# Carolyn R. Abbott

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**Appointments**

**Associate Professor** July 2026 – current
Brandeis University

**Assistant Professor** January 2025 – June 2026
**Landsman Career Development Chair in the Sciences**
Brandeis University

**Assistant Professor** July 2021 – December 2025
Brandeis University

**NSF Postdoctoral Fellow** June 2019 – May 2021
Columbia University

**NSF Postdoctoral Fellow** June 2018 – May 2019
University of California, Berkeley

**Morrey Visiting Assistant Professor** August 2017 – June 2018
University of California, Berkeley

**Education**

**University of Wisconsin-Madison**, Madison, WI May 2017
Ph.D. in Mathematics, Advisor: Tullia Dymarz

**Cornell University**, Ithaca, NY
Master of Arts and Teaching in Secondary Mathematics Education, May 2007
New York State Teaching Certificate in Mathematics 7–12 June 2007

**Jagiellonian University,** Krakow, Poland June 2005
Diploma in Polish language

**Tufts University,** Medford, MA May 2004
B.A. in Mathematics and Asian Studies, Magna Cum Laude

**Visiting Positions**

**Mathematical Sciences Research Institute** Fall 2016
*Program Associate in Geometric Group Theory Semester*

**The Graduate Center at CUNY** Spring 2016, Spring 2017
*Visiting Research Scholar*

**Research Interests**

Geometric group theory, including applications to hyperbolic geometry, computation, and random walks.

**Grants**

**NSF CAREER Grant DMS-2340341**, $549,981 2024 - 2029
*CAREER: Large-scale geometry and negative curvature*
**NSF Grant DMS-2106906**, $263,986 2021 - 2025
*Group actions on hyperbolic spaces*

**NSF Conference Grant DMS-2453830**, $40,000 2025-2026
*Conference: Groups in Geometry, Analysis, and Logic*
**NSF Conference Grant DMS-2309437**, $40,000 2023 - 2024
*Conference: Groups, Actions, and Geometry*

**Publications & Preprints**

1. **Not all finitely generated groups have universal acylindrical actions**
Proc. Amer. Math. Soc., 144(10):4151–4155, 2016

2. **Hyperbolic structures on groups**
Algebr. Geom. Topol., 19-4 (2019), 1747–1835 (with S. Balasubramanya and D. Osin)

3. **Property $P_{naive}$ for acylindrically hyperbolic groups**
Math. Z., 291(1-2):555-568, 2019 (with F. Dahmani)

4. **Extending group actions on metric spaces**
J. Topol. Anal., 12(3): 625–665, 2020 (with D. Hume and D. Osin)

5. **The geometry of generalized loxodromic elements**
Ann. I. Fourier (Grenoble), 70(4): 1689–1713, 2020 (with D. Hume)

6. **Largest acylindrical actions and stability in hierarchically hyperbolic groups**
Trans. Amer. Math. Soc. Ser. B, 8: 66–104, 2021 (with J. Behrstock and M. Durham)

7. **Actions of small cancellation groups on hyperbolic spaces**
Geom. Dedicata, 212(1), 325–363, 2021 (with D. Hume)

8. **Conjugator lengths in hierarchically hyperbolic groups**
Groups Geom. Dyn. **17**, no. 3, 805–838, 2023 (with J. Behrstock)

9. **Actions of solvable Baumslag-Solitar groups on hyperbolic metric spaces**
Algebr. Geom. Topol. **23**, no. 4, 1641–1692, 2023 (with A. Rasmussen)

10. **Acylindrically hyperbolic groups and their quasi-isometrically embedded subgroups**
Michigan Math. J. **74** (2024), no. 2, 357–402 (with J. Manning)

11. **Random walks and quasi-convexity in acylindrically hyperbolic groups**
J. Topol. **14**, no. 3, 992–1026, 2021 (with M. Hull)

12. **Largest hyperbolic actions and quasi-parabolic actions in groups**
J. Topol. Anal. **16** (2024), no. 4, 495–539 (with A. Rasmussen)

13. **Higher rank confining subsets and hyperbolic actions of solvable groups**
Adv. Math. **424**, Paper No. 109045, 47pp, 2023 (with S. Balasubramanya and A. Rasmussen)

