David Harry Richman

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

RESEARCH INTERESTS Combinatorics: effective resistance, discrete potential theory, curvature on graphs
Tropical geometry: curves and Jacobians, moduli space of metric graphs
Number theory: bounds on rational points, Möbius function bounds
Phylogenetics: distance methods, metrics on tree space, applications of p-adic distance

EMPLOYMENT

National Center for Theoretical Sciences, Taipei, Taiwan
Postdoctoral Fellow, Division of Mathematics   2024 – present

Fred Hutchinson Cancer Center, Seattle, WA
Postdoctoral Fellow, Matsen Group, Herbold Computational Biology Program   2023 – 2024

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

"Counting two-forests and random cut size via potential theory," with Farbod Shokrieh and Chenxi Wu, accepted to *Ann. Inst. Henri Poincaré Probab. Stat.*.

"A Ricci flow on graphs from effective resistance," with Aleyah Dawkins, Vishal Gupta, Mark Kempton, William Linz, Jeremy Quail, and Zachary Stier, *J. Combinatorics* **16** (2025) no. 4, 553–573.
DOI: 10.4310/JOC.250923002737

"Node resistance curvature in Cartesian graph products," with Aleyah Dawkins, Vishal Gupta, Mark Kempton, William Linz, Jeremy Quail, and Zachary Stier, *J. Combinatorics* **16** (2025) no. 4, 575–589.
DOI: 10.4310/JOC.250923003413

"The family of a-floor quotient partial orders," with Jeffrey Lagarias, in *Proceedings of Combinatorial and Additive Number Theory VI* (2025), 283–318.
DOI: 10.1007/978-3-031-65064-2_15

"Lower rational approximations and Farey staircases," *Integers* **24** (2024), paper A37.
DOI: 10.5281/zenodo.10944039

"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 Math. J.* **9** (2023) 359–379.
DOI: [10.1007/s40598-022-00216-z](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](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](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

CONFERENCE PROCEEDINGS

"PhyloVAE: unsupervised learning of phylogenetic trees via variational autoencoders," with Tianyu Xie, Jiansi Gao, Frederick A. Matsen, and Cheng Zhang, in *Proceedings of the 13th International Conference on Learning Representations (ICLR 2025)*

PREPRINTS

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

"Vector encoding of phylogenetic trees by ordered leaf attachment," with Erick Matsen and Cheng Zhang, in revision.
preprint: arXiv:2503.10169

"Principal minors of tree distance matrices," with Farbod Shokrieh and Chenxi Wu, submitted.
preprint: arXiv:2411.11488

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

HONORS AND AWARDS

NSTC (Taiwan) International Conference Travel Funding for Domestic Scholars	2025
AMS-Simons Travel Grant ($5,000)	2020 – 2022
Rackham Predoctoral Fellowship ($32,640)	2019 – 2020
AMS Graduate Student Travel Grant	2019
AMS Math in Moscow Scholarship ($8000)	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

