

Shira Zerbib – CV

Assistant Professor
Department of Mathematics
Iowa State University

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Research Interests

Combinatorics, discrete geometry and combinatorial topology.

Education

- Ph.D.: Department of Mathematics, Technion–Israel Institute of Technology (2009 – 2014). Thesis Advisors: Ron Aharoni and Rom Pinchasi.
- M.Sc. (Summa Cum Laude): Department of Mathematics, Technion–Israel Institute of Technology (2004 – 2007). Thesis Advisor: Eli Aljadeff.
- B.Sc. (Summa Cum Laude): Department of Mathematics, Technion–Israel Institute of Technology (2001 – 2004).

Appointments

- August 2019 – : *Assistant Professor* (tenure-track), Department of Mathematics, Iowa State University.
- September 2015 – March 2019: *Postdoctoral T. H. Hildebrandt Assistant Professor*, Department of Mathematics, University of Michigan, Ann Arbor.
- August 2017 – December 2017:
 - *Postdoctoral Fellow*, the Geometric and Topological Combinatorics Program, MSRI.
 - *Visiting Scholar*, UC Berkeley.
- August 2014 – July 2015: *Postdoctoral Fellow*, Department of Mathematics, Technion, Haifa, Israel.
- 2004 – 2006, 2009 – 2013: *Teaching Assistant*, Department of Mathematics, Technion, Haifa, Israel.

External Awards

- 2020 – 2023: National Science Foundation (NSF). Award number DMS-1953929. Matching Theory in Hypergraphs. PI: Shira Zerbib. Amount: \$193,993.

- 2019 – 2022: The US–Israel Binational Science Foundation (BSF). Grant number 2016077. Bimatroids. PIs: Ron Aharoni, Eli Berger, Maria Chudnovsky, Shira Zerbib. Total amount: \$123,200. Amount per PI: \$30,800.
- 2020 – 2023: National Science Foundation (NSF). Award no. 1953445 Collaborative Research: Graduate Research Workshops in Combinatorics. PI: Leslie Hogben. Co-PIs: Steve Butler, Bernard Lidicky, Michael Young, Shira Zerbib. Total amount: \$42,581. Amount per PI: \$8,516.
- 2020 – 2025: Simons Foundation, Mathematics and Physical Sciences-Collaboration Grants for Mathematicians. PI: Shira Zerbib, Total amount: \$42,000. **Awarded, declined by the PI.**

ISU Internal Awards

- 2020: Foreign Travel Grant, ISU (was not used due to COVID-19).

Publications

In mathematics, authors are traditionally listed in alphabetical order. See [AMS Culture Statement](#) for more explanation.

Published or Accepted

20. D. McGinnis and S. Zerbib, Line transversals in families of connected sets the plane. Accepted to **SIAM Journal of Discrete Math.** [\[arXiv\]](#)
19. R. Aharoni, E. Berger, M. Chudnovsky and S. Zerbib, Rainbow paths and large rainbow matchings. Accepted to **Electronic Journal of Combinatorics.** [\[arXiv\]](#)
18. R. Aharoni, E. Berger, J. Briggs, E. Segal-Halevi, and S. Zerbib, Fractionally balanced hypergraphs and rainbow KKM theorem, Accepted to **Combinatorica.** [\[arXiv\]](#)
17. E. Berger, K. Choromanski, M. Chudnovsky, and S. Zerbib, Tournaments and the Strong Erdos-Hajnal Property. Accepted to **European Journal of Combinatorics.** [\[arXiv\]](#)
16. K. Nyman, F. E. Su, and S. Zerbib. Fair division with multiple pieces. **Discrete Applied Mathematics**, 283 (2020), 115–122. [\[arXiv\]](#) [\[doi\]](#)
15. D. Oliveros, C. O’Neill, and S. Zerbib. The geometry and combinatorics of discrete line segment hypergraphs. **Discrete Mathematics**, 343 (2020), no. 6. [\[arXiv\]](#) [\[doi\]](#)
14. R. Aharoni and S. Zerbib. A generalization of Tuza’s conjecture. **Journal of Graph Theory**, 94 (2020), no. 3, 445–462. [\[arXiv\]](#) [\[doi\]](#)
13. P. Bennett, A. Dudek, and S. Zerbib. Large triangle packings and Tuza’s conjecture in sparse random graphs. **Combinatorics, Probability and Computing** 29 (2020), no. 5, 757–779. [\[arXiv\]](#) [\[doi\]](#)

