

ALLISON H. MOORE

Department of Mathematics & Applied Mathematics
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RESEARCH INTERESTS

Knot theory, low-dimensional topology and geometry, Heegaard Floer and Khovanov homology.
Applications of knot theory to DNA topology and molecular biology.

EDUCATION

Ph.D. in Mathematics (2013) University of Texas
Advisor: Cameron McA. Gordon
Dissertation: *Behavior of Knot Floer Homology Under Conway and Genus Two Mutation*

B.S. in Mathematics, with High Honors (2006) University of Texas

B.A. in Plan II, with High Honors (2006)

Undergraduate Study, Math In Moscow (2004) Independent University of Moscow, Russia

APPOINTMENTS

Assistant Professor of Mathematics, Virginia Commonwealth University, August 2019 — current

Krener Assistant Professor of Mathematics, University of California, Davis July 2016 — June 2019
and postdoctoral appointment (Dept. of Microbiology and Molecular Genetics) July 2017 — June 2019

RTG Lovett Instructor of Mathematics, Rice University Fall 2013 — June 2016

Instructor of Record, University of Texas Fall 2012

Research / Teaching Assistant, University of Texas Fall 2006 — Spring 2013

Coordinator of the Saturday Morning Math Group Spring 2011 – Spring 2012

GRANTS AND HONORS

Grants and awards as faculty:

National Science Foundation DMS-2204148, \$294,584 (Sole PI) 08/01/2022–07/31/2025
Explorations in Entanglement and Knotting in Low-Dimensional Topology

VCU Breakthroughs Fund Award, \$200,000 (Co-PI) 07/30/2022–07/30/2024
Symmetry, Surfaces, and Knots: Empowering Middle School Students through Experiential Activities in Geometry

VCU Quest Fund Award, \$47,794 (Co-PI) 07/01/2022–12/31/2023
Quantum Fields and Knots: An Integrative Approach

Jeffress Trust Awards Program in Interdisciplinary Research, \$100,000 (Sole PI) 07/31/2021–04/30/2023
Advancing theory and exploring applications of unknotting to molecular biology

AIM SQuaRE (Co-PI), Travel support 2019; 2022-2023
Unknotting spatial graphs

Teaching awards:

G. Thomas Saltee Mathematics Teaching Award, University of California, Davis 2018 Frank Gerth III Teaching Excellence Award, University of Texas 2009

Postdoc and graduate awards and funding:

NSF DMS-1716987, \$290,000 July 18, 2017 – June 30, 2019
The Dynamic Genome: Studying the Interplay between Local Strand-Passage and Reconnection
Role: I co-designed the specific aims of the grant and co-wrote the proposal with the PI (M. Vazquez).
Support: Provided 50% of my postdoctoral funding for two years, travel and equipment.

NSF DMS-1148609 (Postdoctoral support only; no role in proposal preparation) Fall 2013–Spring 2016

NSF DMS-1148609 (Graduate student support only; no role in proposal preparation) Fall 2010, Summer 2011

Professional Development Award (Travel Grant), University of Texas Spring 2013

Math Department Summer Fellowship, University of Texas	Summer 2009, Summer 2007
Vigre NSF Research Grant for Undergraduates, University of Texas	Spring 2006
Mathematics Honored Graduate (Williams Scholar), University of Texas	2006
Chair's Honored Graduate, University of Texas	2006
AMS/NSF Scholarship Grant, <i>Math In Moscow</i>	2004
Plan II Research and Travel Grant, University of Texas	2004

PUBLICATIONS

Refereed publications (*Authorship is alphabetical.*)

