces over finite fields and their relationship to a geometric notion called a “cap”. From this work, we submitted a **manuscript** to *Involve*.
- *Summer Undergraduate Research Fellowships, Carnegie Mellon University, Summer 2018:* The undergraduate research office at CMU awards grants for undergraduates to do summer research. I supervised Sunny He through this program. The program is competitive and Sunny needed to write a strong grant proposal in order to win the grant. During the summer, Sunny and I worked on a problem in hypergraph Turán theory. From this work, we submitted a **manuscript** to the *SIAM Journal on Discrete Math*.
- *Undergraduate Reading and Research Course, Carnegie Mellon University, Spring 2018:* I supervised Hannah Mahon in a reading course that she took for credit in the Spring 2018 semester. We worked on a problem in hypergraph Ramsey theory, and are currently preparing a manuscript to submit for publication.
- *Summer Undergraduate Applied Mathematics Institute, Carnegie Mellon University, Summer 2017 and Summer 2018:* In the summers of 2017 and 2018, I helped to mentor the graph theory project at SUAMI, the REU that is run at CMU. In 2017, Jessica De Silva, Michael Young, and I mentored three bright undergraduates on an Anti-Ramsey problem in extremal graph theory. Based on the results proved during the summer, we wrote a **paper** which is to appear in *The Australasian Journal of Combinatorics*. In 2018, Juergen Kritschgau, Michael Young, and I mentored three other bright undergraduates on an Anti-Ramsey problem in combinatorial number theory, and from this work we submitted a **manuscript** to *Integers* which is currently under peer review.
- *Carnegie Mellon University, Spring and Summer 2017:* I worked with two talented undergraduates who were taking a graduate course in random graphs. We proved some theorems about the threshold

for a random graph to contain a spanning planar subgraph of fixed girth with the maximum possible number of edges and published [a paper](#) in *The Electronic Journal of Combinatorics*. Manuel presented our work at the Midwest Graph Theory Conference in October 2017.

- *Sacramento State University, Summer 2016*: Craig Timmons and I supervised Vladislav Taranchuk, an undergraduate at Sacramento State who was supported through a SURE grant from the College of Natural Sciences and Mathematics at CSUS. This summer research culminated in [a paper](#) that Vlad published in *Discussiones Mathematicae Graph Theory*.
- *GULP, University of California, San Diego, Winter 2015*: Robert Won and I held weekly research meetings with four undergraduate researchers through the Graduate-Undergraduate Learning Program, a UCSD program which pairs undergraduates and graduate students together to show the undergraduates what doing research is like.

## Publications

### Submitted Preprints

- (34) Jürgen Krietschgau, Abhishek Methuku, Michael Tait, and Craig Timmons, Few  $T$  copies in  $H$ -saturated graphs.
- (33) Yixuan Huang<sup>1</sup>, Michael Tait, and Robert Won, Sidon sets and 2-caps in  $\mathbb{F}_3^n$ .
- (32) Erin Bevilacqua<sup>1</sup>, Sam King<sup>1</sup>, Jürgen Krietschgau, Michael Tait, Suzannah Tebon<sup>1</sup>, and Michael Young, Rainbow numbers for  $x_1 + x_2 = kx_3$  in  $\mathbb{Z}_n$
- (31) Sunny He<sup>1</sup> and Michael Tait, Hypergraphs with few Berge paths of fixed length between vertices.
- (30) Boris Bukh and Michael Tait, On the Turán number for theta graphs.
- (29) Michael Tait and Craig Timmons, The Zarankiewicz problem in 3-partite graphs.
- (28) Sean English, Dániel Gerbner, Abhishek Methuku, and Michael Tait, Linearity of Saturation for Berge Hypergraphs.
- (27) Michael Ferrara, Daniel Johnston, Sarah Loeb, Florian Pfender, Alex Schulte, Heather C. Smith, Eric Sullivan, Michael Tait, and Casey Tompkins, On Edge-Colored Saturation Problems.
- (26) Michael Tait, The Colin de Verdière parameter, excluded minors, and the spectral radius.