12. F. Meunier and S. Zerbib. Envy-free cake division without assuming the players prefer nonempty pieces. **Israel Journal of Mathematics**, 234 (2019), no. 2, 907–925. [[arXiv](#)] [[doi](#)]
11. S. Zerbib. An improved bound in Vizing’s conjecture. **Graphs and Combinatorics**, 35 (2019), no. 6, 1401–1404. [[arXiv](#)] [[doi](#)]
10. F. Frick and S. Zerbib. Colorful coverings of polytopes and piercing numbers of colorful d -intervals. **Combinatorica** 39 (2019), no. 3, 627–637. [[arXiv](#)] [[doi](#)]
9. S. Gao and S. Zerbib. The $(2, 2)$ and $(4, 3)$ properties in families of fat sets in the plane. **SIAM Journal of Discrete Mathematics** 33 (2019), no. 3, 1326–1337. [[arXiv](#)] [[doi](#)]
8. F. E. Su and S. Zerbib. Piercing Numbers in Approval Voting. **Mathematical Social Sciences**, 101 (2019), 65–71. [[arXiv](#)] [[doi](#)]
7. R. Meshulam and S. Zerbib. On Lusztiq-Dupont Homology of Flag Complexes. **Journal of Algebra** 531 (2019), 83–101. [[arXiv](#)] [[doi](#)]
6. S. Zerbib. The (p, q) property in families of d -intervals and d -trees. **Discrete Mathematics** 342(4), 1089–1097 (2019). [[arXiv](#)] [[doi](#)]
5. M. Chudnovsky, S. Spirkl and S. Zerbib. Piercing axis-parallel boxes. **Electronic Journal of Combinatorics**, Volume 25, Issue 1 (2018). [[arXiv](#)] [[doi](#)]
4. R. Aharoni, T. Kaiser and S. Zerbib. Fractional covers and matchings in families of weighted d -intervals. **Combinatorica** 37(4) (2016) 555–572. [[arXiv](#)] [[doi](#)]
3. R. Aharoni, R. Holzman and S. Zerbib. Edge-covers in d -interval hypergraphs. **Discrete & Computational Geometry**, 58(3) (2017) 650–662. [[arXiv](#)] [[doi](#)]
2. G. Nivasch, J. Pach, R. Pinchasi and S. Zerbib. The number of distinct distances from a vertex of a convex polygon. **Journal of Computational Geometry** 4(1) (2013), 1–12. [[arXiv](#)] [[doi](#)]
1. S. Zerbib. On the Zone Complexity of a Vertex. **SIAM Journal of Discrete Mathematics** 25(2) (2011), 719–730. [[arXiv](#)] [[doi](#)]

Submitted

1. M. Aliabadi and S. Zerbib, Matchings in matroids over abelian groups. **Submitted**. [[arXiv](#)]
2. D. McGinnis and S. Zerbib, A sparse colorful polytopal KKM theorem. **Submitted**. [[arXiv](#)]
3. Ron Aharoni, Eli Berger, Maria Chudnovsky and Shira Zerbib. Two remarks on the Caccetta-Häggkvist conjecture. **Submitted**. [[arXiv](#)]
4. Abdul Basit, Daniel McGinnis, Henry Simmons, Matt Sinnwell, and Shira Zerbib. Improved bounds on a generalization of Tuza’s conjecture. **Submitted**. [[arXiv](#)]

5. B. Lidický, T. Masařík, K. Murphy, and S. Zerbib, On Weak Flexibility in Planar Graphs. **submitted.** [\[arXiv\]](#)

Theses

1. Ph.D. Thesis. *Problems in Combinatorial Geometry*. Technion–Israel Institute of Technology, 2014.
2. M.Sc. Thesis. *On the Projective Analogue of the Brauer–Witt Theorem*. Technion–Israel Institute of Technology, 2007.

Invited Conference Talks

2022:

- Geometry, Combinatorics and Optimization Workshop, Paris, June 2022.
- 7th Lake Michigan Workshop on Combinatorics and Graph Theory, University of Illinois at Chicago, May 2022.
- Special session on Geometric and Topological Combinatorics. Joint Mathematics Meetings in Seattle, WA, April 2022.
Title: Line transversals in families of connected sets in the plane.
- Special session on Topics in Extremal Combinatorics. Joint Mathematics Meetings in Seattle, WA, April 2022.
Title: The generalized Tuza conjecture.
- Special session on Discrete and Convex Geometry. AMS Spring Eastern Sectional Meeting at Tufts University in Medford, Massachusetts. March 2022.
- First Joint Meeting of the Israel Mathematical Union and the German Mathematical Society, session on Algebraic and Geometric Combinatorics. February 2022.
Canceled due to COVID-19.

