

MIRANDA HOLMES-CERFON

Courant Institute of Mathematical Sciences, New York University
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EDUCATION

- New York University, PhD.** Applied Mathematics and Atmosphere-Ocean Science. 2010
Thesis: Stochastic models of Internal Waves and Ocean Mixing.
Advisor: Oliver Bühler.
- University of British Columbia, BSc.** Honours Mathematics. 2005
Thesis: Ecology as a mechanism for cooperation in the evolutionary Public Goods Game.
Advisor: Michael Doebeli.

RESEARCH INTERESTS

Applied mathematics: physical modeling, stochastic analysis, statistical mechanics, Monte Carlo methods, computational geometry, materials science, soft-matter physics, fluid dynamics.

ACADEMIC AND SCIENTIFIC POSITIONS

- Associate professor of mathematics, University of British Columbia 2022-present
Associate professor of mathematics, New York University 2020-2022
Visiting Professor of Physics, EPFL 2020-2021
Assistant professor of mathematics, New York University 2013-2020
Courant Instructor, New York University Sept 2012-Aug 2013
Applied Mathematics Instructor, Harvard University Sept 2010-Aug 2012
Geophysical Fluid Dynamics Fellow, Woods Hole Oceanographic Institution Summer 2007
Research Assistant, Los Alamos National Laboratory Summer 2006
Research Assistant, Department of Earth and Ocean Science, UBC Summer 2002, 2003

AWARDS

- Alfred P. Sloan Research Fellow in Mathematics 2018
Kurt O. Friedrichs Prize for outstanding dissertation in mathematics (NYU) 2010
Peter D. Lax Fellowship (NYU) 2008
Bella Manel Prize (NYU) 2008
President's Service Award (NYU) 2008
NSERC Postgraduate Scholarship PGS-D 2008-2010
NSERC Postgraduate Scholarship PGS-M 2006-2007
HSBC Emerging Leader Scholarship (UBC) 2005
Wesbrook Scholar (UBC) 2005
Lorraine Schwarz Prize in Probability and Statistics (UBC) 2005
Hugh M. Brock National Entrance Scholarship (UBC) 2001-2005
Maureta Evelyn McDonald Memorial scholarship (UBC) 2003
Charles and Jane Banks scholarship (UBC) 2002
Lawrence Roberts Putnam Prize (UBC) 2002
NSERC undergraduate summer research grant 2002

FUNDING

NSF Computational Mathematics: Collaborative Research <i>Numerical Methods for High-Dimensional Sticky Diffusions</i> co-PI with Nawaf Bou-Rabee 349,193 US\$ over 3 years to PI	2021-2024
Sloan Research Fellow 50,000 US\$ over 3 years	2018-2021
US Department of Energy Early Career award <i>Kinetics of particles with short-range interactions</i> 759,765 US\$ over 5 years	2014-2019
NSF-FRG: Collaborative Research <i>Stability of structures large and small</i> with R. Connelly (Cornell), M. Sitharam (U. Florida), S. Gortler (Harvard), M. Thorpe (ASU) 51,689 US\$ to PI over 3 years	2016-2019
NSF-RTG <i>Research Training Group in Mathematical Modeling and Simulation</i> educational grant at Courant with A. Donev, E. Tabak, C. Peskin, L. Ristroph 1,866,045 US\$ over 5 years to fund students, postdocs, & educational activities, shared among PIs	2017-2022
NSF-MRSEC co-PI (joint with NYU Chemistry & Physics departments) ~1.25 years of postdoc funding to PI	2014-2019

PUBLICATIONS

Publications in science journals are generally in order of seniority, with authors near the front of the list taking the lead in the work, and authors near the end playing a more supervisory role. Publications in mathematical journals are generally in alphabetical or reverse alphabetical order.

Trainees under my direct or partial supervision are in bold font. A * indicates authors that contributed equally.