### Publications

- (25) Jessica De Silva, Xiang Si<sup>1</sup>, Michael Tait, Yunus Tuncbilek<sup>1</sup>, Ruifan Yang<sup>1</sup>, and Michael Young, Anti-Ramsey Multiplicities, to appear in *The Australasian Journal of Combinatorics*.
- (24) Vladimir Nikiforov, Michael Tait, and Craig Timmons, Degenerate Turán problems for hereditary properties, to appear in *The Electronic Journal of Combinatorics*.
- (23) Michael Tait, On a problem of Neumann, to appear in *Discrete Mathematics special issue on Algebraic and Extremal Graph Theory*.
- (22) Cory Palmer, Michael Tait, Craig Timmons, and Adam Wagner, Turán numbers for Berge-hypergraphs and related extremal problems, to appear in *Discrete Mathematics*.
- (21) Sinan G. Aksoy, Fan Chung, Michael Tait, and Josh Tobin, The maximum relaxation time of a random walk, *Advances in Applied Mathematics*, Volume 101, 1–14, (2018).
- (20) Manuel Fernández<sup>1</sup>, Nicholas Sieger<sup>1</sup>, and Michael Tait, Maximal planar subgraphs of fixed girth in random graphs, *The Electronic Journal of Combinatorics*, 25.2, P2.45, (2018).
- (19) Michael Tait and Josh Tobin, Characterizing graphs of maximum principal ratio, *Electronic Journal of Linear Algebra*, 34.1, 61–70, (2018).

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<sup>1</sup>Undergraduate coauthor

- (18) Thang Pham, Michael Tait, Le Anh Vinh, and Robert Won, A structure theorem for product sets in extra special groups, *Journal of Number Theory*, 184, 461–472, (2018).
- (17) Po-Shen Loh, Michael Tait, Craig Timmons, and Rodrigo Zhou, Induced Turán numbers, *Combinatorics, Probability and Computing*, 27.2, 274–288, (2018).
- (16) Ghodrattollah Aalipour, Aida Abiad, Zhanar Berikkyzy, Leslie Hogben, Franklin H. J. Kenter, Jephian C.-H. Lin, Michael Tait. Proof of a conjecture of Graham and Lovász concerning unimodality of coefficients of the distance characteristic polynomial of a tree. To appear in *The Electronic Journal of Linear Algebra*.
- (15) Michael Tait. Degree Ramsey numbers of even cycles, *Discrete Mathematics*, 34(1), 104–108, (2017).
- (14) Michael Tait and Josh Tobin, Three conjectures in extremal spectral graph theory, *Journal of Combinatorial Theory Series B*, 126, 137–161, (2017).
- (13) Thang Pham, Michael Tait, Craig Timmons, and Le Anh Vinh. A Szemerédi-Trotter type theorem, sum-product estimates in finite quasifields, and related results, *Journal of Combinatorial Theory Series A*, 147, 55–74, (2017).
- (12) Aida Abiad, Sebastian Cioabă, and Michael Tait, Spectral upper bounds for the  $k$ -independence number, *Linear Algebra and its Applications*, 510, 160–170, (2016).
- (11) Michael Tait and Craig Timmons, Independent sets in polarity graphs, *SIAM Journal on Discrete Mathematics*, 30 (4), 2115–2129 (2016).
- (10) Michael Tait and Craig Timmons, Orthogonal polarity graphs and Sidon sets, *Journal of Graph Theory* 82 (1), 103–116, (2016)
- (9) Jessica De Silva, Theodore Molla, Florian Pfender, Troy Retter, and Michael Tait. Increasing paths in edge-ordered graphs: the hypercube and random graphs. *The Electronic Journal of Combinatorics*, Volume 23, Issue 2, P2.15, 1–9, (2016).
- (8) Godratollah Aalipour, Aida Abiad, Zhanar Berikkyzy, Jay Cummings, Jessica De Silva, Wei Gao, Kristin Heysse, Leslie Hogben, Franklin H.J. Kenter, Jephian C.-H. Lin, Michael Tait. On the distance spectra of graphs. *Linear Algebra and its Applications*, Volume 497 Issue 15, 66–87, (2016).
- (7) Michael Tait and Jacques Verstraëte. On sets of integers with restrictions on their products. *European Journal of Combinatorics* 51, 268 – 274, (2016).
- (6) Michael Tait and Craig Timmons. Small dense subgraphs of polarity graphs and the extremal number for the 4-cycle. *The Australasian Journal of Combinatorics*, Volume 63 (1), 107–114, (2015).
- (5) Xing Peng, Michael Tait, and Craig Timmons. On the chromatic number of the Erdős-Rényi orthogonal polarity graph. *The Electronic Journal of Combinatorics*, P2.21, 1–19, (2015).
- (4) Bob Chen, Jeong Han Kim, Michael Tait, and Jacques Verstraëte. On Coupon Colorings of Graphs, *Discrete Applied Mathematics* 193, 94 – 101, (2015).
- (3) Michael Tait and Craig Timmons. Sidon sets and graphs without 4-cycles. *Journal of Combinatorics*, Volume 5, Issue 2, 155 –165 (2014).
- (2) Sebastian M. Cioabă and Michael Tait. Variations on a theme of Graham and Pollak, *Discrete Mathematics*, Volume 313, Issue 5, 665 – 676, (2013).
- (1) Sebastian M. Cioabă and Michael Tait. More Counterexamples to the Alon-Saks-Seymour Conjecture and the Rank-Coloring Conjecture. *The Electronic Journal of Combinatorics*, P26, 1–9, (2011).

