

# ANDREW ZIMMER

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amzimmer2@wisc.edu

<https://www.math.wisc.edu/~amzimmer2>

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## EDUCATION

**University of Michigan** • Ph.D. Mathematics, May 2014

Advisor: Ralf Spatzier

**University of Illinois at Urbana-Champaign** • M.S. Mathematics, May 2010

**University of Puget Sound** • B.S. Mathematics and Computer Science, May 2008

Honors in Mathematics, Summa Cum Laude

**Budapest Semesters in Mathematics** • Fall 2006

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## EMPLOYMENT HISTORY

**Associate Professor**, University of Wisconsin-Madison, 2023-present

**Assistant Professor**, University of Wisconsin-Madison, 2020-2023

**Assistant Professor**, Louisiana State University, 2018-2020

**Assistant Professor**, College of William and Mary, 2017-2018

**L.E. Dickson Instructor** (postdoc), University of Chicago, 2014-2017

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## GRANTS AND AWARDS

- co-PI: NSF conference grant (2023)
- Alfred P. Sloan Research Fellowship in Mathematics (2022)
- NSF CAREER Grant (2020)
- NSF Research Grant (2017)
- NSF Postdoctoral Fellowship, mentor: Benson Farb (2014)

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## PUBLICATIONS AND PREPRINTS

Publications and preprints are listed by the year they were made publicly available.

### 2024:

1. Counting, mixing and equidistribution for GPS systems with applications to relatively Anosov groups  
Joint with P.-L. Blayac, R. Canary, F. Zhu.  
Preprint, 55 pages.  
Available at: [arXiv:2404.09718](https://arxiv.org/abs/2404.09718)
2. Patterson-Sullivan theory for coarse cocycles  
Joint with P.-L. Blayac, R. Canary, F. Zhu.  
Preprint, 66 pages.  
Available at: [arXiv:2404.09713](https://arxiv.org/abs/2404.09713)

### 2023:

3. Smooth equivalence of families of strongly pseudoconvex domains  
Joint with H. Gaussier, X. Gong.  
Submitted, 31 pages.  
Available at: [arXiv:2311.04111](https://arxiv.org/abs/2311.04111)
4. Patterson-Sullivan measures for relatively Anosov groups  
Joint with R. Canary, T. Zhang.  
Submitted, 40 pages.  
Available at: [arXiv:2308.04023](https://arxiv.org/abs/2308.04023)

5. (REU project!) A rigidity result for proper holomorphic maps between balls  
Joint with E. Gevorgyan, H. Wang.  
**Proceedings of the AMS**, 152: 1573-1585, 2024.  
Available at: [arXiv:2305.18590](https://arxiv.org/abs/2305.18590)
6. Patterson-Sullivan measures for transverse subgroups  
Joint with R. Canary, T. Zhang.  
**Journal of Modern Dynamics**, to appear, 46 pages.  
Available at: [arXiv:2304.11515](https://arxiv.org/abs/2304.11515)

## 2022:

7. Relatively Anosov representations via flows II: examples  
Joint with F. Zhu.  
Submitted, 51 pages.  
Available at: [arXiv:2207.14738](https://arxiv.org/abs/2207.14738)
8. Relatively Anosov representations via flows I: theory  
Joint with F. Zhu.  
Submitted, 73 pages.  
Available at: [arXiv:2207.14737](https://arxiv.org/abs/2207.14737)
9. Unbounded visibility domains, the end compactification, and applications  
Joint with G. Bharali.  
**Transactions of the AMS**, 376: 5949-5988, 2023.  
Available at: [arXiv:2206.13869](https://arxiv.org/abs/2206.13869)
10. The structure of relatively hyperbolic groups in convex real projective geometry  
Joint with M. Islam.  
Submitted, 30 pages.  
Available at: [arXiv:2203.16596](https://arxiv.org/abs/2203.16596)
11. Entropy rigidity for cusped Hitchin representations  
Joint with R. Canary, T. Zhang.  
Submitted, 57 pages.  
Available at: [arXiv:2201.04859](https://arxiv.org/abs/2201.04859)

