

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, oceanography.

ACADEMIC AND SCIENTIFIC POSITIONS

- Assistant professor of mathematics, New York University Sept 2013-present
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

- US Department of Energy Early Career award** 2014-2019
Kinetics of particles with short-range interactions
- NSF-FRG: Collaborative Research** 2016-2019
Stability of structures large and small
with R. Connelly (Cornell), M. Sitharam (U. Florida), S. Gortler (Harvard), M. Thorpe (ASU).

PUBLICATIONS

Preprints

3. M. Holmes-Cerfon. “Simulating sticky particles: A Monte Carlo method to sample a stratification,” *Submitted*.
2. M. Holmes-Cerfon, L. Theran, S. Gortler. “Almost-rigidity of frameworks,” *Submitted*.
1. A. Trubiano, M. Holmes-Cerfon. “From canyons to valleys: Numerically continuing sticky hard sphere clusters to the landscapes of smoother potentials,” *Submitted*.

Refereed publications

26. N. Bou-Rabee, M. Holmes-Cerfon. “Sticky Brownian Motion and its Numerical Solution,” *SIAM Review*, (To appear).
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

Co-organizer, Simons Center for Geometry and Physics Workshop “Geometry, Topology, and Symmetry in Soft and Living Matter”	Summer 2020
Co-organizer, ICERM Workshop “Circle Packings and Geometry 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	2009-2010

- conference for graduate students from schools in northeastern USA
 - first held May 2009 at the Courant Institute and subsequently held annually
- Initiator and organizer of cSplash (title “Director”) 2006-2008
- 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.
- 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

Internal

- Organizer & co-founder, Modeling & Simulation group meeting 2017-present
- ~30 regular participants, among graduate students, postdocs, faculty
- Organizer & co-founder, AM-SURE Summer 2018-present
- summer undergraduate research program in applied math
- Faculty mentor, Undergraduate Math Club, Courant 2016-present
- 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

Courses

- Applied Stochastic Analysis (PhD course), NYU Spring 2014, 2015, 2017, 2019
- 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 (joint mentor with Aleskander Donev) 2019-present
- Emilio Zappa 2015-2018
- James Lee-Thorp (joint mentor with Bob Kohn) 2016-2017

Graduate Students

- Anthony Trubiano (in progress, 4th year)
- Sylvie Bronsard (in progress, 3rd year)

Master's Students

- Guanhua Sun (in progress)
- Ling Lan (now PhD at Columbia) MS 2019
- Chanyang Ryoo (now PhD at Columbia) MS 2016

Undergraduate Students

- Guanhua Sun Summer 2019
- Shiva Darshan Summer 2019
- Ling Lan Summer 2018
- Jiadai Xia Fall 2017-Spring 2018
- Zhijian Yang Spring 2018
- John Ryan Summer 2016, Spring 2017
- Yi Mi Summer 2016
- Shaofei Sang Summer 2015

INVITED TALKS

- University of South Floriday, Physics Colloquium Jan 2020
- Columbia University, applied math seminar Nov 2019
- IAS-Rutgers-U.Penn, workshop on Topology 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 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
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