Curriculum Vitae
KATHRYN A. LINDSEY

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Employment

2023-present	Associate Professor, Department of Mathematics, Boston College.
2017-2023	Assistant Professor, Department of Mathematics, Boston College.
2014-2017	Dickson Instructor & N.S.F. Mathematical Sciences Postdoctoral Research Fellow, University of Chicago.

Education

2010-2014	Ph.D. in Mathematics, Cornell University.
2007-2010	M.S. Special in Mathematics, Cornell University.
2003-2007	B.A. in Mathematics, Williams College.

Research Interests

Mathematical Foundations of Deep Learning:
I use geometry/topology/dynamics to prove theorems about neural networks; focus on feedforward neural networks with ReLU activations.

Dynamical Systems:
Iterative dynamics with connections to geometry; specifically, holomorphic dynamics, Thurston sets, Teichmuller dynamics, ergodic theory.

Grants & Fellowships

2021	NSF DMS SCALE MoDL Program Award # 2133822, Collaborative Research: Probabilistic, Geometric, and Topological Analysis of Neural Networks, From Theory to Applications, joint with E. Grigsby ($300,000).
2019	NSF DMS Analysis Program Award #1901247, Shapes of Julia sets, Thurston Sets, and Neural Networks ($150,000).
2018	"Women in STEM" co-PI Major Grant, Institute for Liberal Arts, Boston College ($24,000).
2018	Research Incentive Grant, Boston College ($14,600).
2014	NSF Mathematical Sciences Postdoctoral Research Fellowship ($150,000).

2009	NSF Graduate Research Fellowship ($120,000).
2009	DoD National Defense Science and Engineering Graduate Fellowship ($120,000).
2008	U.S. State Department Critical Languages Scholarship (Mandarin Chinese).
2007	Cornell University Graduate Fellowship.

Awards

2010	Robert John Battig Graduate Prize, Cornell University - awarded annually by the Cornell math faculty to a Ph.D. candidate “based on excellence and promise in mathematics”
2007	Highest Honors in Mathematics, Williams College
2007	Magna Cum Laude, Williams College
2007	Phi Beta Kappa, Williams College

Research Program Participation

Fall 2023	Semester program "Math + Neuroscience: Strengthening the Interplay between Theory and Mathematics," ICERM, Providence, RI.
Fall 2013	Research Fellow, Semester program "Low-dimensional Topology, Geometry & Dynamics," ICERM, Providence, RI.
2017 Jun.	Mathematics Research Community, Dynamical Systems: Smooth, Symbolic & Measurable, Snowbird, Utah.
2013 Jun.	Mathematics Research Community, Complex Dynamics, Snowbird, Utah.
2006 summer	SMALL REU Ergodic Theory research group, Williams C.

Publications

2025	Regularization implies balancedness in deep linear networks (with G. Menon). Preprint online at https://arxiv.org/abs/2511.01137
2025	Empirical NTK tracks task complexity (with J. E. Grigsby). Preprint online at https://openreview.net/pdf?id=HkswvbYIp
2025	Functional dimension of feedforward ReLU neural networks (with J. E. Grigby, R. Meyerhoff, C. Wu). *Advances in Mathematics*, Vol 482, Part C.
2024	On Functional Dimension and Persistent Pseudodimension (with J. E. Grigsby). Preprint online at https://arxiv.org/abs/2410.17191.

2023 Hidden symmetries of ReLU neural networks (with J. E. Grigsby, D. Rolnick). In *Proceedings of the 40th International Conference on Machine Learning*, available at https://proceedings.mlr.press/v202/grigsby23a.html.

2023 A characterization of Thurston's Master Teapot (with C. Wu). *Ergodic Theory & Dynamical Systems*, vol 43, pp. 3354–3382.

2022 On the deck groups of iterates of bicritical rational maps (with S. Koch and T. Sharland). Preprint online at https://arxiv.org/abs/2210.03148.

2022 Bicritical rational maps sharing a common iterate (with S. Koch, T. Sharland). *International Math. Research Notices*, vol 2024(2), 2024.

2022 Local and global topological complexity measures of generic, transversal ReLU neural network functions (with J. E. Grigsby, M. Masden). Preprint online at https://arxiv.org/abs/2204.06062.

2022 Existence of maximum likelihood estimates in exponential random graph models (with H. Bayly, A. Khanna). Preprint online at arxiv.org/abs/2204.04757.

