

CURRICULUM VITAE

Aaron Abrams

Mathematics Department
Washington and Lee University
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Positions

Professor of Mathematics, Washington and Lee University, 2020–present.
(Previously Associate Professor of Mathematics, 2014–2020,
and Assistant Professor of Mathematics, 2012–2014.)

Assistant Professor of Mathematics, Emory University, 2005–2012.

NSF VIGRE Postdoctoral Fellow, University of Georgia, 2001–2004.

Franklin Postdoctoral Fellow, University of Georgia, 2000–2001.

Awards

Collaboration Grant for Mathematicians, Simons Foundation, 2013–2018.

The Lester R. Ford Award, Mathematical Association of America, 2011.

Research in Pairs Programme, Mathematisches Forschungsinstitut Oberwolfach, 2011.

Structured Quartet Research Ensemble, American Institute of Mathematics, 2009–2011.

Press

Related to lotteries

Between 2012 and 2018 I was featured in several local, national, and international media outlets, including NPR’s “All Things Considered,” the BBC’s “BBC World News,” the ABC News show “20/20,” CNN’s “CNN Newsroom,” as well as numerous other newspaper, radio, and television productions.

Related to topology and robotics

Science: My work was profiled by D. Mackenzie in “Topologists and Roboticians Explore an ‘Inchoate World,’” *Science*, vol. 301 no. 5634 (8 August 2003), pg. 756.

Education

Ph.D., University of California, Berkeley, Mathematics, 2000.

B.S. with highest honors, University of California, Davis, Mathematics, 1993.

Fellowships, Visiting Positions, Consultancies

Visiting Scholar, Institute of Mathematical Science, University of Virginia, Spring 2020.

Research Member, ICERM, Fall 2019.

Director’s Mathematician in Residence, Budapest Semesters in Mathematics, Summer 2019.

Research Member, ICERM, Spring 2015.
 Research Member, Mathematical Sciences Research Institute, Fall 2011.
 Postdoctoral Fellow, Mathematical Sciences Research Institute, Fall 2004.
 Visiting Research Fellow, University of California, Berkeley, Fall 2003.
 Mathematics Consultant, Ember Corporation, Summer 2002.

Advisees

Postdoctoral: Pallavi Dani, Emory University, 2008–2009.

Ph.D. student: Praphat Fernandes, Emory University, 2007–2012.

Dissertation: *Quasi-isometric rigidity of graph braid groups*

Undergraduate thesis students:

Callie Garst, Washington and Lee University, 2021.

Thesis: *TBD*

Jiahao (Eric) Zhang, Washington and Lee University, 2020.

Thesis: *Germ ordering and the D-avoiding problem*

Michelle Chu, Emory University, 2011.

Thesis: *Hyperbolic 3-manifolds as discretized configuration spaces of simple graphs*

Phillip Andreae, Emory University, 2010.

Thesis: *Relationships between areas in a triangulation of a square*

Scholarly works

Research articles

- “An illustrated encyclopedia of area relations,” with J. Pommersheim, submitted for publication. Preprint at [arxiv:2105.00563](https://arxiv.org/abs/2105.00563).
- “Generalized dissections and Monsky’s Theorem,” with J. Pommersheim, to appear in *Discrete and Computational Geometry*. Preprint at [arxiv:2006.04286](https://arxiv.org/abs/2006.04286).
- “One-Dimensional Packing: Maximality and Rationality,” with H. Landau, Z. Landau, J. Pommersheim, J. Propp, and A. Russell, submitted for publication. Preprint at [arxiv:1807.06495](https://arxiv.org/abs/1807.06495).
- “Group trisections and smooth 4-manifolds,” with D. Gay and R. Kirby, *Geometry & Topology* 22 (2018), pp. 1537–1545.
- “Fixed-energy harmonic functions,” with R. Kenyon, *Discrete Analysis* 2017:18, 21 pp.
- “Spaces of polygonal triangulations and Monsky polynomials,” with J. Pommersheim, *Discrete and Computational Geometry*, vol. 51 no. 1 (2014), pp. 132–160.
- “Homological and homotopical Dehn functions are different,” with N. Brady, P. Dani, and R. Young, *Proceedings of the National Academy of Sciences*, vol. 110 no. 48 (Nov. 26, 2013), pp. 19206–19212.
- “Sums of twisted circulants,” with H. Landau, Z. Landau, and J. Pommersheim. Preprint at [arxiv:1607.05716](https://arxiv.org/abs/1607.05716).
- “A central limit theorem for repeating patterns,” with E. Babson, H. Landau, Z. Landau, and J. Pommersheim, [arXiv:1204.2872](https://arxiv.org/abs/1204.2872).
- “Dull cut off for circulants,” with E. Babson, H. Landau, Z. Landau, and J. Pommersheim. Submitted for publication; see [arXiv:1208.5235](https://arxiv.org/abs/1208.5235).

