Diana Davis

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Employment	**Phillips Exeter Academy**, Instructor in Mathematics	2020–
	Swarthmore College, Visiting Assistant Professor	2017–2020
	Williams College, Visiting Assistant Professor	2016–2017
	Northwestern University, Postdoctoral Lecturer	2013–2016

Research Interests: Polygonal billiards, discrete dynamical systems, planar tilings, tiling billiards; gerrymandering reform, data science

Education:

Brown University
Ph.D. in Mathematics, 2013. Advisor: Richard Schwartz
Thesis: *Cutting sequences on translation surfaces.*
Sc.M. in Mathematics, 2010.

Williams College
B.A. in Mathematics, 2007, *cum laude*, with honors in mathematics

Papers * student coauthors

1. Sara Asgari*, Quinn Basewitz*, Ethan Bergmann*, Jackson Brogsol*, Nathaniel Cox*, Diana Davis, Martina Kampel*, Becca Keating*, Katie Knox*, Angus Lam*, Jorge Lopez-Nava*, Jennifer Paige*, Nathan Pitock*, Victoria Song*, Dylan Torrance*, Assessing congressional districting in Maine and New Hampshire, preprint (2020).
2. Harrison Bray, Diana Davis, Kathryn Lindsey and Chenxi Wu, *The shape of Thurston's master teapot*, **Advances in Mathematics** 277 (2021).
3. Jon Chaika, Diana Davis, *The typical measure preserving transformation is not an interval exchange transformation*, submitted (2020).
4. Diana Davis and Samuel Lelièvre, *Periodic trajectories on the double pentagon and golden L*, submitted (2019).
5. Aaron Calderon, Solly Coles*, Diana Davis, Justin Lanier and André Oliveira, *How to hear the shape of a billiard table*, submitted (2018).
6. Paul Baird-Smith*, Diana Davis, Elijah Fromm* and Sumun Iyer*, *Tiling Billards on Triangle Tilings, and Interval Exchange Transformations*, accepted pending revision in **Bulletin of the London Mathematical Society** (2019).
7. Diana Davis, Irene Pasquinelli and Corinna Ulcigrai, *Cutting sequences on Bouw-Möller surfaces: an S-adic characterization*, to appear in **Annales Scientifiques de l'École Normale Supérieure** (2019).
8. Diana Davis and W. Patrick Hooper, *Periodicity and ergodicity in the trihexagonal tiling*, **Commentarii Mathematici Helvetici**, 93(4), pp. 661–707 (2018).

9. Diana Davis, Kelsey DiPietro*, J.T. Rustad*, and Alexander St Laurent*, *Negative refraction and tiling billiards*, **Advances in Geometry**, 18(2), 133–159 (2018).
10. Keith Burns, Orit Davidovich and Diana Davis, *Average pace and horizontal chords*, **Mathematical Intelligencer**, 39(4), 41–45 (2017).
11. Diana Davis, Victor Dods, Cynthia Traub and Jed Yang, *Geodesic trajectories on the regular tetrahedron and the cube*, **Discrete Mathematics**, 340(1), 3183-3196 (2017).
12. Diana Davis, *Cutting sequences on translation surfaces*, **New York Journal of Mathematics**, Volume 20, 399–429 (2014).
13. Diana Davis, *Cutting sequences, regular polygons, and the Veech group*, **Geometriae Dedicata**, 162(1), 231–261 (2013).
14. Diana Davis, Dmitry Fuchs and Sergei Tabachnikov, *Periodic trajectories in the regular pentagon*, **Moscow Mathematical Journal**, Volume 3, 439–461 (2011).
15. Joseph Corneli, Ivan Corwin, Stephanie Hurder, Vojislav Šešum, Ya Xu, Elizabeth Adams, Diana Davis, Michelle Lee, Regina Visocchi and Neil Hoffman, *Double Bubbles in Gauss Space and Spheres*, **Houston Journal of Mathematics**, 34(1), 181–204 (2008).
16. Elizabeth Adams, Ivan Corwin, Diana Davis, Michelle Lee and Regina Visocchi, *Isoperimetric Regions in Gauss Sectors*, **Rose-Hulman Undergraduate Mathematics Journal**, 8(1), (2007).