2021:

- Special Session on New trends in combinatorics. AMS fall sectional meeting at Creighton University, Omaha, NE. October 2021.
Title: Two generalizations of the Caccetta-Haggkvist conjecture.
- Special Session on Geometric and Topological Combinatorics and Their Applications. AMS fall sectional meeting at Creighton University, Omaha, NE. October 2021.
Title: Line transversals in families of connected sets in the plane.
- First Joint Meeting of the Israel Mathematical Union and the German Mathematical Society, session on Algebraic and Geometric Combinatorics. March 2021.
Canceled due to COVID-19.
- Dagstuhl Seminar: Vertex Partitioning in Graphs: From Structure to Algorithms – Schloss Dagstuhl, Germany. January 2021.
Canceled due to COVID-19.

2020:

- Special Session on Graphs, Hypergraphs and Set Systems, Fall Western Sectional Meeting of the AMS. October 2020.

Title: Dividing cakes with topological Hall.

- Oberwolfach Workshop – Discrete Geometry. September 2020.
Title: Dividing cakes with topological Hall.
- Topological Combinatorics Workshop – Prague, Czech Republic. August 2020.
Canceled due to COVID-19.
- SIGMA – Waterloo. July 2020.
Canceled due to COVID-19.
- Discrete and Computational Geometry Conference in memory of Ricky Pollack – New York. April 2020.
Canceled due to COVID-19.
- Joint Mathematics Meetings in Denver, Colorado – Special Session on Extremal and Probabilistic Combinatorics. January 2020.
Title: Tuza’s conjecture for random graphs and a generalization.

2019:

- Sectional AMS Meeting at the University of Florida – Special Session on Geometric and Topological Combinatorics. November 2019.
Title: Covering hypergraphs of discrete line segments in the plane.
- BIRS-CMO Workshop – Helly and Tverberg type Theorems, Casa Matemática Oaxaca, Mexico. October 2019.
Title: Covering hypergraphs of discrete line segments in the plane.
- Sectional AMS Meeting at University of Wisconsin-Madison – Special Session on Extremal Graph Theory. September 2019.
Title: Tournaments, caterpillars and the Erdős-Hajnal conjecture
- Topological Combinatorics Workshop – Prague, Czech Republic. July 2019.
Title: Tuza’s conjecture for random graphs and a generalization.

2018:

- AMS Sectional Meeting at the University of Michigan, Ann Arbor - Special Session on Probabilistic Methods in Combinatorics. October 2018.
Title: Covering hypergraphs of discrete line segments in the plane.
- The Mostly Manitoba, Michigan and Minnesota Combinatorics Graduate Students Workshop, Iowa State University. September 2018.
Title: Envy-free division of a cake without the “hungry players” assumption.
- Meeting on Applications of Topology to Combinatorics - University of Shantou, China. August 2018. Two talks.
Title 1: Envy-free division of a cake without the “hungry players” assumption.
Title 2: Colorful coverings of polytopes – the hidden topological truth behind different colorful phenomena.
- AMS Sectional Meeting at Northeastern University in Boston, Massachusetts - Special Session on Algebraic, Geometric and Topological Methods in Combinatorics. April 2018.
Title: Colorful coverings of polytopes – the hidden topological truth behind different colorful phenomena.
- AMS Sectional Meeting at The Ohio State University in Columbus - Special Session on Probabilistic and Extremal Graph Theory. March 2018.
Title: A generalization of Tuza’s conjecture.

- BIRS, Banff - Extremal Problems in Combinatorial Geometry Workshop. February 2018.
Title: Colorful coverings of polytopes – the hidden topological truth behind different colorful phenomena.
– **2017:**
- The 4th Lake Michigan Workshop on Combinatorics and Graph Theory, Kalamazoo, Michigan. April 2017.
Title: The (p, q) property in families of d -intervals
- Oberwolfach – Discrete Geometry Conference. April 2017.
Title: Matchings and covers in d -interval hypergraphs and their duals.
- The 5th Canadian Discrete and Algorithmic Mathematics Conference (CanaDAM), University of Saskatchewan, Saskatoon SK, Canada – invited mini-symposium talk. June 2015.
Title: Fractional covers and matchings in families of weighted d -intervals.
- The Haifa Workshop on Interdisciplinary Applications of Graphs, Combinatorics and Algorithms, University of Haifa. June 2015.
Title: Fractional covers and matchings in families of weighted d -intervals.