### Selected Talks

Villanova University Colloquium, November 2018

Colloquium: *Algebraic methods in extremal graph theory*

Discrete Mathematics Seminar, University of Rhode Island, October 2018

Seminar Talk: *Using random polynomials in extremal graph theory*

Combinatorics Seminar, Dartmouth College, October 2018

Seminar Talk: *8 theorems in extremal spectral graph theory*

AMS Fall Central Sectional, University of Michigan, October 2018

Invited Talk: *Using random polynomials in extremal graph theory*

AMS Fall Eastern Sectional, University of Delaware, September 2018

Invited Talk: *The Zarankiewicz problem in 3-partite graphs*

Summer Undergraduate Institute for Applied Mathematics, Carnegie Mellon University, July 2018

REU Panel: *The research process*

SIAM DM 18, Denver, June 2018

Invited Talk: *Edge colored saturation problems*

Combinatorics Seminar, UC San Diego, May 2018

Seminar Talk: *On the Turán number of theta graphs*

ICOMAS 2018, University of Memphis, May 2018

Special Session Talk: *8 theorems in extremal spectral graph theory*

Discrete Mathematics Seminar, University of Delaware, May 2018

Seminar Talk: *On the Turán number of theta graphs*

CAGE: Philadelphia Area Combinatorics and Algebraic Geometry Seminar, May 2018

Seminar Talk: *Using random polynomials in extremal graph theory*

AMS Spring Central Sectional, Ohio State University, March 2018

Invited Talk: *Sets of integers with restrictions on their products*

2018 Joint Math Meetings, San Diego California, January 2018

Special Session on Emerging Topics in Graphs and Matrices: *7 theorems in extremal spectral graph theory*

2018 Joint Math Meetings, San Diego California, January 2018

Special Session on Connections in Discrete Mathematics: Graphs, Hypergraphs, and Designs: *Applications of projective plane graphs in combinatorial number theory*

2017 CMS Winter Meeting, University of Waterloo, December 2017

Invited Session Talk: *7 theorems in extremal spectral graph theory.*

Combinatorics, Algebra, and Topology Seminar, US Naval Academy, November 2017

Seminar Talk: *Applications of graph theory in combinatorial number theory.*

VCU Discrete Mathematics Seminar, Virginia Commonwealth University, October 2017

Seminar Talk: *7 theorems in extremal spectral graph theory.*

MIT Combinatorics Seminar, Massachusetts Institute of Technology, October 2017

Seminar Talk: *7 theorems in extremal spectral graph theory.*

AMS Fall Eastern Sectional Meeting, SUNY Buffalo, September 2017.

Invited Talk: *Degree Ramsey numbers for even cycles.*

Algebraic and Extremal Graph Theory: a conference in honor of Willem Haemers, Felix Lazebnik, and Andrew Woldar, University of Delaware, August 2017.

Invited Talk: *Degree Ramsey numbers for even cycles.*

ILAS 2017: Connections, Ames IA, July 2017.

Invited Special Session Talk: *The spectral radius of graphs with no induced  $K_{s,t}$ .*

New York Combinatorics Seminar, CUNY graduate center, May 2017.

Seminar Talk: *7 Theorems in extremal spectral graph theory.*

Bi-Co Math Colloquium, Bryn Mawr College, April 2017.

Colloquium: *Applications of finite geometry in extremal combinatorics.*

Princeton Discrete Mathematics Seminar, Princeton University, March 2017.

Seminar Talk: *Four conjectures in extremal spectral graph theory.*

Rutgers Discrete Math Seminar, Rutgers University, November 2016.

Seminar Talk: *Four conjectures in extremal spectral graph theory.*

Discrete Math Seminar, University of Nebraska-Lincoln, November 2016.

Seminar Talk: *Four conjectures in extremal spectral graph theory.*

ISU Discrete Mathematics Seminar, Iowa State University, November 2016.

Seminar Talk: *Four conjectures in extremal spectral graph theory.*

AMS Fall Central Sectional Meeting, University of St. Thomas, October 2016.

Invited Talk: *Four conjectures in extremal spectral graph theory.*

Atlanta Lecture Series in Combinatorics and Graph Theory XVIII, Emory University, October 2016.

Invited Talk: *Induced Turán numbers.*

AMS Fall Western Sectional Meeting, University of Denver, October 2016.