Pedagogy

17. Diana Davis, *Inquiry-based learning in a first-year honors course*, **PRIMUS**, 28(5), 387–408 (2018).

Books

18. Diana Davis (Editor) *Illustrating Mathematics*, **AMS** (2020).
19. Diana Davis, *Lines in positive genus: An introduction to flat surfaces*, in *Dynamics done with your bare hands*, **European Mathematical Society** (2017).

Exposition

20. Diana Davis, *Billiards and Flat Surfaces*, **Snapshots of Modern Mathematics for Oberwolfach**, No. 1 (2015).
21. The above was subsequently translated into German and published as *Billard und ebene Flächen*, in **Notices of the German Mathematical Society**, Volume 23, Issue 3, 151–155 (2015).

Honors and Awards

Phillips Exeter Academy, Innovation award ($5000 towards research)	2022
Northwestern University, Math Dept award for Excellence in Teaching	2016
Brown University, Presidential Award for Excellence in Teaching finalist	2012
"Dance Your Ph.D." competition winner – Physics and Math category	2012
Brown University, Math Dept Outstanding Teaching Award	2011
Williams College, Morgan Prize for Excellence in Teaching	2007

Data science

Organizer & research mentor, Districting Data REU — Summer 2020
Trained 40 students to collect data, and clean and merge it using *pandas*
Published shapefiles for New Hampshire, Nebraska, Maine for others to use
Wrote the article [1] using our data to assess gerrymandering in ME & NH

Summer research programs advised

Summer@ICERM, Brown University, co-organizer — 2021
Organized program, advised billiards research for 19 undergraduates

PROMYS, Boston University, research mentor — 2019, 2020
Gerrymandering research project for 4–5 high school students

Polygonal Billiards cluster at Tufts University, member — 2017
Participated equally with faculty, postdocs, grad students and undergrads, resulting in the paper [5]

SMALL REU at Williams College, faculty — 2016
Advised three students on tiling billiards, resulting in the paper [6]

Summer@ICERM REU, TA — 2012, 2013
Advised groups of students, leading to three publications including [9]

Teaching Experience

College courses taught using a problem-centered curriculum that I wrote, with a discussion-based classroom

Calculus I	Swarthmore F17
Discrete mathematics with gerrymandering	Swarthmore F18
Multivariable calculus	Nw S16; Will S17; Sw F18, S19, S20
Real analysis	Swarthmore S18, F19
Introduction to proof	Northwestern S16
Geometry, surfaces & billiards	Williams F16

Courses taught in the lecture method

The magic of numbers	Northwestern W14
Combinatorial game theory	Northwestern S14
Calculus I	Brown F10
Multivariable calculus	Brown F11; Nw W14, F14, W15, W16; Sw S18
Linear algebra	Brown S13; Nw F13, F14, F15
Introduction to proof	Northwestern F13, S14
Applied real analysis	Williams F16

Course Head for first-year honors sequence at Northwestern 2015–2016
Coordinated instruction and exams for six sections, four instructors, three TAs

High school courses

Real analysis	Exeter S22
Multivariable calculus	Exeter F20, W21, S21, F21, W22, S22
Billiards, surfaces and geometry	Exeter S21
Calculus I and II	Exeter W22, S22
Trigonometry & pre-calculus	Exeter F21, W21, S21, F21
Geometry	Exeter W21, F21

Talks

I have given over 100 talks in 24 states and 10 countries:

Keynote Talks	Fields Institute, Symposium for M. Mirzakhani, student talk	November 2018
	University of Oklahoma Math Day, plenary speaker	November 2019
	University of Glasgow, LMS popular lecture	September 2020
	Math Encounters, National Museum of Mathematics	February 2021
International Talks	University of Bristol (U.K.)	February 2012
	Freie Universität Berlin (Germany)	November 2012
	Oxford University (U.K.)	December 2012
	Oberwolfach, conference on flat surfaces (Germany)	March 2014
	CIRM, two conferences on Teichmüller space (France)	July 2015, Feb. 2017
	Tel Aviv University (Israel)	January 2018
	Institut Fourier, conference on Teichmüller dynamics (France)	June 2018
	Aix-Marseille Université (France)	July 2018
	Trinity College, Hamilton Geometry & Topology Workshop (Ireland)	Aug. 2018
	Institut des Hautes Études Scientifiques (France)	March 2019
	University of Luxembourg (Luxembourg)	June 2019
	Brazil-France Joint Mathematical Congress, IMPA (Brazil)	July 2019
	Université Sorbonne (Jussieu), LPSM (France)	March 2020
	Université Paris-Saclay (talk given in French!)	May 2020
	CIRM, conference on differential geometry (France)	October 2021
	IST Austria, DynamIST seminar	March 2022
Selected Seminar Talks	Harvard University, Geometry & Dynamics Seminar	February 2013
	Yale University, Geometry & Topology Seminar	April 2013
	University of Utah, Max Dehn Seminar	April 2014
	Northwestern University, Dynamics Seminar	October 2013, January 2015
	University of Minnesota, Combinatorics Seminar	February 2015
	University of Chicago, Dynamics Seminar	March 2014, November 2015
	Penn State University, Dynamical Systems Seminar	November 2015
	U.S. Naval Academy, Seminar	January 2016
	City University of New York, Dynamical Systems Seminar	April 2017
	Brown University, Geometry & Topology Seminar	November 2017
	University of Michigan, Geometry Seminar	November 2017
	University of Maryland, Dynamics Seminar	February 2013, March 2018
	Boston College, Dynamics Seminar	March 2018
	Boston University, Dynamical systems seminar	January 2019
	Rutgers University, Topology seminar	March 2019
	Ohio State University, Ergodic theory seminar	April 2019
	Duke University, Geometry & Topology seminar	September 2019
Selected Pedagogy Talks	National IBLT Conference (interactive session)	June 2019
	UNC Greensboro, teaching colloquium	September 2021
	NCSSM Contemporary Mathematics Conference	February 2022

Mini Courses

Summer School on Boundaries and Dynamics, Notre Dame University May 2015
A 4-day, 6-hour introduction to flat surfaces for undergraduates
Lecture notes from this course are the book[19]

Anja Greer Conference on Mathematics and Technology 2012, 13, 15, 17, 19, 22
6-day, 10-hour courses for high school math teachers, on how to write and teach a problem-centered, discussion-based math course

Research students

High school student research on gerrymandering

Corinne Mulvey, Equal splits of vertex-weighted trees 2020–2021

Karthik Seetharaman, A comparison of metrics for the identification of partisan gerrymandering 2020–2021

Charlie Du, Tati Kong, Zoe Shleifer, Steven Tang, How we used math to explore racial segregation in Pennsylvania public school districting Summer 2020

Jiahua Chen, Aneesha Manne, Rebecca Mendum, Poonam Sahoo, Alicia Yang, *Minority voter distributions and partisan gerrymandering* Summer 2019

