David Harry Richman

| CONTACT INFORMATION | *E-mail:* hrichman@alum.mit.edu *Website:* harryrichman.info |

RESEARCH INTERESTS — tropical geometry, potential theory on graphs, phylogenetics, curves and Jacobians, moduli space of metric graphs, effective resistance, curvature on graphs, applications of p-adic distance, combinatorics, multiplicative number theory

EMPLOYMENT

Fred Hutchinson Cancer Center, Seattle, WA
Postdoctoral Fellow, Herbold Computational Biology Program   2023 – present
   PI: Frederick Matsen

University of Washington, Seattle, WA
Postdoctoral Scholar, Department of Mathematics   2020 – 2022

EDUCATION

University of Michigan, Ann Arbor, MI
Ph.D. in Mathematics   2014 – 2020
   Thesis: Weierstrass points and torsion points on tropical curves
   Advisor: David Speyer

Independent University of Moscow, Moscow, Russia
Math in Moscow Study Abroad Program   2013 – 2014

Massachusetts Institute of Technology, Cambridge, MA
S.B. in Mathematics with Computer Science   2009 – 2013

RESEARCH PAPERS

"Lower rational approximations and Farey staircases," accepted for publication in *Integers*.
preprint: arXiv:2303.02935

"The distribution of Weierstrass points on a tropical curve," *Selecta Math. New Ser.* **30** (2024).
DOI: 10.1007/s00029-024-00919-5

"The floor quotient partial order," with Jeffrey C. Lagarias, *Adv. Appl. Math.* **153** (2024).
DOI: 10.1016/j.aam.2023.102615

"The tropical Manin–Mumford conjecture," *Int. Math. Res. Not. IMRN* **2023** (2023) no. 21, 18714–18751.
DOI: 10.1093/imrn/rnad098

"Counting tripods on the torus," with Jayadev S. Athreya and David Aulicino
Arnold Mathematical Journal **9** (2023) 359–379.
DOI: 10.1007/s40598-022-00216-z

"Derangements and the p-adic incomplete gamma function," with Andrew O'Desky
Trans. Amer. Math. Soc. **376** (2023) no. 2, 1065–1087.
DOI: 10.1090/tran/8716

"Dilated floor functions with nonnegative commutators II: Negative dilations," with Jeffrey C. Lagarias
Acta Arithmetica **196** (2020) no. 2, 163–186.
DOI: 10.4064/aa190628-14-1

"Dilated floor functions with nonnegative commutators I: Positive and mixed sign dilations," with Jeffrey C. Lagarias, *Acta Arithmetica* **187** (2019) no. 3, 271–299.
DOI: 10.4064/aa180602-21-9

"Dilated floor functions that commute," with Jeffrey C. Lagarias and Takumi Murayama
Amer. Math. Monthly **123** (2016) no. 10, 1033–1038.
DOI: 10.4169/amer.math.monthly.123.10.1033

PREPRINTS

"Tropical Weierstrass points and Weierstrass weights," with Omid Amini and Lucas Gierczak, submitted
preprint: arXiv:2303.07729

"Counting two-forests and random cut size via potential theory," with Farbod Shokrieh and Chenxi Wu, submitted
preprint: arXiv:2308.03859

"The Möbius function on the poset of triangular numbers under divisibility," with Rohan Pandey, submitted
preprint: arXiv:2402.07934

"A Ricci flow on graphs from effective resistance," with Aleyah Dawkins, Vishal Gupta, Mark Kempton, William Linz, Jeremy Quail, and Zachary Stier, submitted.
preprint: arXiv:2403.01151

"Node resistance curvature in Cartesian graph products," with Aleyah Dawkins, Vishal Gupta, Mark Kempton, William Linz, Jeremy Quail, and Zachary Stier, submitted.
preprint: arXiv:2403.01037

"The family of a-floor quotient partial orders," with Jeffrey Lagarias, submitted

"Minors of tree distance matrices," with Farbod Shokrieh and Chenxi Wu, in preparation

HONORS AND AWARDS

AMS-Simons Travel Grant ($5,000)	2020 – 2022
Rackham Predoctoral Fellowship ($32,640)	2019 – 2020
AMS Graduate Student Travel Grant	Fall 2019
Rackham Conference Travel Grant	Summer 2016, 2017, 2019
AARMS award for best student poster, CMS Meeting	Summer 2016
AMS Math in Moscow Scholarship ($8000)	Fall 2013

TEACHING EXPERIENCE

University of Washington, Seattle, WA, USA

Primary Instructor

Math 208, Linear Algebra	Winter 2022, Spring 2022
Math 308, Linear Algebra	Autumn 2020, Spring 2021

University of Michigan, Ann Arbor, MI, USA

Primary Instructor

Math 116, Calculus II (Primary Instructor)	Winter 2015, Winter 2016, Winter 2018, Winter 2019
Math 115, Calculus I (Primary Instructor)	Fall 2014

Teaching Assistant

Math 215, Multivariable calculus (TA)	Fall 2016
Math 216, Differential equations (TA)	Fall 2015