1. Tye Lidman, Allison H. Moore and Claudius Zibrowius. L-space knots have no essential Conway spheres. arXiv:2006.03521 [math.GT], To appear in *Geometry & Topology*, (2022). 22 pages.
2. Eugene Gorsky, Beibei Liu, Tye Lidman and Allison H. Moore. Triple Linking Numbers and Heegaard Floer Homology. *International Mathematical Research Notices*, r nab368, (2022).
3. Stanislav Jabuka, Beibei Liu, and Allison H. Moore. Knot graphs and Gromov hyperbolicity. *Mathematische Zeitschrift*, 301(1):811–834, (2022).
4. Christopher Flippen, Allison H. Moore, and Essak Seddiq. Quotients of the Gordian and H(2)-Gordian Graphs. *Journal of Knot Theory and Its Ramifications*, 30(05):2150037, (2021).
5. Eugene Gorsky, Beibei Liu, and Allison H. Moore. Surgery on links of linking number zero and the Heegaard Floer d -invariant. *Quantum Topology*, 11(2):323–378, (2020).
6. Allison H. Moore and Mariel Vazquez. A note on band surgery and the signature of a knot. *Bulletin of the London Mathematical Society*, 52(6):1191–1208, (2020).
7. Tye Lidman, Allison H. Moore and Mariel Vazquez. Distance one lens space fillings and band surgeries on the trefoil knot. *Algebraic & Geometric Topology*; 19(5):2439–2484, (2019).
8. Allison H. Moore and Mariel Vazquez. The non-coherent band surgery model for site-specific recombination. In *Topology and geometry of biopolymers*, volume 746 of *Contemporary Mathematics*, pages 101–125. Amer. Math. Soc., Providence, RI, (2020).
9. Kenneth Baker and Allison H. Moore. Montesinos knots, Hopf plumbings, and L-space surgeries. *Journal of the Mathematical Society of Japan*, 70(1):95–110, (2018).
10. Tye Lidman and Allison H. Moore. Cosmetic surgery in L-spaces and nugatory crossings. *Transactions of the American Mathematical Society*, 369(5):3639–3654, (2017).
11. Tye Lidman and Allison H. Moore. Pretzel knots with L-space surgeries. *Michigan Mathematical Journal*, 65(1):105–130, (2016).
12. Allison H. Moore. Symmetric unions without cosmetic crossing changes. In Gail Letzter et al., editors, *Advances in the Mathematical Sciences: Research from the 2015 Association for Women in Mathematics Symposium*, volume 6, pages 103–116. Springer International Publishing, Cham, (2016).
13. Allison H. Moore and Laura Starkston. Genus-two mutant knots with the same dimension in knot Floer and Khovanov homologies. *Algebraic & Geometric Topology*, 15(1):43–63, (2015).

Preprints

14. Artem Kotelskiy, Tye Lidman, Allison H. Moore, Liam Watson, and Claudius Zibrowius. Cosmetic operations and Khovanov multicurves. arXiv:2109.14049 [math.GT], Submitted, (2021). 20 pages.
15. Kenneth Baker, Dorothy Buck, Allison H. Moore, Danielle O'Donnol, and Scott Taylor. Primality of theta-curves with proper rational tangle unknotting number one. arXiv:2201.08213 [math.GT], Submitted, (2022). 16 pages.
16. Matthew Elpers, Rayan Ibrahim, and Allison H. Moore. Determinants of simple theta curves and graphs with involutive symmetry. In preparation. 13 pages.

Software / Other

17. M. Nasrollahi, S. Witte and A. H. Moore. *BraidGenerator*: Software to generate random braid representatives of a fixed knot type via Markov chain. Open-source software, 2019. Publicly available on Github and PyPi.org.

Thesis

18. Allison H. Moore. *Behavior of Knot Floer Homology Under Conway and Genus Two Mutation*. PhD Thesis, Department of Mathematics, University of Texas at Austin, 2013.

CONFERENCE, COLLOQUIA AND SEMINAR PRESENTATIONS

Conferences and Workshops:

Canadian Mathematical Society Winter Meeting (Online)	Dec. 2021
Knots in Washington 49.5, George Washington University, Washington D.C.	Dec. 2021
Boston Graduate Topology Seminar, MIT, Boston MA	Nov. 2021
Workshop in Geometry Topology (Online), Texas Christian University	Jun. 2021
Lightning Talk (Online), 4D Topology ARC, American Institute of Mathematics	Mar. 2021
AMS Special Session on Geometry and Topology in Dimensions 3 and 4, Joint Meetings of the AMS/MAA	Jan. 2021
AMS Special Session on Applied Knot Theory, Fall Southeastern Sectional Meeting (Online)	Oct. 2020
Mini Symposium: Knot Theory on Okinawa, Okinawa Institute of Science and Technology, Okinawa, Japan	Feb. 2020
AMS Special Session on Applications and Computations in Knot Theory, Joint Meetings, Denver, CO	Jan. 2020
AMS Special Section on Floer homology, University of Wisconsin-Madison, Madison, WI	Sep. 2019
The Topology of Nucleic Acids, Banff International Research Center, Banff, Canada	Mar. 2019
Winter Meeting of the Canadian Mathematical Society, Session on Topology, Vancouver, BC, Canada	Dec. 2018
AMS Sectional on Mathematical Methods for Biopolymers, SFSU, San Francisco, CA	Nov. 2018
Topology in Dimensions 3, 3.5 and 4, University of California, Berkeley, CA	May. 2018
Eastern IL Integrated Conference in Geometry, Dynamics, and Topology, Charleston, IL	Apr. 2018
Summer School on Modern Knot Theory. University of Freiburg, Freiburg, Germany.	Jun. 2017
Joint Meetings of the AMS/MAA, Seattle, WA	Jan. 2016
Tech Topology Conference, Georgia Tech, Atlanta, GA	Dec. 2015
AMS Special Session on Knots, Links and 3-Manifolds, Rutgers, NJ	Nov. 2015
Workshop in Geometric Topology, TCU, Fort Worth, TX	Jun. 2015
Moab Topology Conference, Moab, UT	May 2015
AWM Research Symposium, University of Maryland, Baltimore, MD	Apr. 2015
AMS Sectional on Knot Theory and Floer-Type Invariants, East Lansing, MI	Mar. 2015
AMS Special Session on Knot Theory, Joint Meetings of the AMS/MAA, San Antonio, TX	Jan. 2015
AMS Sectional on Interactions between Knots and Manifolds, San Francisco, CA	Oct. 2014
AMS Sectional on Invariants in Low-Dimensional Topology, Baltimore, MD	Mar. 2014
AMS Sectional on Geometric Topology of Knots and 3-Manifolds, Philadelphia, PA	Oct. 2013
Rolsenfest, Centre International de Rencontres Mathématiques, Marseille, France	Jul. 2013
Joint Meetings of the AMS/MAA, San Diego, CA	Jan. 2013
Topology Students Workshop, Georgia Tech, Atlanta, GA	Jun. 2012
Joint Meetings of the AMS/MAA, Boston, MA	Jan. 2012
Graduate Student Topology and Geometry Conference, Michigan State University	Apr. 2011

Colloquia:

Colloquium, Virginia Commonwealth University, Richmond, VA	Dec. 2018
Colloquium, Western Washington University, Bellingham, WA	Nov. 2018
Colloquium, University of Nevada at Reno, Reno, NV	Oct. 2018
Colloquium, Texas State University, San Marcos, TX	Jan. 2018
Colloquium, Towson University, Towson, MD	Dec. 2017
Colloquium, University of Alabama, Tuscaloosa, AL	Feb. 2016
Colloquium, Sam Houston State University, Huntsville, TX	Oct. 2014
Colloquium, Rice University, Houston, TX	Sep. 2013
Colloquium, University of Nevada at Reno, Reno, NV	May 2013

Seminars:

Geometry and Topology Seminar, Le Centre de recherche en géométrie et topologie (CIRGET), Université du Québec à Montréal (Online)	April 2022
Geometry Seminar, University of Virginia, Charlottesville, VA	Nov. 2021
Topology Seminar, Boston College, Boston, MA	Nov. 2021
Topology Seminar, Oklahoma State University (Online)	Nov. 2021
Topology Seminar, University of Texas (Online)	Nov. 2020
Topology Seminar, Stanford (Online)	Sep. 2020
Topology Seminar, Brandeis (Online)	Sep. 2020

