Hanmeng (Harmony) Zhan

CONTACT INFORMATION

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RESEARCH INTERESTS

Algebraic Graph theory, Quantum Walks, Orthogonal Polynomials, Quantum Information, Equiangular Lines

CURRENT POSITION

Department of Mathematics and Statistics, York University, Toronto, ON, Canada

- York Science Fellow — Oct 2019, - Present
  Supervisor: Ada Chan

PREVIOUS POSITIONS

Centre de Recherches Mathématiques, Université de Montréal, Montréal, QC, Canada

- Postdoctoral Fellow — Oct 2018 - Sep 2018
  Supervisor: Luc Vinet

EDUCATION

University of Waterloo, Waterloo, ON, Canada

- Ph.D. — May 2014 - Sept 2018
  Department of Combinatorics and Optimization, Faculty of Mathematics
  Thesis: *Discrete Quantum Walks on Graphs and Digraphs*
  Supervisor: Chris Godsil
- Master of Mathematics — Sep 2012 - Apr 2014
  Department of Combinatorics and Optimization, Faculty of Mathematics
  Thesis: *Uniform Mixing on Cayley Graphs over* $\mathbb{Z}_3^d$
  Supervisor: Chris Godsil
- Bachelor of Arts — Jan 2010 - Aug 2012
  Department of Economics, Faculty of Arts
  Thesis: *Second-Price Auction with Resale*
  Supervisor: Philip Curry

Xiamen University, Xiamen, Fujian, China

- Bachelor of Economics — Sep 2008 - Jun 2014
  Department of Statistics, Faculty of Economics
  Thesis: *Multi-Player Multi-State Quantum Games*
  Supervisor: Zhengming Qian

PUBLICATIONS

Journal Publications

1. G. Coutinho, L. Vinet, H. Zhan, A. Zhedanov. *Perfect state transfer in a spin chain without mirror symmetry.* arXiv:1903.04707 (2019). To appear in Journal of Physics A: Mathematical and Theoretical.
2. C. Godsil, H. Zhan, *Discrete-time quantum walks and graph structures.* Journal of Combinatorial Theory, Series A (2019), 181212, doi:10.1016/j.jcta.2019.05.003.

3. A. Chan, G. Coutinho, C. Tamon, L. Vinet, H. Zhan, *Quantum fractional revival on graphs.* Discrete Applied Mathematics (2019), doi.org/10.1016/j.dam.2018.12.017.

4. G. Coutinho, C. Godsil, K. Guo, H. Zhan, *A new perspective on the average mixing matrix.* Electronic Journal of Combinatorics (2018) 25(4): P4.14.

5. C. Godsil, H. Zhan, *Uniform mixing on Cayley graphs.* Electronic Journal of Combinatorics (2017) 24(3): P3.20.

6. G. Coutinho, C. Godsil, M. Shirazi, H. Zhan, *Equiangular lines and covers of the complete graph.* Linear Algebra and its Applications (2016) 488: 264-283.

7. R. Alvir, S. Dever, B. Lovitz, J. Myer, C. Tamon, Y. Xu, H. Zhan. *Perfect state transfer in Laplacian quantum walk.* Journal of Algebraic Combinatorics (2016) 43(4): 801-826.

Preprints

8. A. Chan, G. Coutinho, C. Tamon, L. Vinet, H. Zhan, *Fractional revival and association schemes.* arXiv:1907.04729 (2019). Submitted.

9. L. Vinet, H. Zhan, *Perfect state transfer on weighted graphs of the Johnson scheme.* arXiv:1904.08838 (2019).

10. H. Zhan, *Quantum walks on embeddings.* arXiv:1711.08831 (2017). Submitted.

11. H. Zhan, *An infinite family of circulant graphs with perfect state transfer in discrete quantum walks.* arXiv:1707.06703 (2017). Submitted.

Book in Preparation

12. C. Godsil, H. Zhan, *Discrete Quantum Walks.*

Presentations

Invited Talks

1. *State transfer via orthogonal polynomials.* In: AMS Sectional Meeting, University of Wisconsin-Madison, Madison, WI, United States, September 14 - 15, 2019.

2. *Quantum state transfer in the algebra of the Johnson scheme.* In: CMS Summer Meeting, University of Regina, Regina, SK, Canada, June 7 - 10, 2019.

3. *Some elegant results in algebraic graph theory.* In: Canadian Discrete and Algorithmic Mathematics Conference, Simon Frase University, Vancouver, BC, Canada, May 28 - 31, 2019.

