

# Mark Greenfield

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**RESEARCH INTERESTS** Topology, geometry, and dynamics: Teichmüller theory of various flavors.  
I am also interested in applying my analytical and computational skills to real-world problems, especially in quantitative finance.

**EDUCATION** *University of Michigan*, Ann Arbor, Michigan  
Ph.D. in Mathematics, April 2021  
Thesis: Some New Directions in Teichmüller Theory  
Advisor: Professor Lizhen Ji, lji@umich.edu

*University of Michigan*, Ann Arbor, Michigan  
M.S. in Mathematics, December 2016

*California Institute of Technology*, Pasadena, California  
B.S. with Honors in Mathematics, June 2015

**PROFESSIONAL EXPERIENCE** Quantitative Researcher Starting Summer 2021  
*Susquehanna International Group* Philadelphia, PA

Quantitative Research PhD Student Intern Summer 2020  
*Susquehanna International Group* (Virtual internship in mathematical finance)

- Highly competitive program for PhD-level researchers
- Participating in developing, testing, and implementing predictive pricing models and quantitative strategies
- Utilizing and learning about mathematical and computational tools and skills
- Educational programs about the application of quantitative theory to real-world problems
- Accepted full-time return offer upon completion of internship

**PUBLICATIONS** Gekhtman, D., Greenfield, M. *Isometric submersions of Teichmüller spaces are forgetful*. To appear. Available at arXiv: 1901.02586.

Greenfield, M., Ji, L. *Metrics and compactifications of Teichmüller spaces of flat tori*. To appear. Available at arXiv: 1903.10655.

Aidala, C., Carcassi, G., Greenfield, M. *Topology and experimental distinguishability*. To appear. Available at arXiv: 1708.05492.

Greenfield, M., Zhang, J. *Null preference and the resolution of the topological social choice paradox*. *Mathematical Social Sciences* 93 (2018), 47–51. Available on my webpage.

Greenfield, M. *A lower bound for Torelli-K-quasiconformal homogeneity*. *Geometriae Dedicata* 177 (2014), Issue 1, 61–70. Available at arXiv: 1309.2666.

Greenfield, M., Marcolli, M. and Teh, K. *Twisted spectral triples and quantum statistical mechanical systems*. *p-Adic Numbers Ultrametric Anal. Appl.* 6 (2014), no. 2, 81–104. Available at arXiv: 1305.5492.

Kuznetsov, I., Greenfield, M., Mehta, Y., Merchan-Merchan, W., Salkar, G., and Saveliev, A. *Increasing the solar cell power output by coating with transition metal-oxide nanorods*. *Applied Energy* 88 (2011), 4218–4221. Available on my webpage.

## TEACHING EXPERIENCE

### University of Michigan:

Fall 2020	EECS 203	Discrete Math (Virtual class, >250 enrolled)	Primary Instructor
Fall 2020	EECS 203	Discrete Math (Virtual class, >100 enrolled)	Primary Instructor
Winter 2019	Math 116	Calculus II	Primary Instructor
Fall 2018	Math 116	Calculus II	Primary Instructor
Winter 2018	Math 592	Introduction to Algebraic Topology	Grader
Fall 2017	Math 490	Introduction to Topology	Course Assistant
Winter 2016	Math 215	Calculus III Mathematica Lab	Primary Instructor
Fall 2015	Math 115	Calculus I	Primary Instructor

### California Institute of Technology:

Spring 2015	IST 4	Information and Logic	Teaching Assistant
Summer 2014	Math 0	Transition to Math Proofs	Lead Teaching Assistant
Spring 2014	IST 4	Information and Logic	Teaching Assistant
Summer 2013	Math 0	Transition to Math Proofs	Teaching Assistant

Private Mathematics Tutor, 2012–2019 (high school to upper-level undergraduate math courses, and introductory physics)

## OTHER SKILLS & COURSES

- Recent relevant coursework: EECS 402: Programming for Scientists and Engineers; Math 571 Numerical Linear Algebra; Math 526: Discrete-state Stochastic Processes
- Coursera course: Machine Learning - Professor Andrew Ng, Stanford Online
- Coursera course: Financial Markets - Professor Robert Shilling, Yale University
- Coursera specialization: Applied Data Science with Python (5 courses), offered by University of Michigan Online
  - Introduction to Data Science in Python
  - Applied Plotting, Charting, and Data Representation in Python
  - Applied Machine Learning in Python
  - Applied Text Mining in Python
  - Applied Social Network Analysis in Python
- Coursera specialization: Financial Technology Innovations (4 courses), offered by University of Michigan Online
  - The Future of Payment Technologies
  - Blockchain and Cryptocurrency Explained
  - Raising Capital: Credit Tech, Coin Offerings, and Crowdfunding
  - Innovations in Investment Technology: Artificial Intelligence
- Computer skills: Python, C++, Mathematica, L<sup>A</sup>T<sub>E</sub>X, WordPress