Topology Seminar, Georgia Tech (Online)	Aug. 2020
The Ohio State University, Seminar on Classical Knots + Virtual Knots (Online)	Aug. 2020
University of British Columbia/PIMS CRG Seminar (Online)	May 2020
Intro to Khovanov Homology (Parts 1, 2, 3), VCU Topology and Geometry (Online)	Apr. 2020
Topology Seminar, Boston College, Boston, MA	Oct. 2019
ALPS Seminar, Virginia Commonwealth University, Richmond, VA	Sep. 2019
Topology Seminar, Indiana University, IN	Jun. 2019
Topology Seminar, University of Oregon, Eugene, OR	May 2019
Geometry Seminar, University of Virginia, Charlottesville, VA	Apr. 2019
LA Joint Topology Seminar, UCLA, Los Angeles, CA	Apr. 2018
Topology Seminar(s), University of California, Berkeley, CA	Apr. 2017
Geometry and Topology Seminar(s), University of California, Davis, CA	Sep. 2016
Student Geometry and Topology Seminar, University of California, Davis, CA	Sep. 2016
Geometry and Topology Seminar, MSU, East Lansing, MI	Nov. 2015
Topology Seminar, University of Texas, Austin, TX	Sep. 2015
Topology Seminar, Rice, Houston, TX	Sep. 2015
Seminar in Symplectic Geometry, Gauge Theory and Categorification, Columbia University, NY	May 2015
Geometry and Topology Seminar, Caltech, Pasadena, CA	Nov. 2013
Geometry and Physics Seminar, University of Miami, Miami, FL	Nov. 2013
Topology Seminar, Rice University, Houston, TX	Sep. 2013
Topology Seminar (Thesis Defense), University of Texas, Austin, TX	Apr. 2013
Majors' Seminar, Trinity University, San Antonio	Mar. 2011

SELECTED OTHER WORKSHOPS AND INVITED ACADEMIC VISITS (2010 – current)

Visitor , UC Davis, Davis, CA; Host: M. Vazquez	Jun. 2022
Invited participant , Braids in Low-Dimensional Topology Workshop, ICERM, Providence RI.	Apr. 2022
Visitor , Washington University, MO; Host: T. Lidman	Mar. 2022
Visiting researcher , <i>AIM Square Program</i> , held at University of Miami, FL	Feb. 2022
Visitor , NC State, Raleigh, NC; Host: T. Lidman	Oct. 2021
Visitor , Georgia Institute of Technology, Atlanta, GA; Host: M. Kuzbary	Aug. 2021
Invited participant <i>American Institute of Mathematics</i> . ARC in 4-Dimensional Topology (Online)	Spring 2021
Invited participant Interactions of Gauge Theory with Contact and Symplectic Topology in dimensions 3 and 4, <i>Banff International Research Center</i> (Online)	Jun. 2020
Group Co-Leader , Women in Symplectic and Contact Geometry and Topology Workshop, ICERM	Jul. 2019
Visiting researcher , <i>American Institute of Mathematics</i> (AIM Square Program), San Jose, CA	Feb. 2019
Tutor , Summer School on Modern Knot Theory, Freiburg, Germany	Jun. 2017
Invited participant Synchronizing Smooth and Topological 4-Manifolds <i>Banff International Research Station</i> , Canada	Feb. 2016
Guest visitor , <i>Institute for Advanced Study</i> , Visitor host: T. Lidman, Princeton, NJ	Oct. 2015
Combinatorial Link Homology Theories, Braids, and Contact Geometry, ICERM, Providence, RI	Aug. 2014
Low Dimensional Topology After Floer, CRM, University of Montréal, Montréal, Canada	Jul. 2013
Low Dimensional Topology, <i>The Simons Center for Geometry and Physics</i> , Stonybrook, NY	May 2013
Holomorphic Curves and Low Dimensional Topology, Stanford University, CA	Aug. 2012
Invited participant AMS MRC in Computational and Applied Topology, Snowbird, UT	Jun. 2011
Categorification and Low Dimensional Topology, Stony Brook University, NY	Jun. 2010
Introductory Workshop: Homology Theories of Knots and Links, MSRI, CA	Jan. 2010

TEACHING EXPERIENCE

Virginia Commonwealth University:

Math 697, Directed Research	Fall 2021, Spring 2022
Math 602, Graduate Abstract Algebra II	Spring 2022
Math 502, Graduate Abstract Algebra I	Fall 2021
Math 491, Independent study	Summer 2021
Math 409, General Topology	Current
Math 401, Abstract Algebra	Fall 2020
Math 310, Linear Algebra	F2019, F2020, S2021, S2022

Math 307, Multivariate Calculus Spring 2021
 Math 200, Calculus with Analytic Geometry Spring 2020

University of California, Davis:

Mat 141, Euclidean and Non-Euclidean Geometry Winter 2017
 Mat 22A, Linear Algebra S2017, F2017, F2018
 Mat 116A, Short Calculus Fall 2016

Rice University:

Math 699, Topology Seminar S2016, F2015, S2015, F2014
 Math 591, Graduate Teaching Seminar S2016, F2015, S2015, F2014
 Math 540/445, Graduate Algebraic Topology Spring 2015
 Math 499, Undergraduate Research Seminar S2016, F2015, S2015, F2014
 Math 368, Topics in Combinatorics (Graph Theory and Combinatorics) F2013, F2014
 Math 306, Elements of Abstract Algebra Spring 2016
 Math 112, Calculus and its Applications (Integral Calculus) Spring 2014
 Math 111, Fundamental Theorem of Calculus (Differential Calculus) Fall 2015

University of Texas at Austin:

M408K, Differential Calculus Fall 2012

University of Texas at Austin – as a Teaching Assistant:

M382C, Graduate Algebraic Topology Fall 2009
 M346, Applied Linear Algebra Fall 2009
 M408M, Vector Calculus Fall 2008, Spring 2009
 M408L, Integral Calculus Spring 2008, Summer 2008
 M408K, Differential calculus Fall 2007
 M408C, Sequence, Series, and Multivariable Calculus Fall 2006, Spring 2007

SPONSORSHIP OF UNDERGRADUATE AND GRADUATE RESEARCH

Spatial graphs and applications. (Fall 2022) Currently advising 3 undergrads and 1 grad (R. Ibrahim) in projects on spatial graph invariants and applications to molecular biology. Funded by Jeffress Trust & NSF-DMS 2204148.

Invariants of theta-curves. (AY 2021-2022) Advised one VCU graduate student (R. Ibrahim) and two undergrads (M. Elpers, H. Dorney) in projects on invariants of theta-curves and KnotInfo. Funding from Jeffress Trust.

Quotients of the Gordian graph. (Summer 2020) Co-authored research article with 2 undergrads on hyperbolicity of quotients of the Gordian graph with funding from HSURP, VCU.

Braid representatives and knot polynomials. (Spring 2019) Advised one undergraduate and one graduate student in development of Markov-chain based software to study braid, resulting in open-source software *BraidGenerator*. Advised another undergraduate on project in knot theory. UC Davis.

Knot invariants and neural knots. (Summer 2018) Supervised 1 undergrad in the construction of a feed-forward neural network to predict knot invariants. UC Davis.

Topological data analysis. (Fall 2014) Seven students were involved in a project to learn basic techniques in data analysis and newer topological methods like persistent homology. Rice University.

Combinatorial knot theory. (Spring 2015, Fall 2015) Directed projects on the Kauffman state sum formulation of the Alexander polynomial and fibered knots, Fox colorings and symmetric unions of knots. Rice University.

Topics in homology. (Spring 2016) Seven students pursued various projects including persistent homology and the study of symmetric unions via the singular homology of branched double covers. Rice University.

SERVICE TO THE PROFESSION

Referee work:

- *Geometry & Topology Monographs*
- *Compositio Mathematica*
- *Mathematical Research Letters*
- *Proceedings of the American Mathematical Society*
- *Proceedings of the Edinburgh Mathematical Society*
- *Proceedings of the London Mathematical Society*
- *Quantum Topology*
- *Algebraic & Geometric Topology*
- *Cambridge Philosophical Society*
- *American Mathematical Monthly*
- *Springer Conference Proceedings*
- *Involve: A Journal of Mathematics*

Conference Co-organizer:

- *Richmond Geometry Festival I*, Virginia Commonwealth University (Online) May 27-2, 2022.
- *Richmond Geometry Festival II*, Virginia Commonwealth University (Online) June 10-11, 2021.
- *AMS Special Session on Knots and Links in Low-Dimensional Topology*.
 AMS Sectional Meeting, University of Virginia, Charlottesville (Cancelled due to Covid).

- *AMS Special Session on Developments in Spatial Graphs* Joint Meetings of the AMS (Online), January 6, 2021
- *Topology in Dimension 3.5: A conference in memory of Tim Cochran*, Rice University, Houston, June 1-4, 2016
- *AMS Special Session on Geometric Perspectives in Knot Theory*, AMS Sectional Meeting, Loyola University, Chicago, IL, October 2015.