2021 Master Teapots and entropy algorithms for the Mandelbrot set (with G. Tiozzo, C. Wu). *Transactions of the A.M.S.*, vol 378, pp. 3297-3348.

2021 The shape of Thurston's Master Teapot (with H. Bray, D. Davis, C. Wu). *Advances in Math*ematics, vol 377, 2021.

2020 On transversality of bent hyperplane arrangements and the topological expressiveness of ReLU neural networks (with J. E. Grigsby). *SIAM Journal on Applied Algebra and Geometry*, vol 6, issue 2.

2019 Degree-d-invariant laminations (with W. Thurston, H. Baik, G. Yan, J. Hubbard, Tan Lei, D. Thurston). In collection *What's Next?: The Mathematical Legacy of William P. Thurston*, Princeton University Press, 2020.

2019 Horocycle flow orbits and lattice surface characterizations (with J. Chaika). *Ergodic Theory & Dynamical Systems*, Vol. 39, Issue 6, pp 1441-1461, 2019.

2017 A Game of Life on Penrose Tilings (with D. Bailey). Preprint online at https://arxiv.org/abs/1708.09301.

2016 Fekete polynomials and shapes of Julia sets (with M. Younsi). *Transactions of the American Math.* Soc., 371 (2019), pp. 8489-8511, 2016

2016 Convex shapes and harmonic caps (with L. DeMarco). *Arnold Math. Journal*, April 2017, Volume 3, Issue 1, pp. 97-117, 2016. (Special volume for 25th anniversary of Institute for Mathematical Sciences.)

2016 Infinite type flat surface models of ergodic systems. *Discrete and Continuous Dynamical Systems - A*., vol 36 (10), pp. 5509-5553, 2016.

2015 Shapes of polynomial Julia sets. *Ergodic Theory & Dynamical Systems*, vol 35 (06), 2015.

2015 Counting invariant components of hyperelliptic translation surfaces. *Israel Journal of Math.*, 210, pp. 125-146, 2015.

2009 On ergodic transformations that are both weakly mixing and uniformly rigid (with James, Koberda, Silva, Speh). *New York Journal of Math.*, 15, pp. 393-403, 2009.

2008 Measurable Sensitivity (with James, Koberda, Silva, Speh). *Proc. Amer. Math. Soc.,* 136, pp. 359-3559, 2008.

Advising

2023-present Ph.D. advisor to Yaoying Fu, B.C.

2020-2025 Ph.D. advisor to Laura Seaberg, B.C.

2018-2023 Ph.D. advisor to Ethan Farber, B.C.

2020-2022 M.S. geophysics thesis committee member for Hong Cai, B.C.

2020-2021 Undergraduate thesis advisor to Henry Bayly & Alexander Benanti, B.C.

2020-2021 Secondary undergraduate thesis advisor to Jieqi Di, B.C.

2019 fall Supervised undergraduate research project on neural networks, B.C.

2018 summer Employed 3 undergraduate math majors as research assistants, B.C.

2015 summer Supervised 3 undergraduate research (REU) projects (two in ergodic theory, one in complex dynamics), U. Chicago.

Conference Organization

2025 American Math. Society Special Session on Geometric and Combinatorial Methods in Deep Learning Theory, Joint Math Meetings, Seattle, Jan. 2025.

2024 CIMAT-Merida Applied Topology School, Unidad Mérida, Mexico, Nov. 2024

2023 American Math. Society Special Session on "Dynamics, Geometry & Group Actions, Joint Math Meetings, Jan. 2023, Boston, MA.

2020 American Math. Society Special Session on Geometric Dynamics and Billiards, American Math. Soc. Spring Sectional Meeting (virtual), Mar. 21-22, 2020.

2018 — 14th William Rowan Hamilton Geometry and Topology Workshop, *Group Actions and ergodic theory in geometry and topology*, Trinity College, Dublin, Ireland.

2018 — American Math. Society Special Session on *Dynamical Systems: Smooth, Symbolic & Measurable*, Joint Math Meetings, San Diego.

2014 — *What's Next? the legacy of Bill Thurston*, June 23-27, 2014, Cornell U., Local organizing committee.

Seminar Organization

2025-present — Co-organizer of Math & Machine Learning seminar, B.C.

2018-2020 — Co-founder and co-organizer of Dynamics Seminar, B.C.

2017-2022 — Organizer of First Year Research Seminar, B.C.

2015-2017 — Co-organizer of Dynamics Seminar, U. Chicago

2013-2014 — Organizer of Dynamical Systems Seminar, Cornell U.

