Matthew H. Faust

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Positions

Aug. 2024– Present **Research Associate**, *Michigan State University*, Department of Mathematics

Education

Aug. 2018– Aug. 2024 **PhD Mathematics**, *Texas A&M University*, Doctoral advisors: Wencai Liu and Frank Sottile

Aug. 2014– May 2018 **B.S. Computer Engineering and B.S. Mathematics**, *University of Illinois at Urbana-Champaign*

Preprints

- *Rare Flat Bands for Periodic Graph Operators*, Matthew Faust, Wencai Liu, Mar 2025, DOI: 10.48550/ARXIV.2503.03632
- *Extrema of spectral band functions of two dimensional discrete periodic Schrödinger operators* (Submitted). Matthew Faust, Wencai Liu, Ethan Luo, Jan 2025, DOI: 10.48550/ARXIV.2501.11155
- *LikelihoodGeometry: Macaulay2 Package*(Submitted). David Barnhill, John Cobb, Matthew Faust, Nov 2024, DOI: 10.48550/ARXIV.2411.11165
- *Likelihood Correspondence of Statistical Models* (Submitted). David Barnhill, John Cobb, Matthew Faust, Dec 2023, DOI: 10.48550/ARXIV.2312.08501

Publications

- *Irreducibility of the Dispersion Polynomial for Periodic Graphs*. Matthew Faust, Jordy Lopez Garcia, SIAM Journal on Applied Algebra and Geometry, 2025, DOI: 10.1137/23M1600256
- *Floquet Isospectrality of the Zero Potential for Discrete Periodic Schrödinger Operators*. Matthew Faust, Wencai Liu, Rodrigo Matos, Jenna Plute, Jonah Robinson, Yichen Tao, Ethan Tran, Cindy Zhuang, J. Math. Phys. 65 (2024), DOI: DOI: 10.1063/5.0201744
- *Critical Points of Discrete Periodic Operators*. Matthew Faust, Frank Sottile, J. Spectr. Theory, (2024), DOI 10.4171/JST/503.
- *The Surprising Accuracy of Benford's Law in Mathematics*. Zhaodong Cai, Matthew Faust, A.J. Hildebrand, Junxian Li, Yuan Zhang, The American Mathematical Monthly, (2020), DOI: 10.1080/00029890.2020.1690387.
  - *Subject of a 2021 Paul R. Halmos - Lester R. Ford Award*
- *Leading Digits of Mersenne Numbers*, Zhaodong Cai, Matthew Faust, A.J. Hildebrand, Junxian Li, Yuan Zhang, Experimental Mathematics, (2019), DOI: 10.1080/10586458.2018.1D551162.

Honors

2021 **2021 Paul R. Halmos - Lester R. Ford Award**

2018 **Math Algebraic-Combinatorics Scholarship ICLUE**

Recent Presentations

- Analysis and PDE Seminar, University of Kentucky, Zoom, March 4, 2025
- MPOA Seminar, Michigan State University, East Lansing Michigan, September 17, 2024
- AMS Fall Central Section Meeting Special Session on Periodicity in Quantum Systems, UTSA, San Antonio, Texas, September 14, 2024
- Early Career Workshop in Mathematical Physics, Texas A&M University, College Station, Texas, September 13, 2024
- Effective Methods in Algebraic Geometry (MEGA), Max Planck Institute, Leipzig, Germany, August 1, 2024
- Great Lakes Math Physics (GLaMP), Michigan State University, East Lancing, Michigan, June 8, 2024
- Workshop on Computational and Applied Enumerative Geometry, Fields Institute, Toronto, Ontario, Canada June 6, 2024
- Texas A&M Algebra and Combinatorics Seminar, College Station, Texas, April 19, 2024
- AMS Eastern Spring Sectional Session on Spectral Theory and Quatum Systems, Howard University, Washington D.C, April 6, 2024

- CombinaTexas, Texas A&M University, College Station, Texas, March 23, 2024
- JMM AMS Special Session on Spectral Methods in Quantum Systems: San Francisco, CA, Jan 6, 2024
- Algebraic Statistics and Our Changing World: Long Program, IMSI Chicago, Illinois, Dec 4, 2023
- SIAM TX-LA: (Complex) analysis in differential equations, Lafayette, Louisiana, November 4, 2023
- SIAM TX-LA: Applications of combinatorial and computational algebraic geometry , Lafayette, Louisiana, November 4, 2023
- Algebraic Statistics and Our Changing World: Long Program, IMSI Chicago, Illinois, October 18, 2023
- Algebraic Statistics and Our Changing World: Apprenticeship week, IMSI Chicago, Illinois, October 4, 2023
- GLaMP, Oberlin Ohio, June 10, 2023
- Copenhagen-Jerusalem Combinatorics Seminar, Zoom, March 30, 2023
- AMS Spring Southeastern Section Meeting, Special Session on Quasi-periodic Schrödinger operators and quantum graphs, Atlanta, GA, March 19, 2023
- JMM AMS Special Session on Applied Enumerative Geometry, Boston, MA, January 4, 2023
- SIAM-TXLA 2022, Houston, Texas, November 5, 2022
- Louisiana State University Applied Analysis Seminar, Baton Rogue, Louisiana, October 11, 2022
- Texas A&M Algebra and Combinatorics Seminar, College Station, Texas, October 7, 2022
- QMath15, Davis, California, September 14, 2022
- MEGA, Krakow, Poland, June 23, 2022
- GLaMP, Michigan State University, East Lancing, Michigan, June 11, 2022
- JMM AMS Special Session on Structured Polynomial Systems In Mathematics and Its Applications, Zoom, April 6, 2022
- AMS Spring Sectional, Zoom, March 26, 2022
- Conference on spectral theory of ergodic quantum systems, Zoom, March 12, 2022
- Texas A&M MPHA seminar, College Station, Texas, March 11, 2022
- SIAM TX-LA, South Padre Island, Texas, Nov. 7, 2021
- Texas A&M MPHA seminar, College Station, Texas, April 30, 2021

