

Ben Knudsen

CONTACT INFORMATION

Mathematics Department
Northeastern University
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EMPLOYMENT

Northeastern University

Assistant Professor, 2019–

Harvard University

NSF Postdoctoral Fellow and Lecturer, 2016–2019

Sponsor: Michael Hopkins

EDUCATION

Northwestern University

Ph.D. in Mathematics, 2016

Advisor: John Francis

Dissertation: *Higher enveloping algebras and configuration spaces of manifolds*

Princeton University

B.A. in Mathematics, 2011

Advisor: Zoltán Szabó

Thesis: *On odd Khovanov homology and its mutation invariance*

PUBLICATIONS (AUTHORSHIP ALPHABETICAL)

Embedding calculus and smooth structures. Ben Knudsen and Alexander Kupers. *Geometry and Topology*, in press (2023).

Projection spaces and twisted Lie algebras. Ben Knudsen. *Contemporary Mathematics* 790 (2023).

Robertson's conjecture in algebraic topology. Ben Knudsen and Eric Ramos. *Séminaire Lotharingien de Combinatoire* 89B (2023).

The topological complexity of pure graph braid groups is stably maximal. Ben Knudsen. *Forum of Mathematics, Sigma* 10 (2022).

Extremal stability for configuration spaces. Ben Knudsen, Jeremy Miller, and Philip Tosteson. *Mathematische Annalen* 3 (2022), pp. 1–22.

On the second homology of planar graph braid groups. Byung Hee An and Ben Knudsen. *Journal of Topology* 15 (2022), pp. 666–691.

A Künneth theorem for configuration spaces. Kathryn Hess and Ben Knudsen. *Journal of the London Mathematical Society* 105 (2022), pp. 639–664.

Asymptotic homology of graph braid groups. Byung Hee An, Gabriel C. Drummond-Cole, and Ben Knudsen. *Geometry and Topology* 26 (2022), pp. 1745–1771.

Farber’s conjecture for planar graphs. Ben Knudsen. *Selecta Mathematica, New Series* 27 (2021).

Edge stabilization in the homology of graph braid groups. Byung Hee An, Gabriel C. Drummond-Cole, and Ben Knudsen. *Geometry and Topology* 24 (2020), pp. 421–469.

Subdivisional spaces and graph braid groups. Byung Hee An, Gabriel C. Drummond-Cole, and Ben Knudsen. *Documenta Mathematica* 24 (2019), pp. 1513–1583.

Configuration spaces of products. William Dwyer, Kathryn Hess, and Ben Knudsen. *Transactions of the American Mathematical Society* 371 (2019), pp. 2963–2985.

Higher enveloping algebras. Ben Knudsen. *Geometry and Topology* 22 (2018), pp. 4013–4066.

Betti numbers of configuration spaces of surfaces. Gabriel C. Drummond-Cole and Ben Knudsen. *Journal of the London Mathematical Society* 96 (2017), pp. 367–393.

Betti numbers and stability for configuration spaces via factorization homology. Ben Knudsen. *Algebraic and Geometric Topology* 17 (2017), pp. 3137–3187.

PREPRINTS
(AUTHORSHIP
ALPHABETICAL)

Farber’s conjecture and beyond. Ben Knudsen. Under review, arXiv:2402.03022.

Analog category and complexity. Ben Knudsen and Shmuel Weinberger. Under review, arXiv:2401.15667.

Robertson’s conjecture and universal finite generation in the homology of graph braid groups. Ben Knudsen and Eric Ramos. Under review, arXiv:2305.19363.

On the stabilization of the topological complexity of graph braid groups. Ben Knudsen. Under review, arXiv:2302.04346.

The Lubin–Tate theory of configuration spaces: I. Lukas Brantner, Jeremy Hahn, and Ben Knudsen. Under review, arXiv:1908.11321.

Configuration spaces in algebraic topology. Ben Knudsen. arXiv:1803.11165.

IN PREPARATION
(AUTHORSHIP
ALPHABETICAL)

Representation asymptotics for pure graph braid groups via twisted algebras. Ben Knudsen.

Cyclic orders and configuration spaces. Kathryn Hess and Ben Knudsen.

Pointless Lie algebras. Lukas Brantner, Jeremy Hahn, and Ben Knudsen.

INVITED TALKS

School on configuration spaces, focus program “Landscape of Algebraic Topology: In Memory of Fred Cohen,” Fields Institute (July 2025).