## 2021:

12. A metric analogue of Hartogs' theorem  
Joint with H. Gaussier.  
**Geometric and Functional Analysis**, 32: 1041-1062, 2022.  
Available at: [arXiv:2111.12029](https://arxiv.org/abs/2111.12029)
13. Hankel operators on domains with bounded intrinsic geometry  
**Journal of Geometric Analysis**, 33, Article number: 176, 2023 (29 pages).  
Available at: [arXiv:2105.15011](https://arxiv.org/abs/2105.15011)
14. Convex co-compact groups with one dimensional boundary faces  
Joint with M. Islam.  
Submitted, 24 pages.  
Available at: [arXiv:2104.05056](https://arxiv.org/abs/2104.05056)
15. Cusped Hitchin representations and Anosov representations of geometrically finite Fuchsian groups  
Joint with R. Canary, T. Zhang.  
**Advances in Mathematics**, 404, Part B: 108439, 2022 (67 pages).  
Available at: [arXiv:2103.06588](https://arxiv.org/abs/2103.06588)

## 2020:

16. Convex co-compact representations of 3-manifold groups

Joint with M. Islam.

**Journal of Topology**, to appear, 48 pages.

Available at: [arXiv:2009.05191](https://arxiv.org/abs/2009.05191)

17. Compactness of the  $\bar{\partial}$ -Neumann problem on domains with bounded intrinsic geometry

**Journal of Functional Analysis**, 281: 108992, 2021 (47 pages).

Available at: [arXiv:2008.05953](https://arxiv.org/abs/2008.05953)

18. Kobayashi hyperbolic convex domains not biholomorphic to bounded convex domains

**Mathematische Zeitschrift**, 300: 1905-1916, 2022.

Available at: [arXiv:2006.07939](https://arxiv.org/abs/2006.07939)

19. A lower bound for the Kähler-Einstein distance from the Diederich-Fornæss index

**Proceedings of the AMS**, 149: 1641-1646, 2021.

Available at: [arXiv:2003.07301](https://arxiv.org/abs/2003.07301)

20. A higher rank rigidity theorem for convex real projective manifolds

**Geometry & Topology**, 27: 2899-2936, 2023.

Available at: [arXiv:2001.05584](https://arxiv.org/abs/2001.05584)

## 2019:

21. Convex co-compact actions of relatively hyperbolic groups

Joint with M. Islam.

**Geometry & Topology**, 27: 417-511, 2023.

Available at: [arXiv:1910.08885](https://arxiv.org/abs/1910.08885)

22. Smoothly bounded domains covering compact manifolds

**Indiana University Mathematics Journal**, 70: 2653-2676, 2021.

Available at: [arXiv:1910.05288](https://arxiv.org/abs/1910.05288)

23. A flat torus theorem for convex co-compact actions of projective linear groups.

Joint with M. Islam.

**Journal of the London Math. Society**, 103: 470-489, 2021.

Available at: [arXiv:1907.03277](https://arxiv.org/abs/1907.03277)

24. Subelliptic estimates from Gromov hyperbolicity.

**Advances in Mathematics**, 402: 108334, 2022 (94 pages).

Available at: [arXiv:1904.10861](https://arxiv.org/abs/1904.10861)

25. Regularity of limit sets of Anosov representations.

Joint with T. Zhang.

Submitted, 58 pages.

Available at: [arXiv:1903.11021](https://arxiv.org/abs/1903.11021)

## 2018:

26. The geometry of domains with negatively pinched Kähler metrics.

Joint with F. Bracci, H. Gaussier.

**Journal of Differential Geometry**, to appear, 26 pages.

Available at: [arXiv:1810.11389](https://arxiv.org/abs/1810.11389)

27. Asymptotic behavior of orbits of holomorphic semigroups.

Joint with F. Bracci, M. Contrears, S. Diaz-Madrigal, H. Gaussier.

**Journal de Mathématiques Pures et Appliquées**, 133: 263-286, 2020.

Available at: [arXiv:1810.07947](https://arxiv.org/abs/1810.07947)

28. Two boundary rigidity results for holomorphic maps.

**American Journal of Mathematics**, 144: 119-168, 2022.

Available at: [arXiv:1810.05669](https://arxiv.org/abs/1810.05669)

29. Homeomorphic extension of quasi-isometries for convex domains in  $\mathbb{C}^d$  and iteration theory.

Joint with F. Bracci, H. Gaussier.