Refereed publications

35. Steven J. Gortler, Miranda Holmes-Cerfon, Louis Theran. “Transverse Rigidity is Prestress Stability,” *Discrete Applied Mathematics* **322**, 439-441 (2022).
34. **Sophie Marbach**, Miranda Holmes-Cerfon. “Mass changes the diffusion coefficient of particles with ligand-receptor contacts in the overdamped limit,” *Physical Review Letters* **129**, 048003 (2022).
33. Fan Cui*, **Sophie Marbach***, Jeana Aojie Zheng, Miranda Holmes-Cerfon, David J. Pine. “Comprehensive view of microscopic binding between DNA-coated colloids,” *Nature Communications* **13**, 2304 (2022).
32. **Sophie Marbach**, Jeana Aojie Zheng, Miranda Holmes-Cerfon. “The Nanocaterpillar’s Random Walk: Diffusion With Ligand-Receptor Contacts,” *Soft Matter* **18**, 3130-3146 (2022).
31. **A. Trubiano**, M. Holmes-Cerfon. “Thermodynamic stability versus Kinetic Accessibility: Pareto Fronts for Programmable Self-Assembly,” *Soft Matter* **17**, 6797-6807 (2021).
30. Mahdi Sadjadi, Varda F. Hagh, Mingyu Kang, Meera Sitharam, Robert Connelly, Steven J. Gortler, Louis Theran, Miranda Holmes-Cerfon, and Michael F. Thorpe. “Realizations of Isostatic Material Frameworks,” *physica status solidi (b)*, 2000555 (2021).
29. M. Holmes-Cerfon. “Simulating sticky particles: A Monte Carlo method to sample a stratification,” *Journal of Chemical Physics* **153**, 164112 (2020).

28. M. Holmes-Cerfon, L. Theran, S. Gortler. “Almost-rigidity of frameworks,” *Communications on Pure and Applied Mathematics* **74**, 2185-2247 (2020).
27. **A. Trubiano**, M. Holmes-Cerfon. “From canyons to valleys: Numerically continuing sticky hard sphere clusters to the landscapes of smoother potentials,” *Physical Review E* **101(4)**, 042608 (2020).
26. N. Bou-Rabee, M. Holmes-Cerfon. “Sticky Brownian Motion and its Numerical Solution,” *SIAM Review* **62(1)**, 164-195 (2020).
25. L. Lee, **J.P. Ryan**, Y. Lahini, M. Holmes-Cerfon, S.M. Rubinstein. “Geometric frustration induces the transition between rotation and counterrotation in swirled granular media,” *Physical Review E* **100**, 012903 (2019).
24. **E. Zappa**, M. Holmes-Cerfon. “Calculating the symmetry number of sticky-sphere clusters,” *Journal of Nonlinear Science* **29**, 2021 (2019).
23. **J.P. Lee-Thorp**, M. Holmes-Cerfon. “Modeling the relative dynamics of DNA-coated colloids,” *Soft Matter* **14**, 8147-8159 (2018).
22. A. McMullen, M. Holmes-Cerfon, F. Sciortino, A.Y. Grosberg, J. Brujic. “Colloidomers: freely-jointed polymers made of droplets,” *Physical Review Letters* **121**, 138002 (2018).
 - [Highlighted](#) as an Editor’s Choice paper
21. **E. Zappa**, M. Holmes-Cerfon, J. Goodman. “Monte Carlo on manifolds: sampling densities and integrating functions,” *Communications in Pure and Applied Mathematics* **71**, 2609-2647 (2018).
20. R. Drori, M. Holmes-Cerfon, B. Kahr, B. Kohn, M. Ward. “Dynamics and unsteady morphologies at ice interfaces driven by D2O-H2O exchange,” *Proc. Natl. Acad. Sci.* **114**, 11627-11632 (2017).
19. **E. R. Chen** and M. Holmes-Cerfon. “Random sequential adsorption of discs on constant-curvature surfaces: plane, sphere, hyperboloid, and projective plane,” *Journal of Nonlinear Science* **27**, 1743 (2017).
18. M. Holmes-Cerfon. “Sticky-sphere clusters,” *Annual Reviews of Condensed-Matter Physics* **8**, 77-98 (2017).
17. Y. Kallus and M. Holmes-Cerfon. “Free energy of singular sticky-sphere clusters,” *Physical Review E* **95**, 022130 (2017).
16. M. Holmes-Cerfon. “Stochastic discs that roll,” *Physical Review E* **94**, 052112 (2016).
15. **J. C. Perkinson**, M. J. Aziz, M. P. Brenner, M. Holmes-Cerfon. “Designing steep, sharp patterns on uniformly ion-bombarded surfaces,” *Proc. Natl. Acad. Sci.* **113(41)**, 11425-11430 (2016).
 - [Commentary](#) by Andrea Bertozzi
14. M. Holmes-Cerfon. “Enumerating rigid sphere packings,” *SIAM Review* **58-2**, 229-244 (2016).
13. **Y. Guo** and M. Holmes-Cerfon. “Internal wave attractors over random, small-amplitude topography,” *Journal of Fluid Mechanics* **787**, 148-174 (2016).
12. **R. W. Perry**, M. Holmes-Cerfon, M. P. Brenner, V. N. Manoharan. “Two-dimensional clusters of colloidal spheres: ground states, excited states, and structural rearrangements,” *Physical Review Letters* **114**, 228301 (2015).
11. N. Schade, M. Holmes-Cerfon, E. Chen, D. Aronzon, J. Collins, J. Fan, F. Capasso, C. Manoharan. “Tetrahedral colloidal clusters from random aggregation of bidisperse spheres,” *Physical Review Letters* **110**, 148303 (2013).
10. O. Bühler, N. Grisouard, M. Holmes-Cerfon. “Strong particle dispersion by weakly dissipative random internal waves,” *Journal of Fluid Mechanics* **719**, (2013).