Undergraduate thesis students at Williams College 2016–2017

Megumi Asada *Periodic paths on the triangle and hexagon billiard tables*

Paul Baird-Smith *Finite systems of fixed-length cranks*

Dylanger Pittman *Double bubbles on the real line with log-convex density*

Grants

AMS Travel Grant for the ICM in St. Petersburg, Russia ($3500, cancelled) 2022

AMS Travel Grant for the ICM in Seoul, South Korea ($3700) 2014

GAANN Fellowship (graduate student salary support) 2010–2012

Conference organization

Organizer, LGBTQ+ geometry & dynamics conference at Michigan June 2019

MAA session on Beauty & Art from Research Mathematics at JMM Jan. 2019

AMS MRC on dynamical systems, conference assistant June 2017

Service

Exeter faculty advisor to Geometry Club and Matter Magazine 2021–

NSF review panel 2021

AMS Epsilon Fund committee chair 2020–2021

AMS Epsilon Fund committee 2019–2020

Swarthmore organizer for student lunches with colloquium speakers 2019–2020

Swarthmore College AWM student chapter advisor 2018–2020

Williams College AMS student chapter advisor 2016–2017

Williams College faculty affiliate to Men's and Women's Cross Country 2016–2017

Northwestern University Women in Mathematics co-organizer 2014–2016

Northwestern University Dynamics Seminar co-organizer 2013–2015

AMS Graduate Working Group Committee 2010–2011

AMS Graduate Student Blog 2009–2012

Brown University Running Club president 2009–2012

Invited research visits

Summer 2022	1 week	Heidelberg University, with Anja Randecker
Summer 2022	1.5 weeks	CIRM, with Serge Troubetskoy
Spring 2022	2 weeks	Institut des Hautes Études Scientifiques
Spring 2020	13 weeks	Institut des Hautes Études Scientifiques
Fall 2019	14 weeks	Illustrating Mathematics semester, ICERM
March 2019	1.5 weeks	Institut des Hautes Études Scientifiques
July 2018	1 week	Lyon, France; with Olga Paris-Romaskevich
March 2018	1 week	Boston; with Kathryn Lindsey & Chenxi Wu
January 2018	1.5 weeks	Tel Aviv, Israel; with Barak Weiss
October 2017	1.5 weeks	Seattle; with Jayadev Athreya & Samuel Lelièvre
July 2015	3 weeks	Paris, France; with Samuel Lelièvre

Outreach for Children

Females Excelling in Math, Engineering, and Science, Michigan — Nov. 2017

Take our Children to Work Day, Northwestern University — April 2016

Hands-on activity on the Fold-and-Cut Theorem

Other Exposure

My mathematical art has been shown at:

- Bridges Conference (Helsinki) — August 2022
- JMM Mathematical Art Exhibition (virtual) — January 2021
- ICERM, Illustrating Mathematics art exhibition, Providence, RI — Fall 2019
- Mathpalooza! Julia Robbins Math Festival, Atlanta, GA — March 2019
- JMM Mathematical Art Exhibition, Baltimore, MD — January 2019

My "viral video" explaining my Ph.D. result through dance has been shown at:

- Public lecture for high school students, Seoul National Univ. — March 2018
- ICM (Seoul), IMAGINARY Exhibition — August 2014
- Bridges Conference (Seoul), Short Movie Festival — August 2014
- Heidelberg Laureate Forum, in Curt McMullen's talk — September 2013

Student colloquium talks advised

Williams College 2016–2017

Troy Cipprelle	*The art (and math) of illumination*
Si Young Mah	*Map coloring for mathematicians*
D. Patrick Gainey	*Geodesics on the tetrahedron*
Chinmayi Manjunath	*Seven bridges of Königsberg*
Ariana Ross	*The Fold-and-Cut problem*
Bridget Bousa	*Julia sets and the Mandelbrot set*
Megumi Asada	*Periodic paths on the triangle and hexagon billiard tables*
Paul Baird-Smith	*Finite systems of fixed-length cranks*
Dylanger Pittman	*Double bubbles on the real line with log-convex density*

I advised 9/90 of the year's colloquium talks, and 3/5 of the year's five best talks.

Other Skills

I program in Sage for my research; also familiar with Java, C++, HTML
Conversational and mathematical French
Competitive long-distance runner
I ran every day (at least 2 miles) for over 6 years, from 2009–2015
PRs: mile - 5:01, 5k - 17:03, 10k - 35:35, half marathon - 1:21:09
Certified in CPR, 14-passenger mini bus driving, safe small boat handling

References

Richard Schwartz, Brown University (Ph.D. advisor)
Curtis McMullen, Harvard University
Moon Duchin, Tufts University
John Smillie, University of Warwick
John Alongi, Northwestern University
Aimee Johnson, Swarthmore College
Susan Loepp, Williams College
Gwynneth Coogan, Phillips Exeter Academy
Stephanie Bramlett, Phillips Exeter Academy