

CURRICULUM VITAE

Aaron Abrams

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Education

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

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

Positions

Associate Professor of Mathematics, Washington and Lee University, 2014–present.

Assistant Professor of Mathematics, Washington and Lee University, 2012–2014.

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

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

Mathematics Consultant, Ember Corporation, Summer 2002.

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

Awards and Fellowships

Research Fellowship, Institute for Computational and Experimental Research in Mathematics,
Spring 2015.

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

Research Membership, Mathematical Sciences Research Institute, Fall 2011.

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.

Postdoctoral Fellowship, Mathematical Sciences Research Institute, Fall 2004.

Visiting Research Fellowship, University of California, Berkeley, Fall 2003.

Press

Related to lotteries

I have been featured in 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 Roboticists Explore an 'Inchoate World,'" *Science*, vol. 301 no. 5634 (8 August 2003), pg. 756.

Research Interests

Geometry and topology: Configuration spaces, tilings.

Geometric group theory: Cube complexes, CAT(0) geometry.

Combinatorics and applications: Graph theory, networks, robotics; probabilistic and topological methods.

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 honors students:

Phillip Andreae, Emory University, 2009–2010.

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

Michelle Chu, Emory University, 2010–2011.

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

Refereed Publications

Research articles

“Group trisections and smooth 4-manifolds,” with D. Gay and R. Kirby. Submitted for publication; see [arxiv:1605.06731](#).

“Sums of twisted circulants,” with H. Landau, Z. Landau, and J. Pommersheim. Submitted for publication; see [arxiv:1607.05716](#).

“Fixed-energy harmonic functions,” with R. Kenyon. Submitted for publication; see [arxiv:1505.05785](#).

“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.

★★ My artwork “Measuring areas of curves,” with J. Cantarella and T. Cantarella, appeared on the cover of this issue of PNAS.

“A central limit theorem for repeating patterns,” with E. Babson, H. Landau, Z. Landau, and J. Pommersheim, [arXiv:1204.2872](#).

“Dull cut off for circulants,” with E. Babson, H. Landau, Z. Landau, and J. Pommersheim. Submitted for publication; see [arXiv: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.

Expository works

- “Braids,” to appear as a chapter in *Office hours with a geometric group theorist*, eds. M. Clay and D. Margalit, Princeton University Press, expected 2016.
- “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

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

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.
 Special session on “Mathematical and Statistical Aspects of Inverse Problems.”
 Eastern sectional AMS meeting (at Rutgers, NJ), November 2015.
 Special session on “Applications of $CAT(0)$ Cube Complexes.”
 Eastern sectional AMS meeting (at Baltimore, MD), March 2014.
 Special session on “Low-dimensional topology and group theory.”
 Spring Topology and Dynamics Conference (at University of Richmond), March 2014.
 Special session on “Geometric group theory.”
 Southeastern sectional AMS meeting (at Statesboro, GA), March 2011.
 Special session on “Geometric group theory.”
 Discrete Mathematics and Algorithms Mini-conference (at Clemson, SC), October 2010.
 Eastern sectional AMS meeting (at Syracuse, NY), October 2010.
 Special session on “Topology and Combinatorics.”
 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.
 Special session on “Low Dimensional Topology.”
 AMS-MAA joint national meetings (at New Orleans, LA), January 2007.
 AMS special session on “Arrangements and Related Topics.”
 Southeast Geometry Conference (at Georgia Tech), December 2005.
 AMS Central Section meeting (at Evanston, IL), October 2004.
 Special session on “Mathematical Problems in Robotics.”
 AMS Western Section meeting (at Albuquerque, NM), October 2004.
 Special session on “Braids and knots.”
 Topology and Robotics (a conference at ETH Zürich, Switzerland), June 2003.
 AMS Southeastern Section meeting (at Baton Rouge, LA), March 2003.

Special session on “Arrangements in Topology and Algebraic Geometry.”
 AMS-MAA joint national meetings (at New Orleans, LA), January 2001.
 AMS special session on “Braid Groups and Configuration Spaces.”
 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.
 Special session on Undergraduate Research.
 AMS-MAA-CMS joint national meetings (at Vancouver, B. C.), August 1993.
 Special session on Undergraduate Research.

Research Seminars

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.
 Mathematics Advanced Study Semesters 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

Workshops and Summer Programs

“Rubik’s Cube the Slow Way,” January 2016.
 Six hour workshop for 9th and 10th graders. Nueva School, San Mateo, CA.

“The Shape of Space,” January 2016.
 Six hour workshop for 9th and 10th graders. Nueva School, San Mateo, CA.

“Introduction to Geometric Group Theory,” June 2012.
 One week workshop for graduate students. Funded by NSF via a UC Berkeley RTG grant.

“What is Geometric Group Theory?” June 2012.
 Two week workshop for undergraduates. Funded by NSF via a UC Berkeley RTG grant.

“Braids, graphs, and robots,” August 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

Courses taught

Graduate courses:

Algebraic Topology (Emory, 2005–06, 2010–11, 2012)
 *Group Theory and Topology (Emory, 2009)
 *Geometric Group Theory (Emory, 2008)
 *Topics in topology and group theory (University of Georgia, 2002)
 Calculus on manifolds (UGA, 2003)

Upper division courses:

*Geometric Group Theory (Washington & Lee, 2016)
 *Geometric Topology (Washington & Lee, 2012)
 Foundations of Mathematics (Emory, 2006, 2012)
 Combinatorics (UGA, 2002)
 Graph theory (UGA, 2002 and 2004)
 Number theory (UGA, 2003)

*Seminar on low-dimensional topology (University of California, Berkeley, 1997)
 Knot theory (Summer Institute for the Mathematical Sciences, 1997, TA)
 Real analysis (UCB, 1997, TA, Professional Development Program)
 Linear algebra (UCB, 1998, TA, PDP)
 Abstract algebra (UCB, 1998, TA, PDP; W&L, 2015–2016)

Lower division courses:

*Freshman Seminar: Knots, Surfaces, and Space (Emory, 2011)
 *Freshman Seminar: Knots and Surfaces (Emory, 2009)
 *Freshman Seminar: The Shape of Space (Emory, 2007; W&L, 2013)
 *Freshman Seminar: Knot Theory (Emory, 2007)
 *Calculus II (Emory, 2005, 2006, 2007, 2008, 2009; W&L, 2012, 2013, 2014)
 Mathematical Modeling (UGA, 2001)
 Precalculus (UCB, 1998)
 Differential calculus (UGA, 2000; W&L, 2013, 2015)
 Integral calculus (UCB, 1996, TA, PDP)
 Multivariable calculus (UCB, 2000, TA)
 Linear Algebra (W&L, 2013, 2014)
 Discrete mathematics (UCB, 1995)

Curriculum Development

I created or substantially redesigned the courses marked (*) above.

At UC Berkeley, I designed, created, and published materials for new IBL versions of lower division Linear Algebra and Integral Calculus courses.

Professional and Community Service

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 numerous professional journals, 1998–present.