Seminar and Colloquium Talks

2022:

- Copenhagen-Jerusalem Combinatorics Seminar – seminar talk, June 2022.
- Free University of Berlin – seminar talk, May 2022.
- Bard College – seminar talk, April 2022.
- University of Haifa – colloquium, February 2022.

2021:

- Georgia Tech – seminar talk, November 2021.
- Hebrew University – seminar talk, October 2021.
- Princeton University – seminar talk, October 2021.
- University of Rochester – seminar talk, October 2021.
- University of Washington – seminar talk, January 2021.

2020:

- Binghamton University, State University of New York – seminar talk, October 2020.
- UIUC – Seminar talk, May 2020.
- University of Kansas – seminar talk, February 2020.

2019:

- Carnegie Mellon University – seminar talk, November 2019.
- Ben-Gurion University – seminar talk, June 2019.
- Hebrew University – seminar talk, May 2019.

2018:

- CUNY Graduate Center and Courant Institute – seminar talk, November 2018.
- Iowa State University – colloquium talk, September 2018:
- UC Davis – seminar talk, May 2018.
- Princeton University – seminar talk, March 2018.
- Western Michigan University – colloquium talk, February 2018.

- University of Oklahoma – colloquium talk, January 2018.

2017:

- Haifa University – colloquium talk, December 2017.
- Tel Aviv University – seminar talk, December 2017.
- Bar-Ilan University – colloquium talk, December 2017.
- Hebrew University – seminar talk, December 2017.
- Ben-Gurion University – seminar talk, December 2017.
- McGill University – seminar talk, November 2017.
- MSRI – seminar talk, October 2017.
- MSRI – seminar talk, September 2017.
- Princeton – seminar talk, March 2017.
- Center for Memory and Recording Research, UCSD – seminar talk, May 2016.
- University of Michigan, Ann Arbor – seminar talk, November 2015.
- University of Michigan, Ann Arbor – Capsule Research Talk, September 2015.
- Bar-Ilan University, Israel – seminar talk, November 2014.
- Technion, Israel – seminar talk, August 2013.

Internal talks

- ISU – seminar talk, November 2020.
- ISU – seminar talk, October 2019.

Short Collaboration Visits

- Technion – Summer 2022.
- Free University of Berlin – May-June 2022.
- Princeton University – October 2021.
- Technion – Summer 2021.
- Carnegie Mellon University – November 2019.
- Technion – May-June 2019.
- CUNY, Baruch College – November 2018.
- University of California, Davis – May 2018.
- McGill University – November 2017.
- Princeton University – March 2017.

Organizing

- MSRI Summer Graduate School on “Topological Methods for the Discrete Mathematician” (together with Pavle Blagojević and Florian Frick) – Summer 2022.
- Graduate school on “Topological Methods in Discrete Mathematics” at the Free University of Berlin (together with Pavle Blagojević and Florian Frick) – May-June 2022.
- Organized a special session on Topological Methods in Discrete Mathematics at the Fall 2021AMS Sectional Meeting at the University of South Alabama (together with Abdul Basit) – November 2021.

- Co-organizer of the Graduate Research Workshop in Combinatorics (GRWC), an annual 2-week collaborative research workshop for graduate students and postdocs from all areas of combinatorics – 2021 –.
- Summer 2020 – organized an international CoSP (Combinatorial Structures and Processes) Zoom Seminar on Topological Combinatorics.

Graduate Students and Postdocs

As major professor

- Daniel McGinnis - PhD student (2020 –). Expected graduation: 2024.

As a temporary advisor

- Conor Thompson - PhD

Postdocs

- Mohsen Aliabadi (2020–2022)
- Abdul Basit (2020–2022)

POS Committees

- Joseph Alameda - PhD 2021
- Elizabeth Sprangel - PhD 2022
- Michael Ross - PhD 2022
- Mitchell Ashburn - PhD
- Kimberly Hadaway - PhD
- Jasmine Martin - PhD

Mentoring Undergraduate Students

- Spring 2022: Supervising, together with Abdul Basit an undergraduate student as part of the Iowa State Mathematical Research Teams (ISMaRT) program.
- Spring 2021: Supervising, together with Abdul Basit and Mohsen Aliabadi, two groups of undergraduate students as part of the Iowa State Mathematical Research Teams (ISMaRT) program.
- 2021: Coaching (together with Jason McCullough) the Iowa State University Putnam team.
- 2016 – 2017: Supervised an undergraduate student (Shiliang Gao) in an extended REU project at the University of Michigan.
- Winter 2018: Supervised four undergraduate and graduate students at the University of Michigan in a research project, as part of the LOG(M) (Laboratory of Geometry) group.
- Summer 2018: Supervised (jointly with Boaz Slomka) two undergraduate students at the University of Michigan in a research project on coloring unit disk graphs.