**Mathematische Annalen**, 379: 691-718, 2021.

Available at: [arXiv:1808.07415](https://arxiv.org/abs/1808.07415)

30. Smoothly bounded domains covering finite volume manifolds.

**Journal of Differential Geometry**, 119: 161-182, 2021.

Available at: [arXiv:1802.01178](https://arxiv.org/abs/1802.01178)

**2017:**

31. The automorphism group and limit set of a bounded domain II: the convex case.

**Journal of the London Math. Society**, 104: 453-491, 2021.

Available at: [arXiv:1712.10251](https://arxiv.org/abs/1712.10251)

32. The automorphism group and limit set of a bounded domain I: the finite type case.

**Advances in Mathematics**, 366: 107085, 2020 (42 pages).

Available at: [arXiv:1712.10249](https://arxiv.org/abs/1712.10249)

33. Projective Anosov representations, convex cocompact actions, and rigidity.

**Journal of Differential Geometry**, 119: 513-586, 2021.

Available at: [arXiv:1704.08582](https://arxiv.org/abs/1704.08582)

34. Characterizing strong pseudoconvexity, obstructions to biholomorphisms, and Lyapunov exponents.

**Mathematische Annalen**, 374: 1811-1844, 2019.

Available at: [arXiv:1703.01511](https://arxiv.org/abs/1703.01511)

**2016:**

35. A gap theorem for the complex geometry of convex domains.

**Transactions of the AMS**, 370: 7489-7509, 2018.

Available at: [arXiv:1609.07050](https://arxiv.org/abs/1609.07050)

36. Generic analytic polyhedron with non-compact automorphism group.

**Indiana University Mathematics Journal**, 67: 1299-1326, 2018.

Available at: [arXiv:1603.09238](https://arxiv.org/abs/1603.09238)

37. Goldilocks domains, a weak notion of visibility, and applications.

Joint with G. Bharali.

**Advances in Mathematics**, 310: 377-425, 2017.

Available at: [arXiv:1602.01742](https://arxiv.org/abs/1602.01742)

**2015:**

38. Proper quasi-homogeneous domains in flag manifolds and geometric structures.

**Annales de l'Institut Fourier**, 68: 2635-2662, 2018.

Available at: [arXiv:1507.06921](https://arxiv.org/abs/1507.06921)

39. Rigidity of convex divisible domains in flag manifolds.

Joint with W. Van Limbeek.

**Geometry & Topology**, 23: 171-240, 2019.

Available at: [arXiv:1510.04118](https://arxiv.org/abs/1510.04118)

40. Entropy rigidity of Hilbert and Riemannian metrics.

Joint with T. Barthelmé and L. Marquis.

**International Mathematics Research Notices**, 2017 (22): 6841-6866, 2017.

Available at: [arXiv:1508.07474](https://arxiv.org/abs/1508.07474)

41. Characterizing the unit ball by its projective automorphism group.

**Geometry & Topology**, 20: 2397-2432, 2016.

Available at: [arXiv:1506.09144](https://arxiv.org/abs/1506.09144)

42. The structure of projective maps between real projective manifolds.

**Geometriae Dedicata**, 190: 81-102, 2017.

Available at: [arXiv:1506.09136](https://arxiv.org/abs/1506.09136)

43. Characterizing domains by the limit set of their automorphism group.

**Advances in Mathematics**, 308: 438 - 482, 2017.

Available at: [arXiv:1506.07852](https://arxiv.org/abs/1506.07852)

**2014 and before:**

44. Gromov hyperbolicity, the Kobayashi metric, and  $\mathbb{C}$ -convex sets.  
**Transactions of the AMS**, 369: 8437-8456, 2017.  
Available at: [arXiv:1602.01444](https://arxiv.org/abs/1602.01444)
45. Gromov hyperbolicity and the Kobayashi metric on convex domains of finite type.  
**Mathematische Annalen**, 365: 1425-1498, 2016.  
Available at: [arXiv:1405.2858](https://arxiv.org/abs/1405.2858)
46. Rigidity of complex convex divisible sets.  
**Journal of Topology and Analysis**, 10: 817-85, 2018.  
Available at: [arXiv:1308.4116](https://arxiv.org/abs/1308.4116)
47. Boundaries of non-compact harmonic manifolds.  
**Geometriae Dedicata**, 168: 339-357, 2014.  
Available at: [arXiv:1208.4802](https://arxiv.org/abs/1208.4802)
48. Compact asymptotically harmonic manifolds.  
**Journal of Modern Dynamics**, 6: 377-403, 2012.  
Available at: [arXiv:1205.2271](https://arxiv.org/abs/1205.2271)
49. A symplectic proof of a theorem of Franks.  
Joint with B. Collier, E. Kerman, B. Reiniger, B. Turmunkh.  
**Compositio Mathematica**, 148: 1969-1984, 2012.  
Available at: [arXiv:1107.1282](https://arxiv.org/abs/1107.1282)