9. M. Holmes-Cerfon, S.J. Gortler, M.P. Brenner. “A geometrical approach to computing energy landscapes from short-ranged potentials,” *Proc. Natl. Acad. Sci.* **110**, (2013).
8. M. Holmes-Cerfon, W. Zhou, A. J. Bertozzi, M.P. Brenner, M.J. Aziz. “Development of knife-edge ridges on ion-bombarded surfaces,” *Applied Physics Letters* **101**, 143109 (2012).
7. M. Holmes-Cerfon, M.J. Aziz, M.P. Brenner. “Creating sharp features by colliding shocks on uniformly irradiated surfaces,” *Physical Review B* **85**, 165441 (2012).
6. O. Bühler, M. Holmes-Cerfon. “Decay of an internal tide due to random topography in the ocean,” *Journal of Fluid Mechanics* **678**, 271-293 (2011).
5. M. Holmes-Cerfon, O. Bühler, R. Ferrari. “Particle dispersion by random waves in the rotating Boussinesq system,” *Journal of Fluid Mechanics* **670**, 150-175 (2011).
4. M. Holmes-Cerfon, J. Whitehead. “Instability and freezing in a solidifying melt conduit,” *Physica D: Nonlinear Phenomena* **240**, 131-139 (2011).
3. B. Wingate, P. Embid, M. Holmes-Cerfon, M. Taylor. “Low Rossby limiting dynamics for stably stratified flow with finite Froude number,” *Journal of Fluid Mechanics* **676**, 2011 (150-175).
2. O. Bühler, M. Holmes-Cerfon. “Particle dispersion by random waves in rotating shallow water,” *Journal of Fluid Mechanics* **638**, 5-26 (2009).
 - **Highlighted** in Focus on Fluids
1. C. Hauert, M. Holmes, M. Doebeli. “Evolutionary games and population dynamics: maintenance of cooperation in public goods games,” *Proceedings of the Royal Society B – Biological Sciences* **273**, 2565-2570 (2006).