KnotInfo. With C. Livingston, I maintain and develop KnotInfo, an online database of knot invariants at knotinfo.org.

Virtual Low-Dimensional Topology. Co-organizer of Virtual Low-Dimensional Topology, an online community resource for topologists during Covid-19 at <https://sites.google.com/bc.edu/virtualtopology/home>.

Seminar Co-organizer: *Colloquium* VCU, AY 2021-2022. *Geometry and Topology Seminar* VCU, 2019-2021. *ALPS* VCU, AY 2020-2021, Current. *Topology Seminar* and *Working Topology Seminar* Rice, F2014 – S2016. *Heegaard Floer 'Computational'* Rice, F2014 – S2015. *Teaching Seminar:* teaching strategies for graduate students, Rice, F2014 – S2016. *RTG Writing Seminar:* technical writing skills for graduate students, Rice, F2014. *Junior Topology Seminar*, University of Texas, 2010. *Python Learning Seminar:* code writing seminar for grad students, University of Texas, Summer 2012

Committee Member: *Graduate Affairs Committee*, VCU Current. *Website Committee*, VCU 2021-2022. *Undergraduate Curriculum Committee*, VCU, 2020-2022. *Covid-19 Prep Team*, VCU, 2020. *Rice University Colloquium Committee*, Rice University, Fall 2013 – Spring 2014. *Distinguished Women in Mathematics Committee*, University of Texas, Fall 2010 - Spring 2013

Group Co-Leader, (with J. Hom). *Women in Symplectic and Contact Geometry and Topology Workshop*, ICERM, Providence RI. July 2019.

Conference Tutor, *Summer School on Modern Knot Theory: Aspects in Algebra, Analysis, Biology, and Physics*. University of Freiburg, Freiburg, Germany, June 2017.

Co-organizer, *TA Training Workshop:* focus on student-centered calculus discussions, University of Texas, Summer 2012

SERVICE TO THE COMMUNITY

REU and Math Camp Speaker:

Sam Houston State University, July 2015 – Research talk and activities on knots and knot invariants.
Texas State University, July 2018 – Math Camp Colloquium Speaker.

Panelist & Co-rganizer:

Sonya Kovalevsky Day, University of Texas, Spring 2013, Spring 2014.
Panelist at the SCMB Symposium in Math-Bio, 2021.
Panelist at the Nebraska Conference for Undergraduate Women, Jan 2012.

Outreach volunteer

Speaker, VCU Math Circle, April 2022
M-PACT middle school outreach, April 2018.
STEM for Girls Workshop, UC Davis, April 2017
Picnic Day, UC Davis, April 2017
Girls Exploring Math and Science, Houston Museum of Natural Science, February 2014;

Coordinator & Speaker, Saturday Morning Math Group & Sunday Math Circle, 2010 – 2012

Coordinator and speaker at University of Texas's 'math circle' for middle and high school students. Program info at <https://www.ma.utexas.edu/users/smmg/>.

Faculty sponsor and member, Local AWM Chapter, Rice University, 2013 – 2016

Mentoring

Research mentor of 1 Ph.D. graduate student, VCU, 2021-current.
Career mentor of 2 Ph.D. graduate students, VCU, 2019–2021.
Mentor (expositional writing projects): 2 master students, VCU 2020–2021.
Research mentoring: 7 undergraduates, VCU 2019–current.
Research mentoring: 3 undergraduates and 1 graduate in research projects, UC Davis, 2018-2019.
Mentor of one undergrad in the *RTG Directed Reading Program*, University of Texas, Spring 2013

Sponsor, AMC and AIME Exams, University of Texas, Fall 2011- Fall 2012

Coordinated and proctored math competitions for Austin area grade school students.

Public lecturer, Austin Science and Engineering Festival, Austin Convention Center, October 2010

Gave the public lecture "How Do You Group It?" for adults and children.

SKILLS AND PROFESSIONAL AFFILIATIONS

Computer skills: Python, Matlab, Mathematica, R, SnapPy, L^AT_EX, HTML/CSS, Website design

Professional affiliations: American Mathematical Society (current), Association for Women in Mathematics (past)

Miscellaneous skills: "Published" musician