- “Pushing fillings in right-angled Artin groups,” with N. Brady, P. Dani, M. Duchin, and R. Young, *Journal of the London Mathematical Society*, vol. 87 no. 3 (2013), pp. 663–688.
- “Distributions of order patterns of interval maps,” with E. Babson, H. Landau, Z. Landau, and J. Pommersheim, *Combinatorics, Probability, & Computing*, vol. 22 no. 3 (2013), pp. 319–341.
- “Discretized configurations and partial partitions,” with D. Gay and V. Hower, *Proceedings of the American Mathematical Society*, vol. 141 (2013), pp. 1093–1104.
- “Filling loops at infinity in the mapping class group,” with N. Brady, P. Dani, M. Duchin, and R. Young, *Michigan Math Journal* vol. 61 no. 4 (2012), pp. 867–874.
- “Optimal estimators for threshold-based quality measures,” with S. Ganzell, H. Landau, Z. Landau, J. Pommersheim, and E. Zaslow, *Journal of Probability and Statistics*, vol. 2010, Article ID 752750, 15 pages, 2010.
- “The number of possibilities for random dating,” with E. R. Canfield and A. Granville, *Journal of Combinatorial Theory, Series A*, vol. 115 (2008), pp. 1265–1271.
- “Random multiplication approaches uniform measure in finite groups,” with H. Landau, Z. Landau, J. Pommersheim, and E. Zaslow, *Journal of Theoretical Probability*, vol. 20 no. 1 (2007), pp. 107–118.
- “Distances of Heegaard splittings,” with S. Schleimer, *Geometry & Topology*, vol. 9 (2005), pp. 95–119.
- “State complexes for metamorphic systems,” with R. Ghrist, *International Journal of Robotics Research*, vol. 23 no. 7–8 (2004), pp. 809–824.
- “Circles minimize most knot energies,” with J. Cantarella, J. Fu, M. Ghomi, and R. Howard. *Topology*, vol. 42 no. 2 (2003), pp. 381–394.
- “An iterated random function with Lipschitz number 1,” with H. Landau, Z. Landau, J. Pommersheim, and E. Zaslow, *Theory of Probability and its Applications*, vol. 47 no. 2 (2003), pp. 286–300.
- “Configuration spaces of colored graphs,” *Geometriae Dedicata*, vol. 92 (2002), pp. 185–194.
- “Evasive random walks and the clairvoyant demon,” with H. Landau, Z. Landau, J. Pommersheim, and E. Zaslow, *Random Structures & Algorithms*, vol. 20 no. 2 (2002), pp. 239–248.
- “Yet another species of forbidden distances chromatic number,” with P. Johnson, Jr., *Geombinatorics*, vol. 10 no. 3 (2001), pp. 89–95.
- “The k^{th} upper chromatic number of the line,” *Discrete Mathematics*, vol. 169 (1997), pp. 157–162.
- “The probability that $(a, b) = 1$,” with M. Paris, *College Mathematics Journal*, vol. 23 no. 1 (1992), pg. 47.

Visualization

- “Configuration spaces,” with R. Antonsen, visualization software in development.
- “Hyperbolic paper,” with S. Paul, in the volume *Illustrating Mathematics*, published by AMS, 2020.
- “Measuring areas of curves,” with J. Cantarella and T. Cantarella, cover art for *Proceedings of the National Academy of Sciences*, vol. 110 no. 48 (Nov. 26, 2013).

Expository works

- “Braids,” a chapter in *Office hours with a geometric group theorist*, eds. M. Clay and D. Margalit, Princeton University Press (2017).
- “Should I play Powerball? A mathematician explains whether the \$1.5 billion jackpot makes the lottery a good bet,” published online by *Slate* at <http://www.slate.com>, Jan. 13, 2016.
- “Finding good bets in the lottery, and why you shouldn’t take them,” with S. Garibaldi, *American Mathematical Monthly*, vol. 117 no. 1 (2010), pp. 3–26.
- “A million-dollar proof,” *The Mathematical Intelligencer*, vol. 29 no. 4 (2007), pg. 8.
- “Finding topology in a factory: configuration spaces,” with R. Ghrist, *American Mathematical Monthly*, vol. 109 no. 2 (2002), pp. 140–150.
- “Upper chromatic numbers: an update,” *Geombinatorics*, vol. 10 no. 1 (2000), pp. 4–11.