Workshop on polyhedral products, focus program “Toric Topology, Geometry and Polyhedral Products,” Fields Institute (July 2024).

“Algebraic Structures in Topology II,” Puerto Rico (June 2024).

University of Chicago geometry and topology seminar (May 2024).

Farber's conjecture and beyond, Louisiana State University topology seminar (May 2023).

The complexity of collision-free motion planning on graphs, UMass Boston topology seminar (March 2023).

Farber's conjecture and beyond, "Configuration Spaces and Related Topics," Kyungpook National University, South Korea (February 2023).

Stability phenomena in the homology of (pure) graph braid groups, "Manifolds, homotopy theory, and related topics" seminar (January 2023).

The complexity of collision-free motion planning on graphs, University of Nevada, Reno colloquium (November 2022).

Smooth structures and embedding calculus. AMS Special Session, "Higher Structures and Homotopical Algebra," UMass Amherst (October 2022).

Stable and unstable homology of graph braid groups. Electronic Computational Homotopy Theory Research Seminar (September 2022).

Farber's conjecture. Northeastern University topology seminar (September 2022).

The topological complexity of pure graph braid groups is stably maximal. Applied Algebraic Topology Research Network Topological Complexity online seminar (July 2022).

Stable and unstable homology of graph braid groups. "Moduli and friends" seminar, Bucharest (July 2022).

Around Farber's conjecture. Topological Complexity and Motion Planning, BIRS-CMO Oaxaca (May 2022).

Smooth structures and embedding calculus. EPFL topology seminar (May 2022).

Extremal stability for configuration spaces. Stockholm University topology seminar (May 2022).

Extremal stability for configuration spaces. "Compactifications, Configurations, and Cohomology," Northeastern University (October 2021).

Smooth structures and embedding calculus. OCHoTop mid-term workshop, Lille (July 2021).

Stable and unstable homology of graph braid groups. Columbia geometric topology seminar (March 2021).

Stable and unstable homology of graph braid groups. Caltech geometry and topology seminar (March 2021).

Topological complexity of pure graph braid groups. Applied Algebraic Topology Research Network Topological Complexity online seminar (February 2021).

Smooth structures and embedding calculus. University of Bonn topology seminar (January 2021).

Stable and unstable homology of graph braid groups. Purdue topology seminar (November 2020).

Smooth structures and embedding calculus. MIT topology seminar (October 2020).

Generalised Lie Algebras in Derived Geometry, Utrecht (June 2020). Canceled due to COVID-19.

Texas Geometry and Topology Conference, Texas Tech (April 2020). Canceled due to COVID-19.

Embedding calculus and smooth structures. “Spaces of Embeddings: Connections and Applications,” Banff International Research Station (October 2019).

Connectivity and growth in the homology of graph braid groups. “Arrangements at Western,” University of Western Ontario (May 2019).

Higher enveloping algebras and configuration spaces of manifolds. Indiana University topology seminar (May 2019).

Connectivity and growth in the homology of graph braid groups. “Graduate Student Topology and Geometry Conference,” UIUC (March 2019).

Connectivity and growth in the homology of graph braid groups. University of Michigan topology seminar (March 2019).

Connectivity and growth in the homology of graph braid groups. University of Louisiana at Lafayette topology seminar (January 2019).

How to build a surface of genus six. University of Louisiana at Lafayette colloquium (January 2019).

Configuration spaces and Lie algebras away from characteristic zero. “Manifolds,” Isaac Newton Institute (December 2018).

Configuration spaces of manifolds and graphs. Special seminar, Northeastern University (November 2018).

Connectivity and growth in the homology of graph braid groups. “Upstate New York Topology Seminar,” SUNY Albany (November 2018).

Connectivity and growth in the homology of graph braid groups. University of Massachusetts at Amherst geometry and topology seminar (November 2018).

Toward the cohomology of the pure elliptic braid group. MIT topology seminar (October 2018).

Connectivity and growth in the homology of graph braid groups. University of Georgia topology seminar (October 2018).

Connectivity and growth in the homology of graph braid groups. Isaac Newton Institute (July 2018).

Edge stabilization in the homology of graph braid groups. SUNY Albany topology seminar (May 2018).

Edge stabilization in the homology of graph braid groups. University of Minnesota topology seminar (May 2018).

Homology of surface and graph braid groups. AMS Special Session “Arrangements of hypersurfaces,” Northeastern University (April 2018).

Edge stabilization in the homology of graph braid groups. University of Chicago topology and geometry/topology joint seminar (April 2018).