Honors and Prizes

- [Postdoctoral Mentoring Award](#) - Iowa State University, 2021.
- [Outstanding Postdoctoral Fellow Award](#) - University of Michigan, 2018.
- Prize for an Outstanding Ph.D. Thesis, Department of Mathematics, Technion, Israel, 2015.
- Postdoctoral Scholarship for Excellent Women Scientists, Technion, Israel, 2015.
- Excellent Teaching Assistant Award, Department of Mathematics, Technion, Israel, Spring 2013.
- The Promotion of Excellence in Mathematics Scholarship, Technion, Israel (2011 – 2012).
- Prize for an Outstanding M.Sc. Thesis, Department of Mathematics, Technion, Israel, 2007.
- Excellence Prize for B.Sc Graduates, Department of Mathematics, Technion, Israel, 2004.

ISU Service

- Chair search committee (2022)
- Faculty Senator for the Department of Mathematics (2020 –)
- Putnam co-coaching, together with Jason McCullough (2021)
- Discrete Mathematics Qualification Exam Committee (2019 –)
- Departmental Executive Committee (2019 – 2020)

Professional Service and Outreach

- Coordinator for the Sonia Kovalevsky Day. This is an event for middle school girls and their math teachers organized by the Department of Mathematics at ISU, which aimed to increase middle school girls' interest in mathematics, assist them in the transition between middle school and high school mathematics, encourage them to pursue careers in STEM disciplines, and to develop more extensive cooperation with middle schools and high schools in their area. Participants in the event engaged in hands-on activities through a series of workshops on exciting math topics.
- Reviewer for Simons Foundation Collaboration Grants for Mathematicians (2021, 2022).
- NSF panelist (2020).
- Reviewer for the Czech Science Foundation (2020).
- Referee for various journals and conferences, including: Journal Topological Methods in Nonlinear Analysis, Michigan Mathematical Journal, Proceedings of the American Mathematical Society, JCTB, DCG, JoGT, Elect. JoC, JoCG, Discrete Math, SODA, SoCG, SIDMA, Mathematical Social Sciences (2014 –).
- ISU Math Club talk (February 2020)
- Reviewer for Mathematical Reviews (2017 – 2019).
- Member of the Program Committee, 34th Symposium on Computational Geometry (SoCG 2018).
- Participant as a GROW Ally in GROW-2018 (Graduate Research Opportunities for Women) at the University of Michigan - a conference aimed at female-identified undergraduate students who may be interested in pursuing degree in math (October 2018).
- Speaker at the Michigan Math Club (February 2017).

- Speaker at the Michigan Math Circle – a program for high school and middle school students focused on the process of mathematical discovery and open-ended exploration of deep mathematical topics that are often not covered in the standard school curricula (November 2015).
- Coordinating the Combinatorics Seminar, Technion, Israel (2014 – 2015).

Teaching

ISU teaching:

- Spring 2022: Math 568 – Enumerative Combinatorics
- Fall 2021: Math 265 – Calculus 3.
- Spring 2021: Math 568 – Enumerative Combinatorics
- Fall 2020: Math 492 – Undergraduate Seminar
- Fall 2020: Math 567 – Graph Theory
- Spring 2020: Math 680D – Topological Methods in Combinatorics
- Fall 2019: Math 166 – Advanced Calculus

Before ISU:

- Fall 2018: Math 115 – Calculus I (University of Michigan).
- Winter 2018: Math 567 – Introduction to Coding Theory (University of Michigan).
- Winter 2017: Math 567 – Introduction to Coding Theory (University of Michigan).
- Fall 2016: Math 465 – Introduction to Combinatorics (University of Michigan).
- Winter 2016: Math 567 – Introduction to Coding Theory (University of Michigan).
- Fall 2015: Math 115 – Calculus I (University of Michigan).
- 2009 – 2014: Teaching Assistant and Grader – Linear Algebra, Abstract Algebra, Field Theory, Calculus II (Technion).

Additional Research Activities

- Participant in the Bárány 70 Conference, Budapest, June 2017.
- Participant in the Barbados Graph Theory Workshop, March 2017.
- Participant in the Informal Analysis Seminar, Kent State University, April 2016.
- Participant in the Polish–Israeli Workshop – Between Combinatorics and Topology, Hebrew University, Israel, November 2014.
- Visiting Student at MIT, Summer 2005.
- Participant in the annual Kupcinet-Getz International Science School for Outstanding Undergraduate Students, Weizmann Institute, Israel, Summer 2003.