LEADERSHIP AND SERVICE EXPERIENCE

External

Associate Editor, SIAM Journal on Applied Mathematics	2021-present
Co-organizer, proposed ICERM Workshop “Geometry of materials, packings, and rigid frameworks”	Fall 2024
Co-organizer, Simons Center for Geometry and Physics Workshop “Geometry, Topology, and Symmetry in Soft and Living Matter”	Summer 2022
Co-organizer, ICERM Workshop “Circle Packings and Geometric Rigidity”	Summer 2020
Member, International Scientific Advisory Committee, CRM (Centre de recherches mathématiques)	Spring 2018-present
Minisymposium co-organizer in SIAM Materials Science meeting, “Mathematical Aspects of Programmable Self-Assembly,” with Daphne Klotsa	July 2018
Member, Organizing committee, Dept of Energy PI Meeting	Sept 2017
Co-organizer, ICERM workshop “Small Clusters, Polymer Vesicles, and Unusual Minima”	March 2015
Faculty member, Woods Hole Geophysical Fluid Dynamics Summer School	2014-2019
Initiator and primary organizer of Atmosphere-Ocean Science Days • conference for graduate students from schools in northeastern USA • first held May 2009 at the Courant Institute and subsequently held annually	2009-2010
Initiator and organizer of cSplash (title “Director”) • one-day-long math conference for ~150-200 high school students • first held in March 2006 at the Courant Institute, now held annually • Colloquium speaker at cSplash, 2015.	2006-2008
Member, Mentor Hiring Committee, Canada/USA Mathcamp	2009
Member, Junior Counsellor Hiring Committee, Canada/USA Mathcamp	2006-2007

Junior Counsellor, Canada/USA Mathcamp Summer 2004,2005
 Referee
 Physical Review Letters, Physical Review E, Nature Communications, Proceedings of the National Academy of Sciences, Journal of Nonlinear Science, Journal of Statistical Physics, Journal of Fluid Mechanics, Geophysical Research Letters, Journal of Atmospheric Science, Symmetry, Transactions on Mathematical Software, Center for Functional Nanomaterials at Brookhaven National Laboratory, etc.

Internal

Organizer & co-founder, Modeling & Simulation group meeting 2017-2022
 • ~30 regular participants, including graduate students, postdocs, faculty
 Organizer & co-founder, AM-SURE Summer 2018-2022
 • summer undergraduate research program in applied math
 co-founder&faculty sponsor, NYU chapter of Association for Women in Mathematics 2021-2022
 Faculty mentor, SIAM NYU Club, Courant 2020-2021
 Faculty mentor, Undergraduate Math Club, Courant 2016-2020
 Co-organizer, Applied Mathematics Seminar, Courant 2013-present
 Courant Instructor committee, Courant 2018,2020
 PhD Fellowship committee, Courant 2017
 Initiator & organizer, Courant Women’s lunch 2015-present
 • organize roughly 2-3 times per year
 Initiator & organizer, NYU Science Chalk Talks 2014-2015
 Organizer, Grad Student / Postdoc Seminar, Courant 2009-2010
 Member, NYU Graduate Forum Jan 2009-May 2010
 • forum to promote discussion between graduate students from different disciplines

TEACHING EXPERIENCE

Undergraduate courses at NYU have ~40-60 students, while graduate courses have ~20-30 students.

Courses

Linear & Nonlinear Optimization (undergraduate), NYU Fall 2021
 Seminar on Teaching, Writing, and Oral Presentation (PhD course), NYU Spring 2020
 Applied Stochastic Analysis (PhD course), NYU Spring 2014, 2015, 2017, 2019, 2022
 Theory of Probability (undergraduate), NYU Fall 2014, 2017, 2018, 2019
 Honors I: Stochastic Processes (undergraduate), NYU Fall 2016
 Mathematical Statistics (undergraduate), NYU Spring 2016
 Calculus III, NYU Fall 2012, 2013
 Probability & Statistics (APMTH 101), Harvard Fall 2010, 2011
 Calculus I, NYU Spring 2008
 Written Exams Workshop (graduate class), NYU Fall 2007
 TA, Quantitative Reasoning, NYU Spring 2006