Invited Talk: *Four conjectures in extremal spectral graph theory.*

AMS Fall Western Sectional Meeting, University of Denver, October 2016.

Invited Talk: *Polarity graphs coming from planar polynomials.*

Discrete Math Seminar, University of Delaware, September 2016.

Seminar Talk: *Four conjectures in extremal spectral graph theory.*

Final Defense, University of California, San Diego, April 2016.

Defense: *Connections between graph theory, additive combinatorics, and finite incidence geometry.*

UVM Mathematics Colloquium, University of Vermont, February 2016.

Colloquium: *Connections between graph theory and combinatorial number theory.*

Joint Math Meetings, AMS Special Session on Research from the 2014 and 2015 Rocky Mountain-Great Plains Graduate Workshop in Combinatorics, I. Seattle, WA, January 2016.

Special Session Talk: *Increasing paths in edge-ordered graphs.*

Discrete Seminar, University of Colorado Denver, October 2015.

Seminar Talk: *Some results on polarity graphs.*

Discrete Math Seminar, University of Delaware, September 2015.

Seminar Talk: *Graphs coming from projective planes.*

Combinatorics and its Applications, Miami University of Ohio, September 2015.

Contributed Talk: *Sum-product estimates in finite quasifields.*

Algorithms, Combinatorics and Optimization Seminar, Carnegie Mellon University, September 2015.

Seminar Talk: *Some results on polarity graphs.*

Connections in Discrete Mathematics: A celebration of the work of Ron Graham, Simon Fraser University, June 2015.

Contributed Talk: *Polarity graphs with many edges.*

Rocky Mountain Algebraic Combinatorics Seminar, Colorado State University Fort Collins, April 2015.

Seminar Talk: *Recent results on polarity graphs.*

Combinatorics Seminar, Emory University, November 2014.

Seminar Talk: *Distinct edge weights on graphs.*

Conference on Graph Theory, Matrix Theory and Interactions, Queen's University, June 2014.

Contributed Talk: *Coupon colorings of regular graphs.*

Modern Trends in Algebraic Graph Theory, Villanova University, PA, June 2014.

Contributed Talk: *Orthogonal polarity graphs and Sidon sets.*

Lake Arrowhead Combinatorics Reunion Conference, Lake Arrowhead, CA, June 2012.

Contributed Talk: *Generalizations of the Graham-Pollak Theorem*

Student Summer Combinatorics Seminar, University of Delaware, August 2011.

Seminar Talk: *On  $L$ -biclique coverings of  $K_n$*

Master's Thesis Defense, University of Delaware, April 2011.

Defense: *The Alon-Saks-Seymour and Rank-Coloring Conjectures*

Hallenbeck Graduate Student Seminar, University of Delaware, March 2011.

Seminar Talk: *Decomposing the complete  $r$ -uniform Hypergraph*

Discrete Math Seminar, University of Delaware, September 2010.

Seminar Talk: *More counterexamples to the Alon-Saks-Seymour Conjecture*

## Academic Service

Carnegie Mellon University ACO seminar organizer, 2017-2018.

*Women and Mathematics at CMU:* with Jessica De Silva, I organized a conference at CMU designed to build support and outreach networks for women in math across the country. This conference was supported by a grant that we won from the Woman and Mathematics Ambassador Program through the Institute for Advanced Study. The conference took place at Carnegie Mellon University on April 14, 2018.

SIAM DM minisymposium organizer: I organized a minisymposium (Linear algebra methods in combinatorics) at SIAM DM18, June 4-8 2018 in Denver.

AMS Special Session organizer: I organized a special session (Extremal graph theory and quantum walks on graphs) at the AMS Spring Eastern Sectional Meeting, April 21-22 2018 at Northeastern University.

Co-organizer of the Food For Thought Seminar: I was an organizer for weekly seminars given by graduate students at UCSD. I obtained a grant from the university that funded the 2015 Spring quarter.

I have refereed manuscripts for the following journals:

*Ars Combinatoria*

*Combinatorica*



*Designs, Codes and Cryptography*  
*Discrete Applied Mathematics*  
*Discrete Mathematics*  
*The Electronic Journal of Combinatorics*  
*Electronic Journal of Linear Algebra*  
*European Journal of Combinatorics*  
*Graphs and Combinatorics*  
*Journal of Combinatorial Theory, Series A*  
*Journal of Combinatorial Theory Series B*  
*Journal of Combinatorics*  
*Linear Algebra and its Applications*  
*Linear and Multilinear Algebra*  
*SIAM Journal on Discrete Mathematics*

I am a reviewer for Mathematical Reviews.

## References

**Professor Fan Chung**, University of California, San Diego  
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