- Graduate Teaching Certificate, Center for Research on Learning and Teaching, 2018
- Rackham Professional Development Diversity, Equity, and Inclusion Certificate, 2019

## **AWARDS & FELLOWSHIPS**

NSF Graduate Research Fellowship, 2015–2020

University of Michigan Honored Instructor, Fall 2018

University of Michigan Math Department Graduate Student Award, 2019  
*For contributions to the scholarly life and inclusive culture of the math department.*

Michigan Inquiry-Based Learning Consortium Minigrant, 2019

Michigan Mathematics Graduate Fellowship, 2015–2016

University of Michigan Mathematics Scholarship Fund Recipient, 2016–2017

Rackham Conference Travel Grant, 2016, 2017, 2018, 2019

E.T. Bell Prize for Outstanding Undergraduate Research in Mathematics, 2014

H.J. Ryser Undergraduate Research Fellowship, 2013

## **SERVICE**

- Manager, Laboratory of Geometry at Michigan (LOG(M)) (2016–2018)  
 Co-founder and organizer of several teams of undergraduate students, graduate students, and faculty conducting mathematical exploration/research projects.
- Admissions committee, LOG(M) (2018–Present)
- Research mentor, LOG(M) (2017–2018)  
 Co-mentor of a small team of undergraduates each semester.  
 Fall 2018: studying polyhedral Finsler metrics on  $\mathbb{R}^2$   
 Winter 2018: computational exploration of the discrete Hodge star operator.  
 Winter 2017: investigating simple closed geodesics on the once-punctured torus.
- Directed Reading Program Mentor (Fall 2019). Topic: Teichmüller spaces
- UM Math Dept. Graduate Student Advisory Committee Member (2017–2020)
- Co-organizer, UM Graduate Student Topology Seminar (2016–2019)
- Chair, Caltech Mathematics Student-Faculty Committee (2014–2015)  
 Led committee to evaluate and update the mathematics curriculum for all undergraduates at the institute.
- Caltech Honor Code Board Member (2012–2015)  
 Investigating violations of academic integrity, educating students on the Honor Code, consultation with faculty and administration on relevant issues.
- Caltech Peer Counselor (2012–2015)  
 Mental health resource and mentor on academic and non-academic issues.

## **SELECTED TALKS & POSTERS**

*Isometric submersions of Teichmüller spaces*

University of Indiana at Bloomington Teichmüller Theory Seminar	April 2019
Combinatorial and algebraic aspects of geometric structures conference Chiang Mai, Thailand (lightning talk)	July 2019
Hyperbolic Lunch (Virtual) at the University of Toronto	April 2020
Caltech Geometry and Topology Seminar (Virtual)	May 2020

*Geometry of  $n$ -tori: Donuts in all dimensions*  
Undergraduate Math Colloquium (Virtual), Kalamazoo College, Michigan May 2020

*Introduction to translation surfaces (joint with B. Zykoski)*  
Summer graduate minicourse, University of Michigan August 2019

*Polyhedral Finsler metrics: geometry and undergraduate mentoring*  
GSTGC, University of Illinois at Urbana-Champaign (lightning talk) March 2019

*Laboratory of Geometry at Michigan (joint with H. Bray)*  
AMS Special Section on Geometry Labs United at JMM January 2019

*Metrics and compactifications of Teichmüller spaces of flat tori*  
University of Michigan Geometry Research Seminar October 2018

*Symmetric spaces as moduli spaces*  
GSTGC, University of Illinois at Chicago April 2018

*Thurston's metric on Teichmüller spaces of flat  $n$ -tori*  
Michigan State University Geometry and Topology Seminar September 2017  
Ventotene Int'l Workshop on Moduli Spaces, Italy (Poster) September 2017

*The moduli space of flat tori*  
Seminar talk for Caltech Math Club May 2017  
University of Michigan Summer Junior Colloquium June 2017

*A new modular characterization of the hyperbolic plane*  
University of Michigan Topology Research Seminar March 2017  
Moduli Spaces and Applications, Morningside Ctr., Beijing (Poster) February 2017

*A Lower Bound for Torelli-K-Quasiconformal Homogeneity*  
SURF Talk, Finalist in Perpall Research Talk Competition November 2013

*QSM Systems Associated to Riemann Surfaces*  
Southern California Conference for Undergraduate Research November 2012

## OUTREACH

*Links, loops, and twists*  
The Mind Museum Science Demo, Manila, Philippines December 2019

*Thinking topologically*  
Kentucky State University Guest Lecture November 2019

*Graduate student panelist*  
University of Michigan at Dearborn REU program June 2019

*Mathematics in Nature*  
Doris Duke Conservation Scholars Program Academic Seminar June 2019

*Mathematical Biology: genes and sequence alignments (joint with M. Daupan)*  
University of Michigan Math Circle February 2019

*Counting Permutations and Combinations*  
Future University Enrichment for Middle Schoolers February 2016