Conference and Seminar Organization

- Mini-symposium Organizer: Algebraic Geometry in Spectral Theory SIAM AG25 (July 7-11 2025).
- Special Session Organizer: Spectral Theory of Schrödinger Operators and Related Topics AMS 2025 Spring Eastern Sectional Meeting (April 5-6 2025).
- Seminar Organizer: Mathematical Physics and Operator Algebras Seminar Michigan State University Department of Mathematics, East Lansing, Michigan (2024 academic year).
- Special Session Organizer: Mathematics of Topological Insulators JMM 2025 (Jan 8-11 2025).
- Special Session Organizer: Quasi-periodic and Disordered Systems AMS 2024 Fall Central Sectional Meeting (Sept 14-15 2024).
- Mini-symposium Organizer: Discrete and Continuous Schrödinger Operators SIAM TX-LA (Nov 3-5 2023).
- Organizer: Spectral Theory and Applications at Texas A&M (Oct 13-15 2023).

Recent journal referees

- The American Mathematical Monthly (2022).

Teaching Experience

2024 Fall – present **Instructor for Math 133 (Calc II)**, *Michigan State University*, East Lansing, MI

2021 Summer **Instructor for Math 142 (Business Calc)**, *Texas A&M University*, College Station, TX
- Five week course, virtually lectured daily through zoom.

2018-2024 **Teaching Assistant**, *Texas A&M University*, College Station, TX
- Fall 2023 Math 613 (Graph Theory)
- Summer 2023: Math 601 (Methods of Applied Mathematics)
- Summer 2022: Math 308 (Differential Equations)
- Spring 2022: Math 416 (Modern Algebra II)
- Fall 2021: Math 147 (Calculus I for Biological Sciences)
- Spring 2021: Math 415 (Modern Algebra I)
- Fall 2020: Math 300 (Foundations of Mathematics)
- Summer 2020: Math 151 (Engineering Mathematics I)
- Spring 2020: Math 151 (Engineering Mathematics I)
- Fall 2019: Math 152 (Engineering Mathematics II)
- Spring 2019: Math 220 (Foundations of Mathematics)
- Fall 2018: Math 220 (Foundations of Mathematics)

2016-2017 **Course Assistant**, *University of Illinois*, Champaign, IL
- Fall 2017: Math 231 (Calculus II) grader
- Fall 2016: CS 374 (Introduction to Algorithms) course assistant
- Spring 2016: CS 374 (Introduction to Algorithms) course assistant

Outreach

May 2025 **Workshop: Applications of Commutative Algebra**, *Fields Institute*, Toronto, Ontario
- Mentor for the spectral theory group with Professors Stephen Shipman and Frank Sottile.

May – July 2025 **SURIEM REU**, *Michigan State University*, East Lansing, MI
- Mentor for the Spectral Theory for Discrete Periodic Operators 2025 project.

Mar. 2024 **Career Panelist**, *The 7th TX-LA Undergraduate Mathematics Conference*

Jan. 2024 – Aug. 2024 **STODO REU 2024**, *Texas A&M University*, College Station, TX
- REU project on the band edges of discrete periodic Schrödinger operators.
- Assisted Professor Wencai Liu in leading the participating student.

Fall 2022 **Directed reading program**, *Texas A&M University*, College Station, TX
- Led a student through selected readings in the philosophy of mathematics.

Aug. 2022 – May 2023 **STODO REU 2022**, *Texas A&M University*, College Station, TX
- REU project on Floquet isospectrality.
- Assisted Professor Wencai Liu and Dr. Rodrigo Matos in leading five students.

Jun. 2022 – May 2024 **Sottile TAMU REU 2022**, *Texas A&M University*, College Station, TX
- REU project, with a previous DRP student, studying discrete periodic operators.
- Led the student through *Ideals, Varieties, and Algorithms* by Cox, Little, O'Shea.
- Employed a computational cluster to gather data and build conjectures.

Spring 2022 **Directed reading program**, *Texas A&M University*, College Station, TX
- Led a student through *Thinking About Mathematics* by Shapiro.

Fall 2021 **Directed reading program**, *Texas A&M University*, College Station, TX
- Led a student reading *Topological Crystallography* by Sunada.
- This reading evolved into an REU project with the student.

May 2021 – August 2021 **Sottile TAMU REU 2021**, *Texas A&M University*, College Station, TX
- Worked with two students in an REU focused on the application of algebraic geometry to problems in mathematical physics.

2020 Spring **Directed reading program**, *Texas A&M University*, College Station, TX
- Led a student reading *Introduction to Quantum Graphs* by Berkolaiko and Kuchment.

2020 **Mentor for Peer Mentoring Program**

Summer 2019 **Panelist for TAMU REU graduate school discussion panel**

Software Contributions

- NormalToricVarieties package for Macaulay2 (contributor).
- MatrixFactorization package for Macaulay2 (contributor, package in development).
- Likelihood Geometry package for Macaulay2 (with Barnhill and Cobb).