14. **Structure invariant properties of the hierarchically hyperbolic boundary.**
J. Top. Anal., https://doi.org/10.1142/S1793525323500516, 2024 (with J. Behrstock and J. Russell)

15. **Hierarchically hyperbolic groups and uniform exponential growth**
Math. Z. **306** (2024), no. 1, Paper No. 18, 33pp. (with T. Ng and D. Spriano)

16. **Infinite-type loxodromic isometries of the relative arc graph**
Algebr. Geom. Topol. **25** (2025), no. 1, 563–644. (with N. Miller and P. Patel)

17. **Valuations, completions, and hyperbolic actions of metabelian groups**
J. Lon. Math. Soc. (2) **109** (2024), no. 6, Paper No. e12916, 72pp. (with S. Balasubramanya and A. Rasmussen)

18. **Largest hyperbolic actions of 3–manifold groups.** Bull. Lond. Math. Soc. **56** (2024), no. 10, 3090–3113. (with H.T. Nguyen and A. Rasmussen)

19. **Relative hyperbolicity, thickness, and the hierarchically hyperbolic boundary**
arXiv:2305.16906. To appear in Michigan Math. J. (with J. Behrstock and J. Russell)

20. **The quasi-isometry invariance of the coset intersection complex**
Algebr. Geom. Topol. **26** (2026), no. 2, 659–698 (with E. Martinez-Pedroza)

21. **Uniform undistortion from barycentres, and applications to hierarchically hyperbolic groups**
Anal. Geom. Metr. Spaces **13** (2025), no. 1, Paper No. 20250027, 29pp. (with M. Hagen, H. Petyt, and A. Zalloum)

22. **Hyperbolic projections and topological invarienace of sublinear Morse boundaries**
arXiv:2212.09539, submitted. (with M. Incerti-Medici)

23. **Shift maps are not type-preserving**
Geom. Dedicata **219** (2025), n0. 5, Paper No. 82, 16pp (with N. Miller and P. Patel)

24. **A new construction of subgroups of big mapping class groups**
New York J. Math. **32** (2026), 118–154 (with H. Hoganson, M. Loving, P. Patel, and R. Skipper)

25. **A non-loxodromic Morse element in a Morse local-to-global group**
arXiv:2502.21176, submitted. (with S. Zbinden)

26. **Homotopy types of complexes of hyperplanes in quasi-median graphs and applications to right-angled Artin groups**
arxiv:2503.08411. submitted. (With A. Genevois and E. Martinez-Pedroza)

27. **Random quotients preserve acylindrical and hierarchical hyperbolicity**
arXiv:2507:16677. Submitted. (with D. Berlyne, G. Mangioni, T. Ng, and A. Rasmussen)

**Invited Talks (Conferences and Colloquia)**

Carleton College Colloquium — April 2026

University of Minnesota Colloquium — April 2026

Blooming Beasts: A Conference on the Geometry, Topology, and Dynamics of Infinite-Type Surfaces, BIRS, Oaxaca — June 2025

Upstate New York Topology Seminar, Plenary Talk — March 2025

Joint Math Meetings Special Session — January 2025
*Combinatorial and Probabilistic Methods in Group Theory*

Vanderbilt University Colloquium — June 2024 Graduate Student Topology and

Geometry Conference — April 2024

University of Utah Colloquium — March 2024

Rice University Colloquium — November 2023

Group Actions and Low Dimensional Topology — July 2023

Escuela de Teoría Geométrical de Grupos — June 2023

Interactions beetween Algebraic Topology & Geometric Group Theory — May 2023

Geometry of Subgroups, CRM (minicourse) — May 2023

University of Wisconsin, Madison, Colloquium — March 2023

AMS Southeast Sectional Meeting, Georgia Tech — March 2023
*Geometric group theory*