Invited Presentations

Colloquia

- Reed College Mathematics Colloquium, March 2020.
- BSM Colloquium, Rényi Institute (Hungarian Academy of Sciences), July 2019.
- Penn State University Mathematics Colloquium, September 2015.
- Reed College Mathematics Colloquium, October 2014.
- Reed College Mathematics Colloquium, April 2013.
- University of Denver Colloquium, February 2013.
- University of Georgia Colloquium, January 2013.
- Reed College Mathematics Colloquium, February 2012.
- San Jose State University Colloquium, November 2011.
- Penn State University Colloquium, October 2011.
- Oregon State University Colloquium, March 2011.
- University of Cape Town Undergraduate Colloquium, August 2009.
- Reed College Mathematics Colloquium, October 2008.
- Reed College Mathematics Colloquium, April 2006.
- Claremont Mathematics Colloquium, February 2005.
- Emory University Mathematics Colloquium, February 2004.
- University of Oregon Mathematics Colloquium, December 2003.
- Emory University Mathematics Colloquium, April 2003.

Research Conferences

[CANCELLED] 17th Chico Topology Conference (at CSU Chico), April 2020.
 Eastern sectional AMS meeting (at Northeastern University), April 2018.
 Spring Topology and Dynamics Conference (at Auburn University), March 2018.
 Virginia Topology Conference (at University of Virginia), November 2016.
 Unusual Configuration Spaces (at ICERM), September 2016.
 Inverse Problems Symposium (at Virginia Military Institute), June 2016.
 Eastern sectional AMS meeting (at Rutgers University), November 2015.
 Eastern sectional AMS meeting (at Baltimore, MD), March 2014.
 Spring Topology and Dynamics Conference (at University of Richmond), March 2014.
 Southeastern sectional AMS meeting (at Statesboro, GA), March 2011.
 Discrete Mathematics and Algorithms Mini-conference (at Clemson, SC), October 2010.
 Eastern sectional AMS meeting (at Syracuse, NY), October 2010.
 Wasatch Topology Conference (at Park City, Utah), August 2010.
 The UnKnot Conference (at Denison University), July 2009.
 Seventh AMS-SMM joint meeting (at Zacatecas, Mexico), May 2007.
 AMS-MAA joint national meetings (at New Orleans, LA), January 2007.
 Southeast Geometry Conference (at Georgia Tech), December 2005.
 AMS Central Section meeting (at Evanston, IL), October 2004.
 AMS Western Section meeting (at Albuquerque, NM), October 2004.
 Topology and Robotics (a conference at ETH Zürich, Switzerland), June 2003.
 AMS Southeastern Section meeting (at Baton Rouge, LA), March 2003.
 AMS-MAA joint national meetings (at New Orleans, LA), January 2001.
 Georgia International Topology Conference (at the University of Georgia), July 2000.
 Paul Erdős and his Mathematics (a conference at the Hungarian Academy of Sciences
 in Budapest, Hungary), July 1999 (poster session).
 AMS Western Section meeting (at Eugene, Oregon), June 1994.
 AMS-MAA-CMS joint national meetings (at Vancouver, B. C.), August 1993.

Research Seminars

Geometry Seminar, University of Virginia, March 2020.
 Northeastern University Topology Seminar, October 2019.
 University of Georgia Topology Seminar, March 2015.
 University of Illinois Integrability and Representation Theory Seminar, October 2014.
 University of Southern California Probability Seminar, September 2014.
 University of Virginia Topology Seminar, February 2014.
 Séminaire de Géométrie Analytique, Université de Rennes 1, May 2013.
 Georgia Tech Topology Seminar, February 2012.
 University of Georgia Topology Seminar, Spring 2012 (series of 3 talks).
 UC Berkeley Topology Seminar, December 2011.
 Louisiana State / Iowa / Rice Joint Virtual Topology Seminar (at LSU), May 2011.
 North Carolina State University Algebra and Combinatorics Seminar, May 2010.
 University of Cape Town Geometry Seminar (two lectures), August 2009.
 University of Georgia Geometry Seminar, January 2007.
 Georgia Tech Topology Seminar, November 2005.
 UC Santa Barbara Topology Seminar, January 2005.
 Claremont Topology Seminar, January 2005.
 UC Davis Discrete Math Seminar, December 2004.
 UC Berkeley Topology Seminar, September 2004.

Mathematical Sciences Research Institute Postdoc Seminar, August 2004.
 Columbia University Geometric Topology Seminar, January 2004.
 UC Davis Topology Seminar, October 2003.
 Mathematical Sciences Research Institute Postdoc Seminar, September 2003.
 UC Berkeley Topology Seminar, September 2003.
 University of Illinois Computational Topology Seminar, December 2002.
 Georgia Tech Combinatorics Seminar, October 2000.
 UC Davis Topology Seminar, June 2000.