<table>
<tr><td>Mentoring Experience</td><td>**University of Washington**, Seattle, WA, USA</td><td></td></tr>
<tr><td></td><td>WXML: Counting spanning trees on the Kagome lattice</td><td>Autumn 2021 – Winter 2022</td></tr>
<tr><td></td><td>WXML: Zeros and critical points of complex polynomials</td><td>Autumn 2020 – Spring 2021</td></tr>
<tr><td></td><td>**University of Michigan**, Ann Arbor, MI, USA</td><td></td></tr>
<tr><td></td><td>MREG: Rational Catalan combinatorics (online)</td><td>Summer 2021</td></tr>
<tr><td></td><td>Laboratory of Geometry: Origami on a Hexagonal Lattice</td><td>Winter 2019</td></tr>
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<table>
<tr><td>Invited Talks</td><td>**Tree distance matrices and their minors**</td><td></td></tr>
<tr><td></td><td>Combinatorics Seminar, University of Michigan</td><td>October 2025</td></tr>
<tr><td></td><td>Discrete Math Seminar, University of South Carolina</td><td>October 2025</td></tr>
<tr><td></td><td>(poster) FPSAC 2025, Sapporo Japan</td><td>July 2025</td></tr>
<tr><td></td><td>ILAS 2025, Kaohsiung Taiwan</td><td>June 2025</td></tr>
<tr><td></td><td>05C50 Online, University of Manitoba</td><td>May 2024</td></tr>
<tr><td></td><td>**Ricci flow on graphs from effective resistance**</td><td></td></tr>
<tr><td></td><td>National Taiwan Normal University Colloquium</td><td>December 2025</td></tr>
<tr><td></td><td>National Central University Colloquium</td><td>September 2025</td></tr>
<tr><td></td><td>NCTS Postdoc Symposium</td><td>September 2025</td></tr>
<tr><td></td><td>JMM 2024, Special Session on Ricci curvatures on graphs and applications</td><td>January 2024</td></tr>
<tr><td></td><td>**Tropical weights of Weierstrass points**</td><td></td></tr>
<tr><td></td><td>NCTS Tropical Geometry in Taiwan</td><td>August 2025</td></tr>
<tr><td></td><td>Taipei Postdoc Seminar, NCTS</td><td>March 2025</td></tr>
<tr><td></td><td>Informal Tropical Geometry Conference, National Taiwan University</td><td>March 2025</td></tr>
<tr><td></td><td>AMS Fall Sectional Meeting, University of Texas San Antonio</td><td>September 2024</td></tr>
<tr><td></td><td>(poster) WAGS 2023, University of Washington</td><td>April 2023</td></tr>
<tr><td></td><td>**OLA encoding of phylogenetic trees**</td><td></td></tr>
<tr><td></td><td>(poster) Current Methods and Open Problems in Phylogenetics, ICERM</td><td>September 2024</td></tr>
<tr><td></td><td>**Uniform bounds for torsion packets on tropical curves**</td><td></td></tr>
<tr><td></td><td>(poster) CCAAGS in honor of Bernd Sturmfels, University of Washington</td><td>June 2022</td></tr>
<tr><td></td><td>Tropical Geometry in Frankfurt (online), Goethe University Frankfurt</td><td>January 2022</td></tr>
<tr><td></td><td>Algebra and Algebraic Geometry Seminar, University of Washington</td><td>January 2021</td></tr>
<tr><td></td><td>**Derangements and the p-adic incomplete gamma function**</td><td></td></tr>
<tr><td></td><td>(poster) FPSAC 2022, Bangalore India</td><td>July 2022</td></tr>
<tr><td></td><td>Algebra and Algebraic Geometry Seminar, University of Washington</td><td>November 2021</td></tr>
<tr><td></td><td>**Weierstrass points on tropical curves**</td><td></td></tr>
<tr><td></td><td>Algebra and Number Theory Seminar, University of Kentucky</td><td>November 2019</td></tr>
<tr><td></td><td>Algebra and Algebraic Geometry Seminar, University of Washington</td><td>October 2019</td></tr>
<tr><td></td><td>SIAM Applied Algebraic Geometry, Bern Switzerland</td><td>July 2019</td></tr>
<tr><td></td><td>(poster) FPSAC 2019, Ljubljana Slovenia</td><td>July 2019</td></tr>
<tr><td></td><td>Analysis and Geometry Seminar, Central Michigan University</td><td>February 2019</td></tr>
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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

SERVICE

Referee for: Journal of Integer Sequences, Electronic Journal of Combinatorics, Annals of Combinatorics, Molecular Biology and Evolution, Philosophical Transactions of the Royal Society B

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

Co-organizer, Taipei Postdoc Seminar	Fall 2025 - Spring 2026
Co-organizer, JMM Special Session on Ricci curvatures of graphs and applications (MRC)	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

EXPOSITORY TALKS

National Chung Hsing University Colloquium

Tree distance matrices and their minors	December 2024

National Yang Ming Chiao Tung University Colloquium

Perspectives on tropical geometry, old and new	December 2024

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

MAA MathFest, Chicago IL

Descartes' rule of signs and beyond	July 2017
Looking for a "local" Gauss–Lucas theorem	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
A brief tour of outer space	October 2018

Tropical Grassmannians and friends	February 2018
Exponentially many perfect matchings	October 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
How to prove the Riemann hypothesis	September 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		
	Autoformalization for the Working Mathematician, ICERM	April 2025
	AI for Mathematics and Theoretical CS, Simons Institute	April 2025
	Combinatorics of Moduli of Curves, BIRS	July 2024
	MRC on Ricci curvature on graphs and applications to data science, New York	May 2023
	SageDays 114, IMS (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 [...] 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, NetworkX, PyTorch, Scala, SageMath
	- Language: English (native), Chinese (proficient), Russian (beginner)