### Expository:

50. The Space of Convex Domains in Complex Euclidean Space.  
Joint with H. Gaussier.  
**Journal of Geometric Analysis** (special issue), 30: 1312-1358, 2020.
51. Gromov Hyperbolicity of Bounded Convex Domains.  
In: Blanc-Centi, editor, **Metrical and dynamical aspects of complex analysis**, pp. 67-114. *Lecture Notes in Mathematics*, Vol. 2195, New York: Springer, 2017.

### Undergraduate research:

The papers below come from research I did as an undergraduate (it took a very long time to write up and submit everything).

52. A new lower bound for the semidefinite minimum rank.  
**Linear Algebra and its Applications**, 438: 1095-1112, 2013.
53. Bounds for minimum rank problems from superpositions and cutsets.  
Joint with J. Beagley, L. Mitchell, S. Narayan, E. Radzwion, S. Rimer, R. Tomasino, J. Wolfe.  
**Linear Algebra and its Applications**, 438: 4041-4061, 2013.
54. Lower bounds for minimum semidefinite rank from orthogonal removal and ...  
Joint with L. Mitchell, S. Narayan.  
**Linear Algebra and its Applications**, 436: 524-536, 2012.
55. Robustness and surgery of frames.  
Joint with S. Narayan, E. Radzwion, S. Rimer, R. Tomasino, J. Wolfe.  
**Linear Algebra and its Applications**, 434: 1893-1901, 2011.
56. Lower bounds in minimum rank problems.  
Joint with L. Mitchell, S. Narayan.  
**Linear Algebra and its Applications**, 432: 430-440, 2010.
57. Symmetric functions, Pascal matrices, and Stirling matrices.  
Joint with M. Spivey.  
**Linear Algebra and its Applications**, 428: 1127-1134, 2008.

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### RECENT TEACHING EXPERIENCE:

#### University of Wisconsin-Madison:

- Math 234: Calculus - Functions of Several Variables (Spring 2022)
- Math 421: The Theory of Single Variable Calculus (Spring 2021, Summer 2021, Fall 2022)
- Math 721: Real Analysis (Fall 2023)
- Math 761: Differentiable Manifolds (Spring 2023)
- Math 765: Differential Geometry (Fall 2021)
- Math 823: Advanced Topics In Complex Analysis (Fall 2020)

### Mentoring:

- MXM Lab undergraduate research advisor:
  1. "Quantitative uniqueness results in complex analysis," Spring 2023, 4 students
  2. "Sports Analytics," Spring 2022, 4 students
- Summer 2022: I co-organized the UW-Madison REU in analysis. This program supported 19 undergraduate students. I mentored seven of these students on 3 different projects involving complex analysis and hyperbolic geometry.
- Undergraduate research advisor (academic year 2019-2020). Topic: "Predicting outcomes in college football using machine learning"
- Undergraduate honors thesis advisor (academic year 2019-2020). Topic: data science.
- Undergraduate research advisor (academic year 2018-2019). Topic: complex analysis.
- Official/unofficial reading courses:
  1. Summer 2022: one graduate level reading course
  2. Spring 2022: two (one unofficial) graduate level reading courses
  3. Fall 2021: two (unofficial) graduate level reading courses,
  4. Spring 2021: two graduate level reading courses, one (unofficial) undergraduate level reading course
  5. Fall 2020: one (unofficial) undergraduate level reading course
  6. Winter 2019: two (unofficial) graduate level reading courses
  7. Winter 2017: one (unofficial) undergraduate level reading course
  8. Fall 2015: one (unofficial) undergraduate level reading course
- REU graduate student mentor (summer 2008): Mentored a group of undergraduates conducting mathematical research at the Central Michigan University summer REU.