Spring Topology and Dynamics Conference — March 2023

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| Queens University, Ontario, Colloquium | January 2023 |
| Hyperbolic groups and their generalizations, IHP | June 2022 |
| Bowdoin College Colloquium | November 2021 |
| University of Wisconsin, Milwaukee, Colloquium | October 2021 |
| Women in Groups, Geometry, and Dynamics Retreat | August 2021 |
| Charney Fest | July 2021 |
| Beyond Hyperbolicity Conference | July 2021 |
| The Interface of Low Dim'l Group Actions & Geom. Structures | January 2021 |
| Geometric group theory: Non-positively curved groups, NCNGT | May 2020 |
| Joint Math Meetings Special Session<br>*Women in topology* | January 2020 |
| Big Mapping Class Groups AIM Workshop | May 2019 |
| Arches Topology Conference | April 2019 |
| California State University, Chico, Colloquium | April 2019 |
| Spring Topology and Dynamics Conference, Semi-plenary speaker | March 2019 |
| St. Johns University Colloquium | February 2019 |
| AMS Sectional Meeting Special Session, University of Arkansas<br>*Groups in Low-dimensional Topology and Dynamics, I* | November 2018 |
| Tufts University Colloquium | November 2018 |
| Graphs, Surfaces, and Cube Complexes, Warwick | July 2018 |
| Boundaries of Groups, CIRM-Luminy | June 2018 |
| Workshop on Large Scale Geometry and Applications, Fields Institute | May 2018 |
| AMS Sectional Meeting Special Session, Vanderbilt University<br>*Non-positive curvature and boundaries* | April 2018 |
| Joint Math Meetings Special Session<br>*Boundaries for groups and spaces* | January 2018 |
| Young Geometric Group Theorists Conference | March 2018 |
| Virginia Topology Conference | November 2017 |
| Geometric Groups on the Gulf Conference | March 2017 |
| Spring Topology and Dynamics Conference | March 2017 |
| Wasatch Topology Conference | August 2016 |
| Beyond Hyperbolicity Conference, Cambridge University | June 2016 |
| GAGTA Conference, Stevens Institute of Technology | June 2016 |
| City College of New York Colloquium | April 2016 |
| Swarthmore College Colloquium | March 2016 |
| AMS Sectional Meeting Special Session, Loyola University<br>*Metric Geometry* | October 2015 |

**Invited Talks (Seminars)**

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| Warwick University • Temple University • University of Maryland | 2026 |
| University of Albany • University of Oxford • University of Chicago • University of Michigan | 2025 |
| University of Oklahoma • Vanderbilt University • University of Buffalo | 2024 |

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| | • Yale University • The Graduate Center at CUNY • Harvard University | |
| | Tufts University • Boston College • University of Wisconsin, Madison | 2023 |
| | •University of Texas, Austin • Brandeis University | 2022 |
| | Tufts University • University of Chicago • McGill University<br>• Virtual Geometric Group Theory Seminar in Mexico | 2021 |
| | Vanderbilt University | 2020 |
| | Columbia University• Temple University | 2019 |
| | University of Florida • Stanford University • University of California, Davis<br>• Yale University • University of California, Irvine<br>• University of California, Santa Barbara | 2018 |
| | University of California, Berkeley • University of Nice • Columbia University<br>• Institute Fourier, Grenoble Alps • Rice University• Boston College<br>• University of Illinois - Chicago• Cornell University • Temple University | 2017 |
| | MSRI Postdoctoral seminar • Brandeis University<br>• The Graduate Center at CUNY • Temple University | 2016 |
| | Vanderbilt University | 2015 |

**Conferences Organized**

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| MAA MathFest Special Session<br>"New directions in group theory" | August 2026 |
| Groups in Geometry, Analysis, and Logic | May 2025 |
| AMS Western Sectional Meeting Special Session<br>"Huge groups from a geometric viewpoint" | May 2025 |
| AWM Research Symposium Special Session<br>"Groups, Geometry, and Dynamics" | May 2025 |
| JMM Special Session "Women in Groups, Geometry, and Dynamics" | January 2025 |
| Advances in Hierarchical Hyperbolicity | May 2024 |
| Young Geometric Group Theorists (YGGT)<br>*Scientific committee* | March 2024 |
| Groups, Actions, and Geometry | August 2023 |
| Spring Topology and Dynamics Conference (STDC)<br>*Steering committee* | 2023–2026 |
| Quotients of Hierarchically Hyperbolic Groups | August 2022 |
| JMM Special Session "Geometric group theory" | March 2022 |
| AMS Northeast Sectional Meeting special session<br>"Geometric group theory" | March 2022 |