MENTORING EXPERIENCE	**University of Washington**, Seattle, WA, USA	
	WXML: Counting spanning trees on the Kagome lattice	Autumn 2021 – Winter 2022
	WXML: Zeros and critical points of complex polynomials	Autumn 2020 – Spring 2021
	University of Michigan, Ann Arbor, MI, USA	
	Laboratory of Geometry: Origami on a Hexagonal Lattice	Winter 2019
INVITED TALKS	**Ricci flow on graphs from effective resistance**	
	JMM 2024, Special Session on Ricci curvatures on graphs and applications	January 2024
	Tropical weights of Weierstrass points	
	(poster) WAGS 2023, University of Washington	April 2023
	Uniform bounds for torsion packets on tropical curves	
	(poster) CCAAGS in honor of Bernd Sturmfels, University of Washington	June 2022
	TGiF (Tropical Geometry in Frankfurt), Goethe University Frankfurt	January 2022
	Algebra and Algebraic Geometry Seminar, University of Washington	January 2021
	Derangements and the p-adic incomplete gamma function	
	(poster) FPSAC 2022, Bangalore India	July 2022
	Algebra and Algebraic Geometry Seminar, University of Washington	November 2021
	Tutte polynomials for metric graphs	
	~~SIAM Discrete Math~~ [cancelled due to COVID]	June 2020
	Weierstrass points on tropical curves	
	Algebra and Number Theory Seminar, University of Kentucky	November 2019
	Algebra and Algebraic Geometry Seminar, University of Washington	October 2019
	SIAM Applied Algebraic Geometry, Bern Switzerland	July 2019
	(poster) FPSAC 2019, Ljubljana Slovenia	July 2019
	Analysis and Geometry Seminar, Central Michigan University	February 2019
	Algebraic Geometry Seminar, Brown University	November 2018
	Combinatorics Seminar, University of Michigan	November 2018
	Algebraic Geometry Seminar, The Ohio State University	October 2018
	Algebra Seminar, Georgia Tech	October 2018
	(poster) AGNES Fall Meeting, Brown University	September 2018
	Dilated floor functions and their commutators	
	AMS Fall Sectional Meeting, Madison WI	September 2019
	Department of Mathematics Colloquium, University of Findlay	December 2018
	INTEGERS Conference 2018, Augusta GA	October 2018
	(poster) MAA MathFest, Chicago IL	July 2017
	(poster) CMS Summer Meeting, University of Alberta	June 2016
	Looking for a "local" Gauss–Lucas theorem	
	MAA MathFest, Chicago IL	July 2017
SERVICE	Referee for: Journal of Integer Sequences, Electronic Journal of Combinatorics, Annals of Combinatorics	
	Research Mentor, Michigan Research Experiences for Graduate Students	Summer 2021
	Washington Experimental Mathematics Lab (WXML)	2020 – 2022
	Laboratory of Geometry at Michigan (LoG(M))	Spring 2019

Contributor to open-source software projects: SageMath, ETE (Environment for Tree Exploration) Toolkit

Co-organizer, JMM Special Session on Ricci curvatures of graphs and applications to data science, January 2024

Co-organizer, Hyperplane Arrangements Reading Group, University of Washington   Winter 2021

Co-organizer, Student Combinatorics Seminar, University of Michigan   2018 − 2019

Organizer, Junior Colloquium, University of Michigan   Summer 2017

Co-Hall Chair, East Campus Dormitory, MIT   Fall 2010 − Spring 2011

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EXPOSITORY
TALKS

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University of Findlay Colloquium (undergraduate audience)
Dilated floor functions   December 2018

Michigan Math Club (undergraduate audience)
The square tile problem   November 2018
Descartes' rule of signs and beyond   September 2017

Great Talks for a General Audience, MAA MathFest Chicago
Descartes' rule of signs and beyond   July 2017

University of Washington Seminars
Weierstrass points of algebraic curves and tropical curves   February 2023
Continuity over p-adic numbers   November 2021

Michigan Graduate Student Seminars
What is the Jacobian of a curve?   October 2019
Bidding games and random-turn games   March 2019
Electrifying random trees II: edge correlation   October 2018
Introduction to p-adic geometry   October 2018
A brief tour of outer space   October 2018
Equidistribution of tropical Weierstrass points   September 2018
Tropical Grassmannians and friends   February 2018
Exponentially many perfect matchings   October 2017
Weierstrass subgroup of the Jacobian   February 2017
The p-adic icosahedron   February 2017
Matching polynomials and double covers   January 2017
What is a tropical curve?   October 2016
Tate curves and Berkovich space   March 2016
Partition identities, generating functions, and physics   February 2016
What is a Néron model?   January 2016
Riemann–Roch on graphs   November 2015
Combinatorics of stable curves   November 2015
How to prove the Riemann hypothesis   September 2015
Rationality of motivic zeta functions   April 2015

Michigan Summer Mini-courses for graduate students
Stratifying moduli spaces of curves by Weierstrass semigroups   Summer 2020
Combinatorial Hodge theory   Summer 2019
Tropical methods in Brill–Noether theory (5 lectures)   Summer 2018
Moduli space of tropical curves (4 lectures)   Summer 2017

Algebraic groups (5 lectures)	Summer 2016
Hodge theory for matroids (3 lectures)	Summer 2016

Workshops and Conferences attended

MRC on Ricci curvature on graphs and applications to data science, New York, May 2023

SageDays 114, Chennai, India, July 2022

GATTACA Conference, Georgia Tech, March 2019

Arithmetic of Algebraic Curves, University of Wisconsin, April 2018

Tropical geometry, logarithmic geometry, and curve counting, Stockholm University, Summer 2017

Tropical geometry, mirror symmetry, and GKZ A-determinant philosophy, KIAS (Seoul Korea), Winter 2017

Combinatorial Algebraic Geometry, Fields Institute, Summer 2016

Explicit Methods for Abelian Varieties, PIMS, University of Calgary, Summer 2016

Gaps between Primes and Analytic Number Theory, MSRI, Summer 2015

Arithmetic and Higher-Dimensional Varieties, University of Arizona, March 2015

Skills

- Computer: Python, Mathematica, LaTeX, Scala, Spark, NetworkX, Sage
- Language: English (native), Chinese (proficient), Russian (beginner)