Other teaching experience

Staff member, Geophysical Fluid Dynamics summer program Summer 2012
 • Mentored one student project, resulting in a publication in J. Fluid Mech.
 Mentor, Canada/USA Mathcamp Summer 2008
 • Designing and teaching math classes and projects for bright high school students.
 • Received Mathcamp teaching “tenure.”
 cSplash, teacher 2006-present

STUDENTS & MENTEES

Postdoctoral Mentees

- Sophie Marbach (subsequently CNRS) 2019-2022
- Emilio Zappa (subsequently faculty at Fordham U.) 2015-2018
- James Lee-Thorp (subsequently Google research; joint mentor with Bob Kohn) 2016-2017

PhD Students

- Alexandre Milewski (in progress)
- Natalie Frank (in progress; joint mentor with Jonathan Niles-Weed)
- Sylvie Bronsard (in progress)
- Anthony Trubiano (subsequently postdoc at Brandeis) PhD 2021

MS Students

- Chenqi (Dan) Jiang 2022-present
- Sujay Kazi (in progress) 2021-present
- Ziyi Ye (subsequently working in industry) MS 2021
- Guanhua Sun (subsequently PhD at U. Michigan) MS 2020
- Ling Lan (subsequently PhD at Columbia) MS 2019
- Chanyang Ryoo (subsequently PhD at Columbia) MS 2016

Undergraduate Students

- Chenqi (Dan) Jiang Summer 2022, Fall 2022
- Athena Liu Fall 2021-Spring 2022
- Kerun Xu Spring 2020-Summer 2022
- Joanna Wang Fall 2021
- Guanhua Sun Summer 2019
- Shiva Darshan Summer 2019
- Ling Lan Summer 2018
- Jiadai Xia Fall 2017-Spring 2018
- Zhijian Yang Spring 2018
- Chen Cheng Fall 2018
- John Ryan Summer 2016, Spring 2017
- Yi Mi Summer 2016
- Shaofei Sang Summer 2015

INVITED TALKS (RESEARCH)

Simon Fraser University, Biophysics and Soft Matter seminar	Nov 2022
Flatiron Institute, Workshop, "Sampling, diffusions, and optimal transport"	Nov 2022
Johns Hopkins, Applied Math seminar	Nov 2022
Lancaster University, Summer school: "Rigidity, flexibility, and applications" taught a 4-lecture course	July 2022
Simons Center for Geometry and Physics, workshop	May 2022
Central Michigan University, Computational & Applied Math seminar (virtual)	April 2022
UBC, Applied Math seminar	Jan 2022
MIT, Distinguished Seminar Series in Computational Science and Engineering	Nov 2021
Courant Institute, Numerical Analysis Seminar	Sept 2021
SIAM Materials Science, Minisymposium invited talk (virtual)	May 2021
IMSI Workshop, "Mathematical and Computational Materials Science" (virtual)	Feb 2021
Syracuse University, Soft Matter Workshop (virtual)	Feb 2021
TU Berlin, Workshop, "Geometric and Topological Structure of Materials" (virtual)	June 2021
Brandeis University, Physics Seminar (virtual)	Nov 2020
ICERM workshop, "Circle Packings and Geometric Rigidity" (virtual)	Jul 2020
University of South Florida, Physics Colloquium	Jan 2020