4. *Quantum walks, orthogonal polynomials, and spectral graph theory.* In: Quantum Walks and Information Tasks, Banff International Research Station for Mathematical Innovation and Discovery, Banff, AB, Canada, April 21 - 26, 2019.

5. *Generating entanglement using quantum walks.* In: David A. Walsh Seminar Series, Clarkson University, Potsdam, NY, United States, February 8, 2019.

6. *Some open problems in discrete quantum walks.* In: Algebraic Graph Theory and Quantum Walks, University of Waterloo, Waterloo, ON, Canada, April 23 - 27, 2018.

7. *Recent progress in discrete quantum walks.* In: AMS Sectional Meeting, Northeastern University, Boston, MA, United States, April 21 - 22, 2018, 2018.

8. *Graph covers and equiangular frames.* In: AMS Sectional Meeting, Ohio State University, Columbus, OH, United States, March 16 - 18, 2018.

9. *From covers to tight frames.* In: AMS Sectional Meeting, College of Charleston, Charleston, SC, United States, March 10 - 12, 2017.

10. *Spectra of discrete quantum walks.* In: CMS Summer Meeting, University of Alberta, Edmonton, AB, Canada, June 24 - 27, 2016.

11. *Lines and covers of complete graphs 2.* In: Systems of Lines: Applications of Algebraic Combinatorics, Worcester Polytechnic Institute, Worcester, MA, United States, August 10 - 14, 2015.

12. *Some open problems in uniform mixing.* In: Summer Research Program, Clarkson University, Potsdam, NY, United States, July 20, 2015.

Conference Talks

1. *The vertex-face walk.* In: Finite Geometry and Extremal Combinatorics, University of Delaware, Newark, DE, United States, August 21 - 24, 2019.

2. *Combinatorial aspects of quantum walks.* In: Prairie Discrete Math Workshop, Brandon University, Brandon, MB, Canada, June 12 15, 2018.

3. *Discrete-time quantum walks and graph embeddings.* In: CMS Winter Meeting, University of Waterloo, Waterloo, ON, Canada, December 8 - 11, 2017.

4. *Quantum walks and mixing.* In: Algebraic and Extremal Graph Theory, University of Delaware, Newark, DE, United States, August 7 - 10, 2017.

5. *Discrete-time quantum walks and graph structures.* In: Canadian Discrete and Algorithmic Mathematics Conference, Ryerson University, Toronto, ON, Canada, June 12 - 15, 2017.

6. *Uniform mixing in quantum walks.* In: 22nd Ontario Combinatorics Workshop, York University, Toronto, ON, Canada, May 16 - 17, 2014.

Research Experience

University of Waterloo

- Graduate Research Assistant 2014 – 2016

  Conducted mathematical experiments on continuous and discrete quantum walks, and maintaned a website of useful data on average mixing, periodic vertices and strongly cospectral vertices

Teaching Experience

University of Waterloo

- Instructor Winter 2018

  MATH 135: Algebra for Honors Mathematics

- Substitute Instructor Winter 2017

  CO 444/644: Algebraic Graph Theory

- Teaching Assistant 2012 – 2017

  Algebraic Enumeration, Algebraic Graph Theory, Calculus, Coding Theory, Introduction to Graph Theory, Graph Theory, Introduction to Combinatorics, Linear Algebra, Portfolio Optimization Models, Special Topics in Mathematical Connections

Service

Journal Reviewer

- Discrete Mathematics
- Electronic Journal of Combinatorics
- ICALP
- Journal of Physics A: Mathematical and Theoretical
- Linear Algebra and Its Applications
- Linear and Multilinear Algebra
- SampTA

Conference, Workshop and Seminar Organizer

- Algebraic Graph Theory and Quantum Information, Fields Institute — May 4 - 8, 2020
- Quantum Information on Graphs, CMS Winter Meeting — Dec 6 - 9, 2019
- Algebraic Graph Theory Seminar, University of Waterloo — Spring 2016, Fall 2017

Awards and Distictions

University of Waterloo

- University Finalist for the Governor General's Gold Medal — 2019
- First Place in the Inaugural Mathematics Doctoral Prize Competition — 2019
- Outstanding Achievement in Graduate Studies — 2015
- Cotton Family Women in Mathematics Graduate Scholarship — 2014, 2016, 2017
- Faculty of Arts Upper-Year Scholarship — 2011-2012
- Robin K. Banks Scholarship — 2011-2012
- Dean's Honours List — 2011-2012