### SERVICE

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- **Co-organizer** of "Junior Workshop in SCV" (Summer 2024).
- **Co-organizer** of special session "Developments in hyperbolic-like geometry and dynamics" at AMS Spring Central Sectional Meeting (Spring 2024)
- **Co-organizer** of "Summer 2022 UW-Madison REU in analysis" (Summer 2022).
- **Co-organizer** of conference "Gromov hyperbolicity and negative curvature in Complex Analysis" in Cortona, Italy (September 2021).
- **Referee/quick opinions for:** Advances in Mathematics, Cambridge Journal of Mathematics, Commentarii Mathematici Helvetici, Communications in Analysis and Geometry, Compositio Mathematica, Discrete Mathematics, Duke Mathematical Journal, Geometriae Dedicata, Geometry & Topology, Ergodic Theory and Dynamical Systems, Illinois Journal of Mathematics, Indiana University Mathematics Journal, International Journal of Mathematics, International Mathematics Research Notices, Journal für die Reine und Angewandte Mathematik, Journal of Differential Geometry, Journal of Geometric Analysis, Journal of Mathematical Analysis and Applications, Journal of Modern Dynamics, Journal of the London Mathematical Society, Journal of Topology, Linear Algebra and its Applications, Mathematische Annalen, New York Journal of Mathematics, Pacific Journal of Mathematics, Proceeding of the AMS, Transactions of the AMS, ...

## NON-LOCAL TALKS

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- Colloquium, University of Michigan (September 2023)
- (virtual) Workshop on “Invariant Distances and Metrics in Complex Analysis,” Sofia, Bulgaria (July 2023)
- Complex analysis and geometry: celebrating the 70+1th birthday of Laszlo Lempert, Renyi Institute (June 2023)
- Homogeneous Dynamics and Geometry in Higher-Rank Lie Groups, IHES (June 2023)
- Midwest Several Complex Variables Meeting, Ohio State University (April 2023)
- INDAM Meeting New Trends in Holomorphic Dynamics, Cortona, Italy (August/September 2022)
- Geometrical Analysis in Castro (May 2022)
- (virtual) The Conference on Complex Geometric Analysis, POSTECH (January 2022)
- (virtual) Conference “SCV, CR geometry and Dynamics”, Nice, France (December 2021)
- (virtual) Complex Analysis and Operator Theory seminar, University of Toledo (November 2021)
- (virtual) Topology Seminar, University of Wisconsin-Milwaukee (October 2021)
- (virtual) Differential Geometry Seminar, Heidelberg University (June 2021)
- (virtual) Geometric Methods of Complex Analysis, Oberwolfach (May 2021)
- (virtual) Differential Geometry Seminar, UC San Diego (April 2021)
- (virtual) Geometry & Topology seminar, Indian Institute of Science (March 2021)
- (virtual) Topology & Geometry seminar, National University of Singapore (February 2021)
- (virtual) Workshop on Topics at the Interface of Low Dimensional Group Actions and Geometric Structures (January 2021)
- (virtual) Midwest dynamics seminar (November 2020)
- Virtual East-West Several Complex Variables seminar (October 2020)
- (virtual) Several Complex Variables: Emerging Applications, Connections, and Synergies. AMS Fall Western Sectional Meeting (October 2020)
- (virtual) Northwestern, Notre-Dame, UIC Complex Geometry Seminar (October 2020)
- Virtual Conference on Several Complex Variables (August 2020)
- First Virtual Conference on Complex Analysis and Complex Geometry (May 2020)
- The Ohio State University (February 2020)
- Colloquium, University of Toronto (February 2020)
- Discrete Subgroups of Lie Groups, Banff (December 2019)
- Colloquium, University of Wisconsin (December 2019)
- Colloquium, University of Waterloo (November 2019)
- AMS Special Session on Geometric Structures on Manifolds, University of Florida (November 2019)
- AMS Special Session on Several Complex Variables, University of Wisconsin (September 2019)
- (2 hr. mini-course) Combinatorial and algebraic aspects of geometric structures, Chiangmai University (July 2019)
- POSTECH Conference on Complex Analytic Geometry, POSTECH, South Korea (July 2019)
- Nordan conference in complex analysis, University of Amsterdam (May 2019)
- Analysis Seminar, University of Wisconsin (April 2019)
- AMS Special Session on Several Complex Variables, University of Hawaii (March 2019)
- Complex Analysis and Geometry Seminar, Rutgers University (March 2019)
- RTG Working Seminar on Geometry, Dynamics and Topology, University of Michigan (February 2019)
- Geometry seminar, University of Michigan (February 2019)
- Dynamics and Analysis seminar, Wesleyan University (February 2019)
- Complex Analysis Seminar, Università di Roma “Tor Vergata” (January 2019)