2009-2010 — Organizer of Olivetti Club (weekly graduate student seminar), Cornell U.

2008-2009 — Organizer of "What Is...?" Seminar, Cornell U.

Selected Invited Talks

2025 Dec. — Workshop on Rational Maps, Boston College.

2025 Nov. — Oberseminar Dynamics, virtual talk, Technische Universität München, Germany.

2025 Aug. — Workshop on Topological Data Analysis, Field Institute, Toronto, Canada.

2025 Jun. — JHH 80 Dynamical Developments: Degenerations of Flat Surfaces and Rational Maps, Institut de Mathematiques de Toulouse, Jun. 10-13, 2025.

2025 Apr. — Trinity College Dublin/Boston College paired colloquia

2025 Apr. — GEOTOP-A Seminar, virtual seminar

2025 Apr. — Keynote speaker at New England Dynamic Seminar, Boston U.

2025 Mar. — Boston Symmetry Day, Northeastern U.

2025 Mar. — Virtual talk, Universidad Juarez del Estado de Durango, Mexico.

2025 Jan. — A.M.S. Special Session on Arithmetic Dynamics of Single and Multiple Maps, Joint Math Meetings, Seattle

2024 Nov.	Minicourse, Applied Topology School, Centro de Investigación en Matemáticas, Mérida, Mexico
2024 Nov.	Colloquium, Dartmouth College
2024 May	Colloquium, Center for Computing Sciences, Institute for Defense Analysis.
2024 Mar.	Featured speaker, Mina Rees NY Women and Math Conference, C.U.N.Y.
2024 Mar.	Complex Analysis and Dynamics Seminar, C.U.N.Y.
2024 Jan.	Guest Lecture in Math 1702: The Making of the Moral Mind, B.C.
2023 Nov.	Open Problems Seminar, Math+Neuroscience Semester, I.C.E.R.M.
2023 Nov.	GeomTop Seminar, Brown U.
2023 Sep.	Colloquium, Mathematics Department, George Mason U.
2023 Jul.	Poster presentation at the 40th International Conference on Machine Learning, Honolulu, HI.
2023 Apr.	Dynamical Systems Seminar, Boston U.
2023 Mar.	One World Seminar Series on the Mathematics of Machine Learning, virtual.
2023 Mar.	A Dynamical Weekend at Wesleyan, Wesleyan U.
2023 Jan.	AMS Special Session on Topology, Algebra, and Geometry in the Mathematics of Data Science, Joint Math Meetings.
2022 Oct.	Earth and Environmental Sciences Department Seminar, Boston College.
2022 Jun.	Minisymposium on computational topology, Computational Geometry Week 2022, Berlin, Germany.
2022 May	Number Theory Seminar, Oregon State U.
2022 May	Houston Workshop on Hyperbolic Dynamical Systems, U. Houston.
2022 Feb.	Pacific Northwest Sem. on Topology, Algebra & Geometry in Data Science.
2022 Jan.	Algebraic Dynamics Seminar, Harvard University.
2021 Sep.	Colloquium, U. Wisconsin-Milwaukee.
2021 Jun.	Colloquium, SUMMER@ICERM, ICERM.

2021 Mar.	Panel Discussion, Williams College.
2020 Dec.	Colloquium, University of Warwick, U.K.
2020 Oct.	Online working seminar in ergodic theory, U. Utah.
2020 Oct.	Dynamics Seminar, U. Wisconsin-Madison.
2020 Jul.	Quasiworld workshop, U.C.L.A.
2020 Jun.	Informal Geometry and Dynamics Seminar, Harvard U.
2019 Nov.	Illustrating Dynamics and Probability, I.C.E.R.M.
2019 Nov.	Geometry/Topology Seminar, Yale U.
2019 Oct.	Ergodic Theory Seminar, The Ohio State U.
2019 Jun.	Dubrovnik IX, Dubrovnik, Croatia.
2019 Apr.	Dynamics Seminar, U. Toronto.
2019 Mar.	Dynamics Seminar, U. Chicago.
2019 Jan.	MAA invited paper session “Beauty and Art from Research Mathematics,” Joint Math. Meetings, Baltimore.
2018 Sep.	Workshop on Neural Networks and Machine Learning, Boston C.
2018 May	International Congress on Mathematical Physics, Dynamical Systems session, Montréal, Canada.
2018 Apr.	Informal Geometry and Dynamics Seminar, Harvard U.
2018 Apr.	Advancing Women’s Impact in Mathematics Symposium, Worcester Polytechnic Institute.
2018 Apr.	Workshop on Dynamical Systems and Related Topics, U. Maryland.
2018 Mar.	Dynamics seminar, Cornell U.
2018 Mar.	Oliver Club colloquium, Cornell U.
2018 Mar.	Colloquium, Brown U.
2018 Mar.	Dynamics Seminar, Boston U.