Edge stabilization in the homology of graph braid groups. Northwestern topology seminar (April 2018).

Homology of surface and graph braid groups. Brandeis topology seminar (February 2018).

Homology of surface and graph braid groups. Oberwolfach workshop “Topology of Arrangements and Representation Stability” (January 2018).

Subdivisional spaces and graph braid groups. MPIM topology seminar (January 2018).

Subdivisional spaces and graph braid groups. University of Oregon topology seminar (December 2017).

Subdivisional spaces and graph braid groups. MIT topology seminar (November 2017).

Higher enveloping algebras. “Lie Theory and Mathematical Physics,” MIT (July 2017).

Configuration spaces of products. IBS Center for Geometry and Physics (June 2017).

Homology of surface and graph braid groups. ICMS workshop “Braids in algebra, geometry and topology” (May 2017).

Subdivisional spaces and graph braid groups. University of Pennsylvania mathematical physics seminar (March 2017).

From Lie algebras to configuration spaces. EPFL topology seminar (February 2017).

A local-to-global approach to configuration spaces. Heidelberg University physical mathematics seminar (February 2017).

Higher enveloping algebras and configuration spaces of manifolds. MIT topology seminar (November 2016).

Higher enveloping algebras. AMS Special Session “Quantum field theories and geometric representation theory,” University of St. Thomas (October 2016).

Higher enveloping algebras and configuration spaces of manifolds. “Midwest Topology Seminar,” Purdue University (September 2016).

Betti numbers of configuration spaces of surfaces. Purdue topology seminar (September 2016).

Higher enveloping algebras. Oberwolfach workshop “Factorization Algebras and Functorial Field Theories” (May 2016).

Higher enveloping algebras and configuration spaces of manifolds. IBS Center for Geometry and Physics seminar (April 2016).

Configuration spaces, Lie algebras, and factorization. University of Copenhagen topology and algebra seminar (January 2016).

Rational homology of configuration spaces via factorization homology, Ohio State University K-theory and homotopy theory seminar (November 2015)

Rational homology of configuration spaces via factorization homology. University of Chicago topology and geometry/topology joint seminar (November 2015)

Rational homology of configuration spaces via factorization homology. Notre Dame topology seminar (October 2015)

Rational homology of configuration spaces via factorization homology. Johns Hopkins topology seminar (September 2015)

Rational homology of configuration spaces via factorization homology. University of Virginia topology seminar (September 2015)

Rational homology of configuration spaces via factorization homology. University of Illinois at Urbana-Champaign topology seminar (April 2015)

Rational homology of configuration spaces via factorization homology. IBS Center for Geometry and Physics (March 2015)

An algebraic approach to configuration spaces. UIC homotopy algebras seminar (February 2015)

Rational homology of configuration spaces via factorization homology. Northwestern topology seminar (February 2015)

Rational homology of configuration spaces via factorization homology. Purdue topology seminar (October 2014)

Rational homology of configuration spaces via factorization homology. Stanford topology seminar (September 2014)

Rational homology of configuration spaces via factorization homology. University of Wisconsin topology seminar (September 2014)

GRANTS

2024–2025 Conference Grant (co-PI, recommended for funding, \$30,000)
Mid-Atlantic Topology Conference 2024
National Science Foundation

2023–2025 Conference Grant (co-PI, funded, DMS 2329854, \$21,400)
*New England Algebraic Topology and Mathematical
Physics Seminar*
National Science Foundation

- 2020–2023 Conference Grant (co-PI, funded, DMS 2017119, \$25,863)
Mid-Atlantic Topology Conference 2020
National Science Foundation
- 2019–2023 Research Grant (PI, funded, DMS 1906174, \$159,696)
New perspectives on configuration spaces
National Science Foundation
- 2019 Travel Grant (funded and declined, \$5,000)
American Mathematical Society and Simons Center
- 2016–2019 Postdoctoral Fellowship (funded, DMS 1606422, \$150,000)
National Science Foundation

TEACHING AND
ADVISING

Graduate teaching

- Spring 2024 MATH 7321 Topology 3 (13 students)
Spring 2024 MATH 7721 Readings in topology (3 students)
Fall 2023 MATH 7221 Topology 2 (15 students)
Fall 2023 MATH 7721 Readings in topology (1 student)
Fall 2022 MATH 7721 Readings in topology (1 student)
Spring 2022 MATH 5121 Topology 1 (14 students)
Spring 2022 MATH 7721 Readings in topology (6 students)
Fall 2021 MATH 5111 Algebra 1 (14 students)
Spring 2021 MATH 7321 Topology 3 (8 students)
Spring 2021 MATH 7721 Readings in topology (1 student)
Fall 2020 MATH 7221 Topology 2 (7 students)
Spring 2020 MATH 7721 Readings in topology (1 student)
Spring 2020 MATH 5121 Topology 1 (15 students)
Fall 2019 MATH 5111 Algebra 1 (17 students)