**University Service**

**Diversity, Equity, Inclusion, and Social Justice (DEIS-J) Committee** (Fall 2023 – current)

**Summer Undergraduate Research Fellowship (SURF) Selection Committee** (Spring 2024)

**Departmental Service**

**Undergraduate Advising Head II** (Fall 2023 – current): responsible for transfer credits and study abroad credits

**Graduate Admissions Committee** (2025-2026)

**Undergraduate Committee** (Fall 2022 – current)

**Curriculum Self-Study Committee** (Fall 2024)

**Tenure-track Hiring Committee** (2022 – 2023): for two positions

**Other Service**

**Associate Editor, K3 Problem List** (2025 – current): Editor of Chapter 2 of the 3rd version of Kirby's Problem List in Low-Dimensional Topology, which will be published as a book

**Chair, MAA Committee on the T. Christine Stevens Award** (2025 – 2026): Review nominations for this leadership development award

**Member, MAA Committee on the T. Christine Stevens Award** (2023 – 2025): Review nominations for this leadership development award

**EDI Reviewer, BIRS Proposals** (2021 – current): Evaluate BIRS conference proposals on their EDI merit

**Co-organizer, Brandeis Topology Seminar** (Fall 2021 – current): Plan and organize the weekly Topology seminar

**Editor, AMS Blog on Teaching and Learning** (Spring 2021 – current) Solicit and edit columns, write columns

**NSF Panel Member**: Spring 2020, Fall 2022, Fall 2024

**Referee Work** (2018 – present): *J. Topol. Anal.*, *Groups Geom. Dyn.*, *J. Éc. polytech.*, *Geom. Dedicata*, *IMRN*, *Michigan Math. J.*, *Geom. Top.*, *Ann. H. Lebesgue*, *Notices of the AMS*, *Forum Math. Sigma*, *Contemp. Math.*, *Amer. J. Math*

**Co-organizer, UC Berkeley Geometry-Topology Seminar** (Fall 2017 – Spring 2019): Plan and organize the weekly Geometry/Topology seminar.

**Organizer, UC Berkeley New Postdoc Talks** (Fall 2017, Fall 2018): Organize session for new postdocs to introduce themselves and their work to the department.

**Organizer, MSRI Working Seminar on** $\mathrm{Out}(F_n)$**–complexes** (Fall 2016): Plan and organize a seminar open to all members of MSRI.

**Founder, Directed Reading Program** (Fall 2015): Program pairs undergraduates with graduate student mentors for a semester-long independent study.

**Member, CTAPP Committee** (Fall 2014 – Fall 2015): Evaluate TAs in the math department, determine policies for TA responsibilities and pay structure.

**Graduate Coordinator, Madison Math Circle** (Spring 2014 – Fall 2015): Organized refreshments and supplies, and coordinated weekly talks by graduate students and faculty on various topics in mathematics for middle and high school students.

**Mentor and Administrative Assistant, Instructional Excellence Program** (Fall 2013 – Fall 2015): Mentor new TAs in the math department, plan and run training workshops on interactive teaching, facilitating group work, writing quizzes, and grading, observe new TAs and give feedback.

**Fundraising Event** (September 2015): Assistant to Jordan Ellenberg in UW-Madison

fundraiser held in New York City.

**Math Help Desk** (Fall 2013 – Fall 2015): Advised undergraduate students on which math courses were most appropriate for them to take and helped them find a class that fit in their schedule.

**Student Orientation, Advising, and Registration** (January 2014, June 2014, August 2015): Advised new undergraduate students on which math courses were most appropriate for them to take, as well as helped students plan a course of study if their interest was mathematics.

**Graduate Coordinator, Women in Math at Wisconsin** (Fall 2014 – Fall 2015): Coordinate events for women in the math department, including inviting colloquium speakers and organizing social events.

**Project Mentor, Women in Math at Wisconsin: High School Math Night** (Fall 2013): Mentor for local high school women, with weekly work on an RSA encryption project, through the Women in Math at Wisconsin organization.

## Mentoring

**Current graduate students**: Joshua Perlmutter, Rachmiel Klein, John-Michael Figueroa

**Former graduate students**: Kaitlyn Ragosta (Ph.D. 2025)

**Postdocs**: Thomas Ng (current), Assaf Bar-Natan (2022-2024)

**Masters students**: Andrew Dias (M.S. 2024)

**AWM Mentor** (Summer 2023 – current): Meet regularly with and mentor several women early in their graduate studies.

**Summer Undergraduate Research Fellow (SURF) advisor** (Summer 2024): Led research project for rising senior on Morse boundaries.