2018 Mar. Colloquium, U. Saskatoon.

2018 Jan. AMS Special Session on Math. Research from the SMALL Undergraduate Research Program, Joint Math. Meetings, San Diego.

2017 Nov. Geometric Group Theory and Topology Seminar, Tufts U.

2017 Aug. William Rowan Hamilton Geometry and Topology Workshop, Trinity C., Dublin, Ireland.

2017 Jul. Special Session on Arithmetic Dynamics, Mathematical Congress of the Americas, Montréal, Canada.

2017 Apr. AMS Special Session on Discrete Structures in Conformal Dynamics and Geometry, Indiana U.-Bloomington.

2017 Feb. Chicago Actions Now, U. of Illinois-Chicago.

2017 Feb. Women in Math Symposium, U. Chicago.

2017 Jan. Colloquium, George Washington U.

2017 Jan. Colloquium, UT Austin.

2016 Dec. Colloquium, Boston C.

2016 Dec. Colloquium, Washington U. in St. Louis.

2016 Nov. Midwest Dynamical Systems Conference, Indiana U.-Purdue U.-Indianapolis.

2016 Nov. Colloquium, U. Wisconsin-Madison.

2016 Oct. Complex Analysis Seminar, U. Michigan Ann Arbor.

2016 Oct. Midwest Workshop on Asymptotic Analysis, Indiana U.-Purdue U.-Fort Wayne.

2016 Aug. Cycles on Moduli Spaces, Geometric Invariant Theory, and Dynamics, Institute for Computational and Experimental Mathematics, Providence, RI.

2016 May Workshop on Flat Surfaces and Dynamics of Moduli Space, Banff International Research Station Casa Matemática Oaxaca, Mexico.

2016 Apr. Dynamics Seminar, Stony Brook U.

2016 Apr. Geometry Group Theory & Dynamics Seminar, Tufts U.

2016 Mar. British Mathematics Colloquium, Ergodic Theory Special Session, Bristol U., Bristol, United Kingdom.

2016 Mar. Dynamics Seminar, Bristol University, Bristol, United Kingdom.

2016 Mar. 50th Spring Topology and Dynamics Conference, Baylor U.

2016 Feb. Dynamical Systems Seminar, U. of Maryland-College Park.

2015 Nov. Teichmüller Theory Seminar, Indiana U.-Bloomington.

2015 Aug. Dynamical developments: a conference in complex dynamics and Teichmüller theory, in honor of John Hubbard's 70th birthday. Jacobs U., Bremen, Germany.

2015 Apr. Dynamical Systems Seminar, Northwestern U.

2015 Mar. Midwest Women in Mathematics Symposium, Dominican U.

2015 Feb. Dynamics Seminar, Indiana U.-Purdue U.-Indianapolis.

2014 Nov. Geometry and Topology Seminar, Stanford U.

2014 Oct. Math Department Seminar, Beloit C.

2014 Aug. Wasatch Topology Conference, Park City, Utah.

2014 Apr. Dynamical Systems Seminar, Northwestern U.

2014 Apr. Workshop on Dynamical Systems and Related Topics, U. Maryland.

2014 Mar. Geometry Seminar, U. of Michigan-Ann Arbor.

2014 Jan. Special Session on Complex Dynamics, Joint Math Meetings, Baltimore.

2013 Aug. International Conference and Workshop on Surfaces of Infinite Type, Universidad Nacional Autonoma de Mexico, Campus Morelia, Mexico.

2013 May Dynamics seminar, U. Chicago.

2013 May Faculty Seminar, Williams C.

2012 Nov. Séminaire COOL, Institut Henri Poincaré, Paris, France.

2012 Nov. Holomorphic Dynamics Seminar, Université d'Angers, France.

2012 Mar. Informal Seminar: Dynamics and Geometry, Harvard U.

2011 Apr. Action Now Wandering Seminar, Ben Gurion U, Israel.

2010 Nov. Oxtoby Centennial Conference, Bryn Mawr C.

Teaching

2025 fall: Math 8875: Topics in Machine Learning

2025 fall Math 3321: Analysis I

2024 spring Math 2216: Introduction to Abstract Mathematics, BC

2024 spring Math 3322: Analysis II, BC

2023 fall Math 3321: Analysis I, BC

2023 fall Math 8810: Real Analysis, BC

2023 spring Math 2202: Multivariable Calculus, 2 sections, B.C.