Undergraduate teaching

- Fall 2023 MATH 2331 Linear algebra (19 students)
Fall 2023 MATH 4992 Directed study (1 student)
Spring 2023 MATH 2331 Linear algebra (29 students)
Fall 2022 MATH 4992 Directed study (1 student)
Fall 2022 MATH 2331 Linear algebra (19 students)
Fall 2021 MATH 2331 Linear algebra (17 students)
Spring 2021 MATH 4971 Junior/senior honors project (1 student)
Fall 2020 MATH 4993 Independent study (1 student)

Courses developed

- Fall 2019 MATH 5111 Algebra 1

Graduate advising

- 2021– Dezhou Li, graduate advisor
2021 Whitney Drazen, thesis committee member
2019 Danny Shi (Harvard), thesis committee member

Graduate mentoring

2023– Yiming Yang, graduate mentor
2023– Mei-Yu Huang, graduate mentor
2023 Erika Beserra, first-year mentor
2023 Pratik Roy, first-year mentor
2023 Nicholas Payne, graduate mentor
2022– Xiaochen Xiao, graduate mentor
2021–23 Shengnan Huang, graduate mentor
2021–23 Brad Turow, graduate mentor
2021 Xiaochen Xiao, first-year mentor
2019 Dezhou Li, first-year mentor

SERVICE AND PROFESSIONAL DEVELOPMENT

Institutional service

2024 College of Science Dean’s Award selection committee
Northeastern University
Committee member

2022– PhD program working group
Northeastern University
Committee member

2022, 2023 Mathematics PhD program open house
Northeastern University
Faculty spotlight speaker

2020–2022 Colloquium committee
Northeastern University
Chair

2020–2021 Faculty search committee
Northeastern University
Committee Member

2020 Research cluster “Topological robotics and machine learning”
Northeastern University
Proposal author

2020 Departmental tea
Northeastern University
Organizer

2020–2022, 2023 Postdoctoral hiring committee
Northeastern University
Committee member

2019– Graduate committee
Northeastern University
Committee member

- 2019– PhD qualifying exams
Northeastern University
Author and grader
- 2019– Topology seminar
Northeastern University
Organizer

Professional service

- 2024 Royal Swedish Academy of Sciences
Reviewer
- 2023, 2024 Mid-Atlantic Topology Conference
University of Pennsylvania, Northeastern University
Organizer
- 2023– New England Algebraic Topology and Mathematical
 Physics Seminar
Northeastern University, Boston University, Amherst College
Organizer
- 2022 French National Research Agency review panel
Reviewer (declined due to conflict)
- 2022 PhD thesis defense (Haoqing Wu)
École Polytechnique Fédérale de Lausanne
Juror
- 2022 Licentiate thesis defense (Louis Hainaut)
Stockholm University
Opponent
- 2022 “Split” conference on homotopy theory and applications
MPIM Bonn and Fields Institute
Organizer
- 2020 National Science Foundation review panel
Panelist
- 2020 Workshop on “Configuration spaces of graphs”
American Institute of Mathematics
Organizer
- 2019 Topology “kickoff” mini-conference
Northeastern University
Organizer

2016– Geom. Topol., Compos. Math., Invent. Math., Adv. Math.,
Notices Am. Math. Soc., Algebr. Geom. Topol., Math. Ann.,
Homol. Homotopy Appl., Order, J. Pure Appl. Algebr., J. Topol.,
Rev. Mat. Complut., Int. Math. Res. Not., Topology Appl.,
Discrete Comput. Geom., J. Algebr.
Referee

Public service

2022 Admissions
Summer Science Program
Volunteer

2021 Calculus Field Day
Northeastern University
Volunteer

Professional development

2020 Guest program
Max Planck Institute for Mathematics

2019 “Arrangements at Western” intensive research period
University of Western Ontario

2018 “Homotopy Harnessing Higher Structures” programme
Isaac Newton Institute for Mathematical Sciences

2015 “Homotopy Theory, Manifolds, and Field Theories” trimester
Hausdorff Research Institute for Mathematics