**Senior Thesis Advisor** (2024-2025): Advise undergraduate student writing a senior thesis on laminations of infinite-type surfaces.

**Mentor, Topology Students Workshop** (June 2024, 2026): Provided professional advice to graduate student participants; ran workshop on the job market.

**Thesis committee member**: Qing Liu (March 2021), Ian Montague (March 2023), Jill Mastrocola (March 2024), Andrew Dias (August 2024), Haochen Qiu (June 2025), Rebecca Rohrlich (December 2025)

**Minor Exams**: Jiajie Zheng (2023), Polyana Benk (2026)

**Oral exam committee member**: mathematics graduate student at University of Utah (March 2023)

**Senior Thesis Advisor, UC Berkeley** (Spring 2018): Advise undergraduate student writing a senior honors thesis defining train track splittings on orbifolds.

## Awards

**Michael L. Walzer '56 Award for Teaching (2024)**: for a combination of superlative scholarship with inspired teaching.

**Perlmutter Faculty Fellow**, 2024-2025 academic year

Nominated: **Dean's Mentoring Award (2023)**

**Letters & Sciences Teaching Fellow Award (2015)**: a campus-wide award for TAs who have achieved outstanding success as students and teachers at UW-Madison

**Elizabeth S. Hirschfelder Scholarship (2014)**: for exceptional work by a female Ph.D. student.

**Department of Mathematics Teaching Award (2014)**: for first-rate teaching

**University Housing's Honored Instructor Award (2012, 2014, and 2015)**: for excellent teaching, based on student nominations

**Edward A. Sheldon Award (2007)**: for excellent female teachers, based on academic achievement

**Robert Noyce Scholarship (2006)**: for superb teachers committed to working in high needs districts

**Tufts University Maxine Gordon Award (2004)**: for an outstanding math major with a strong literary interest

**Tufts University Class of 1942 Prize Award (2004)**: for the student most likely to become an outstanding university professor

Nominated: **Exceptional Service (2015)**: a campus-wide award for outstanding TAs who perform exceptional service related to the educational mission of their department and our university

Nominated: **Early Excellence in Teaching Award (2013)**: campus-wide award for outstanding and inspirational performance on the part of TAs with fewer than four semesters of teaching experience

Nominated: **Cornell University Mathematics Graduate Student Teaching Award (2006)**: for excellent teaching, based on student nominations

## Teaching Experience

**Brandeis University**
*Instructor* Fall 2021 – current

- Courses taught: Math 15a: Linear Algebra, Math 36a: Probability, Math 221: Graduate topics course titled "Hyperbolic groups," Math 221A&B: Topology I & II, Math 271A: The geometry and topology of 3–manifolds, Math 271B: Graduate topic courses titled "Mapping class groups," "Huge groups"
- Average Teaching Evaluation Score: 4.78/5.00

**Columbia University**
*Instructor* Spring 2020, Fall 2020

- Courses taught: Calculus III

**University of California, Berkeley**
*Instructor* 2017-2018

- Courses taught: Abstract Algebra and Honors Linear Algebra and Differential Equations
- Average Teaching Evaluation Score: 6.35/7.00

**University of Wisconsin - Madison**
*Instructor* 2012-2015

- Courses taught: Calculus 1, 2, and 3, and Problem Solving: Algebra, Probability, Statistics
- Selected as a TA coordinator in 2015 (overseeing first-year TAs)

- Selected for Wisconsin Emerging Scholars section in 2014-15 (sections that provide extra support for students from underprivileged backgrounds)
- Average Teaching Evaluation Score: 4.93/5.00

**The Anderson School**, New York, NY March 2009 – June 2012
*7th and 8th Grade Mathematics Teacher*
- Taught Integrated Algebra and Integrated Geometry, founded an honors program for gifted students, Robotics Club advisor, MathCounts Coach

**The Bronx High School of Science**, Bronx, NY August 2007 – January 2009
*High School Mathematics Teacher*
- Courses Taught: Algebra, Geometry, Trigonometry

**Cornell University**, Ithaca, NY
*Instructor*
- Courses Taught: Calculus 1, Calculus for Engineers, Calculus for Life and Social Sciences, Introduction to College Mathematics