Expository lectures

REU Seminar, St. Mary's College of Maryland, July 2016.
 MASS Colloquium, Penn State University, September 2015.
 Purdue University "Basic Notions" seminar, November 2014.
 Prime Time Theorem, HCSSiM, July 2013.
 Pi Mu Epsilon initiation ceremony, Washington and Lee University, April 2013.
 MASS Colloquium, Penn State University, October 2011.
 Undergraduate Seminar, Coastal Carolina University, April 2010.
 University of Cape Town Undergraduate Topology Seminar (two lectures), August 2009.
 Math/CS Graduate Student Seminar, Emory University, November 2008.
 Research Focus Group on Geometric Group Theory, UC Davis, June 2007.
 Emory University Undergraduate Math Majors Association, September 2007.
 Emory Math Club Lecture, Emory University, February 2007.
 Emory Math/CS Graduate Student Colloquium, Emory University, November 2005.
 University of Georgia VIGRE Seminar, various dates 2001–2007.
 Mathematics Advanced Study Semesters Colloquium, Penn State University, October 2003.
 Canada/USA Mathcamp Colloquium, University of British Columbia, July 2000.
 University of Georgia Math Club Lecture, various dates 2000–2002.
 UC Berkeley Mathematics Undergraduate Student Association Lecture, November 1998.
 UC Berkeley Graduate Student Colloquium, various dates 1993–2000.
 UC Davis Mathematics Awareness Week Lecture, April 1993.

Teaching Experience

Workshop and Short Course Design

"Rubik's Cube the Slow Way," 2016, 2017, 2020.
 Six hour workshop for 9th and 10th graders. Nueva School, San Mateo, CA.
 "How big is big? An exploration of infinity," 2017.
 Six hour workshop for 9th and 10th graders. Nueva School, San Mateo, CA.
 "The Shape of Space," 2016, 2020.
 Six hour workshop for 9th and 10th graders. Nueva School, San Mateo, CA.
 "The Mathematics of Knots," 2016.
 An online course for high school students taught through Pioneer Academics.
 "Introduction to Geometric Group Theory," 2012.
 One week workshop for graduate students at UC Berkeley, funded by NSF.
 "What is Geometric Group Theory?" 2012.
 Two week workshop for undergraduates at UC Berkeley, funded by NSF.

“Braids, graphs, and robots,” 2009.

One week course for graduate students. Part of “New Trends in Geometry and Topology,” at Shota Rustaveli State University, Batumi, (Republic of) Georgia.

Hampshire College Summer Studies in Mathematics:

Senior Staff 2012, 2014

Junior Staff 1993, 1998

Regular courses taught

First-year seminars:

Knots, surfaces, and space. The shape of space. Knot theory. Knots and surfaces.

Lower division courses:

Differential and integral calculus. Discrete mathematics. Linear algebra. Mathematical modeling. Precalculus. Multivariable calculus.

Interdisciplinary course:

Dimensions in Math and Art.

Upper division courses:

Mathematics of tiling. Abstract algebra. Hyperbolic geometry. Real analysis. Knot theory. Number theory. Graph theory. Geometric topology. Geometric group theory. Combinatorics. Foundations of mathematics. Seminar in low-dimensional topology.

Spring term courses:

Mathematics of tiling. Introduction to proof.

Independent study courses:

Continued fractions. Algebraic topology. The unsolvability of the word problem in groups.

Graduate courses:

Algebraic topology. Geometric group theory. Calculus on manifolds. Groups and topology.

Professional and Community Service

University Committee on Inclusion and Campus Climate, 2020–present.

Various W&L departmental and university committees, 2012–present.

Freedom U (Georgia): volunteer math teacher, 2014.

MSRI: Committee of Academic Sponsors, W&L representative, 2013–present.

Euclid Lab: Chairman, Board of Directors, 2012–present.

Marin Math Circle: guest presenter, 2011.

Berkeley Math Circle: guest presenter, 2011.

Atlanta Math Circle: Advisory Board and guest presenter, 2010–2012.

MSRI: Committee of Academic Sponsors, Emory representative, 2007–2012.

Sonia Kovalevsky Day (for high school girls): workshop leader, Emory University, 2008.

Georgia International Topology Conference: organizer, 2002.

Manitoba Theater Company: consultant on production of “Proof”, 2002.

American Regions Math League: assistant site coordinator, 1995–1999.

Referee for uncountably many professional journals, 1998–present.