Columbia University, Applied math seminar	Nov 2019
IAS-Rutgers-U.Penn, workshop on Topology	Nov 2019
Isaac Newton Institute, seminar	Nov 2019
AIM, workshop, “Rigidity and flexibility of microstructures”	Nov 2019
Ohio State University, TRIPODS workshop, “Structure in the micro world”	May 2019
NJIT Frontiers in Applied Math, workshop	May 2019
University of Maryland, Applied Math seminar	May 2019
Ohio State University, Geometry & Topology seminar	March 2019
BIRS-Oaxaca workshop, tutorial speaker (2-hour talk), “Computational Statistics and Molecular Simulation”	Nov 2018
Princeton, Applied Math seminar	Nov 2018
Rensselaer Polytechnic Institute, Applied Math seminar	Apr 2018
University of Rutgers-Camden, Mathematics seminar	Feb 2018
Kavli Institute for Theoretical Physics, program “Memory in Matter”	Jan 2018
UCLA, Center for Nonlinear Science	Jan 2018
Princeton Center for Theoretical Science, workshop “Geometrically Frustrated Assembly”	Nov 2017
Lancaster University, workshop, plenary speaker , “Bond-node structures: rigidity, combinatorics and materials science”	June 2017
Courant Institute of Mathematical Sciences, Applied Math Seminar	Apr 2017
Princeton, Chemical & Biological Engineering seminar (invited by students)	May 2017
Cornell University, Geometry seminar	Nov 2016
Midwest Probability Colloquium, plenary speaker ,	Oct 2016
University of Delaware, Applied Math seminar	Sept 2016
ICERM, workshop on “Unusual configuration spaces”	Sept 2016
NJIT, Applied Math conference	Jun 2016
SIAM Materials Science Meeting, Minisymposium invited talk	May 2016
NYU-Oxford, Materials Science Meeting	Fall 2016
Northwestern, Applied Mathematics Seminar	Nov 2015
MBI, workshop on “Geometric and topological modeling of biomolecules”	Sept 2015
ICERM, workshop on “Small Clusters, Polymer Vesicles, and Unusual Minima”	Mar 2015
AIM, workshop “Configuration spaces of linkages”	Oct 2014
Brown University, Dynamical systems seminar	Oct 2014
University of Maryland, Applied math seminar	Nov 2014
IAS/Park City Mathematics Institute, workshop “Mathematics and materials”	Jul 2014
Harvard, Applied math seminar	Feb 2013
MIT, Applied math seminar	Feb 2013
UCLA, Applied math seminar	Feb 2013
Columbia, Applied math seminar	Feb 2013
Courant Institute of Mathematical Sciences, Applied Math Seminar	Oct 2012
Conference on the Applications of Accelerators in Research and Industry, Forth Worth TX	Aug 2012
Geophysical Fluid Dynamics summer program, Woods Hole, MA	July 2012
UCLA, Applied math seminar	Feb 2012
Courant Institute of Mathematical Sciences, Applied Math Lab seminar	Nov 2011
Geophysical and Astrophysical Internal Waves Conference, Les Houches	Feb 2011
MIT, Physical Oceanography Seminar	Dec 2010
MIT, Applied Mathematics Seminar	Mar 2010
Yale, Geophysics seminar	Mar 2010
EPFL, Statistics seminar	Jan 2010
Harvard, Applied Mathematics Seminar	Dec 2009
Princeton, Dynamical Systems and Nonlinear Science Seminar	Dec 2009
Woods Hole Oceanographic Institution, Geochemistry and Geophysics Seminar	Aug 2009

17th Conference on Atmospheric and Oceanic Fluid Dynamics, Stowe, VT	Jun 2009
2nd Wave-Flow Interactions Meeting, Edinburgh, UK	May 2009
Courant Institute of Mathematical Sciences, Applied Math Lab seminar	Apr 2009
PIMS Wave Phenomena II, Vancouver, BC. (Poster)	Apr 2008
American Physical Society Division of Fluid Dynamics Meeting, Salt Lake City, UT	Nov 2007

INVITED TALKS (OUTREACH)

Undergraduate Lecture Series, NYU	June 2022
Girls Advancing in Science (GAINS), New York City	Feb 2022
Biobus, New York City	November 2020
Undergraduate Lecture Series, NYU	June 2019