- Geometry & Topology seminar, Caltech (November 2018)
- Complex Analysis Seminar, Università di Roma "Tor Vergata" (May 2018)
- (2.5 hr. mini-course) Progress in Several Complex Variables, KIAS, South Korea (April 2018)
- Conference in Complex Geometry and Several Complex Variables, University of Notre Dame (March 2018)
- Colloquium, Louisiana State University (January 2018)
- GAIA seminar on complex analytic geometry, POSTECH, South Korea (January 2018)
- Geometry-Topology seminar, University of Maryland (November 2017)
- Geometry & Topology seminar, Caltech (October 2017)
- Summer 2017 Wasatch Topology Conference, Midway, Utah (August 2017)
- Complex Analysis and Geometry XXII, Levico Terme, Italy (June 2017)
- AMS Special Session on Several Complex Variables and PDEs, Washington State University (April 2017)
- Topology seminar, University of Michigan (April 2017)
- RTG Working Seminar on Geometry, Dynamics and Topology, University of Michigan (April 2017)
- Colloquium, College of William and Mary (March 2017)
- Workshop on Invariant Metrics, Squeezing Functions, and Mapping Problems, Oslo (March 2017)
- Complex Analysis and Geometry Seminar, Rutgers University (February 2017)
- University of Oklahoma (January 2017)
- AMS Special Session on Group Actions and Geometric Structures, JMM (January 2017)
- AMS Special Session on Character Varieties, JMM (January 2017)
- Special Session on Complex Analysis and Applications, CMS (December 2016)
- Colloquium, University of Wisconsin (December 2016)
- Felix Klein Seminar, University of Notre Dame (November 2016)
- RTG Working Seminar on Geometry, Dynamics and Topology, University of Michigan (Fall 2016)
- Analytic Aspects of Higher Teichmüller Theory, Rutgers University at Newark (Fall 2016)
- Complex Analysis and Complex Geometry, Banff (Spring 2016)
- Analysis seminar, University of Western Ontario (Spring 2016)
- AMS Special Session on Partial Differential Equations in Complex Analysis, JMM (Winter 2016)
- AMS Special Session on Metric Spaces: Geometry, Group Theory, and Dynamics, Loyola University (Fall 2015)
- Department colloquium, Bowling Green State University (Fall 2015)
- Geometry working seminar, Pennsylvania State University (Fall 2015)
- Analysis & Applied Mathematics seminar, Central Michigan University (Fall 2015)
- Spring School in Lille: Metrical and dynamical aspects of complex analysis, Université Lille 1 (Spring 2015)
- Bloomington Geometry Workshop, University of Indiana (Spring 2015)
- AMS Special Session on Geometry of Manifolds, Singular Spaces, and Groups, Michigan State University (Spring 2015)
- Geometry, Groups and Dynamics seminar, University of Illinois at Urbana-Champaign (Winter 2015).
- Ahlfors-Bers Colloquium, Yale University (Fall 2014)
- GEAR junior retreat, University of Michigan (Summer 2014)
- Group actions in Riemannian geometry, University of North Carolina (Summer 2014)
- Geometry/Topology seminar, Temple University (Spring 2014)
- Semi-annual Workshop in Dynamical Systems and Related Topics, Penn State University (Fall 2013)
- Geometry/Topology seminar, University of Chicago (Fall 2013)
- Geometry/Topology seminar, Michigan State University (Fall 2013)



- RTG Workshop on Random Walks on Groups, University of Michigan (Winter 2013)
- AMS Special Session on Interactions between Geometry and Topology, University of Akron (Fall 2012)
- Geometric Analysis Seminar, Michigan State University (Fall 2011)
- Mathematics REU Guest Speaker, Central Michigan University (Summer 2011)