2022 fall Math 8810: Real Analysis, B.C.

2022 spring Math 2202: Multivariable Calculus, B.C.

2021 fall Math 8831: Geometry & Topology III, B.C.

2020 fall Math 8810: Real Analysis, B.C.

2020 fall Math 3320: Introduction to Analysis, B.C.

2020 spring Math 2216: Introduction to Abstract Mathematics, B.C.

2019 fall Math 8810: Real Analysis, B.C.

2018 fall Math 1105: Calculus II AP (for math/science majors), B.C.

2017 fall Math 8855: Topics in Geometry & Topology, B.C.

2017 fall Math 1102: Calculus I (Math/Science Majors), B.C.

2017 spring Math 20500: Analysis in R^n III, U. Chicago.

2016 spring Math 20300: Analysis in R^n I, U. Chicago.

2015 autumn Math 15300: Calculus III, U. Chicago.

2009-2014 sum Nautical Science, Sea Education Association, SSV Corwith Cramer.

2012 summer Math 1110: Calculus I, Cornell U.

2009 spring Teaching Assistant, Math 2130: Calculus III, Cornell U.

2008 fall	Teaching Assistant, Math 1910: Calculus for Engineers, Cornell U.

Outreach and Service

2025	NSF Panelist
2024	NSF Panelist
2023-present	Chair, American Math. Soc. Mathematics Research Communities Advisory Board
2023	NSF Panelist
2021-2023	American Math. Soc. Mathematics Research Communities Advisory Board
2021-2022	Website committee, math dept., Boston C.
2021	NSF Panelist
2021	Public lecture "Dynamical Roots" (joint with G. Tiozzo and Y. M. He).
2020	NSF Panelist
2019 summer	Taught one-month course about fractals for 9^{th} and 10^{th} grade high school students, U. Chicago Young Scholars Program.
2019-2020	Graduate admissions committee, math dept., B.C.
2018-2019	Hiring committee, math dept., B.C.
2018-2019	Distinguished lecturer committee, math dept., B.C.
2018-2019	Prize committee, math dept., B.C.
2018	Co-organizer of "Women in STEM" lectures series, B.C.
2017 summer	Taught two-week course for 9^{th} and 10^{th} grade high school students on complex dynamics, Young Scholars Program, U. Chicago.
2016 summer	Taught dynamical systems unit (joint with A. Brown, H. Masur), Research Experience for Undergraduates, U. Chicago.
2015 summer	Taught ergodic theory unit, Research Experience for Undergraduates, U. Chicago.
2016 Apr.	Presentation for U. Chicago Math Club.
2015	Made short video for use in American Math. Society production of "Who wants to be a mathematician?"

2013-2014	Committee to Consider the Future Access to Mathematical Literature at Cornell U.
2010-2013	President, Cornell Student Chapter of the Association for Women in Mathematics.
2012 summer	Mentor to four students in Summer Math Institute, Cornell U.
2010	Co-Founded Cornell U. Student Chapter of the Association for Women in Math.
2007-2010	Class Representative, Mathematics Department, Cornell U.
2009	Wrote online Math Explorers Club unit *Introduction to Tilings*.
2009 Dec.	Guest speaker in Math 5080: Mathematics for Secondary School Teachers, Cornell
2009 Mar.	Led enrichment activities, Boynton Middle School "Math Day."
2004-2007	Student Mathematics and Statistics Advisory Board, Williams C.
2006-2007	Grievance Committee, Williams C.
2005-2006	Calendar and Schedule Committee, Williams C.

Organizational Memberships

American Mathematical Society
Association for Women in Mathematics
Association for Mathematical Research

Other Skills

Computing:	Mathematica, Python, Sage, LaTex
Languages:	English (native), French (fluent), Chinese (intermediate), Hindi (beginner)
Maritime:	U.S.C.G. Merchant Mariner Credentials: 200 GRT Near-Coastal Mate, 100 GRT Inland Master, AB Sail with Lifeboatman certification, >500 days of sea time Watch leader (3rd mate) with Sea Education Association
Music:	Pedal harp
Art:	Ceramics - wheel throwing