

# KERSTIN N. NORDSTROM

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INTERESTS           Soft matter, granular materials, complex fluids, rheology, biophysics, robophysics, MEMS, networks

PROFESSIONAL       **Clare Boothe Luce Assistant Professor, 2014-present**  
APPOINTMENTS       –Department of Physics, Mount Holyoke College

**Postdoctoral Researcher 2011-2014**

- IREAP, University of Maryland
- Impact dynamics in a granular bed, collective dynamics of epithelial and embryonic cells
- Advisor: Wolfgang Losert

EDUCATION           **University of Pennsylvania**, Philadelphia, Pennsylvania

- Ph.D. Physics, December 2010 (M.S., Physics, 2006)
  - Thesis Title: “Jamming and Flow of Soft Particle Suspensions”
  - Advisors: Doug Durian and Jerry Gollub

**Bryn Mawr College**, Bryn Mawr, PA

- B.A., Physics and Mathematics, with honors, 2004
  - Thesis Title: “A Solid State NMR Relaxation Study of 1,3-dimethoxy-4-tert-butylcalix[4]arene”
  - Advisor: Peter Beckmann

GRANTS               **Current**

- 2019: NSF CAREER: Mesoscale Analysis of Dense Granular Flows (\$615,296) - (PI)
- 2018: NSF MRI (\$516,249)- Acquisition of a Confocal Microscope at Mount Holyoke (Co-PI)
- 2018: Cottrell Scholar Award (\$100,000) - “Flow in Amorphous Systems: Understanding Dynamics Across Scales” - (PI)
- 2018: MHC-Fund The Future (\$149,837) “Active Soft Matter: Connecting Microscale Motion to Macroscale Behavior” (PI)

**Past**

- 2016: ACS-PRF (\$55,000) “Dense Granular Flows: Connecting Dynamics Across Scales” (PI)

AWARDS AND           **Love Your Lyons Award, “Best New Faculty,” 2015**  
FELLOWSHIPS       –Mount Holyoke College

**AAAS Mass Media Fellow, 2012**

- Placement site: *Raleigh News and Observer*.

**Teaching Fellow, Center for Teaching and Learning, 2005**

- School of Arts and Sciences, University of Pennsylvania

**Chairman’s Teaching Award, 2005**

- Department of Physics and Astronomy, University of Pennsylvania

\*Denotes undergraduate author

19. Emma Thackray\* and Kerstin N. Nordstrom, "Using Robots for Mechanics Labs: Rolling, Friction, and Optimization," in preparation for *American Journal of Physics*
18. Anna Belle Harada\*, Emma Thackray\*, and Kerstin N. Nordstrom, "Gravity-driven flow and clogging in the presence of an obstacle," to be submitted to *Physical Review Fluids*
17. Grace Cai\*, Emma Thackray\*, Anna Belle Harada\*, and Kerstin N. Nordstrom, "Cooperative and uncooperative motions in gravity-driven flows," to be submitted to *Granular Matter*
16. Tamia Williams, Simone Hyater-Adams, Kathleen Hinko, Claudia Fracchiolla, Kerstin Nordstrom, and Noah Finkelstein, "The Intersection of Identity and Performing Arts for Black Physicists," *PERC Proceedings* (2018)
15. E. Thackray\* and K. N. Nordstrom, "Gravity-driven granular flow in a silo: Characterizing local forces and rearrangements" *EPJ Web of Conferences* 140, 03087 (2017)
14. E. D. Cubuk, R. J. S. Ivancic, S. S. Schoenholz, D. J. Strickland, A. Basu, Z. S. Davidson, J. Fontaine, J. L. Hor, Y. R. Huang, Y. Jiang, N. Keim, K. D. Koshigan, J. Lefever, T. Liu, X.G. Ma, D. J. Magagnosc, Emily Morrow, C. P. Ortiz, J. M. Rieser, A. Shavit, T. Still, Y. Xu, Y. Zhang, K. N. Nordstrom, P. E. Arratia, R. W. Carpick, D. J. Durian, Z. Fakhraai, D. J. Jerolmack, Daeyeon Lee, Ju Li, R. Riggleman, K. T. Turner, A. G. Yodh, D. S. Gianola, A. J. Liu, "Structure-property relationships from universal signatures of plasticity in disordered solids," *Science* 358, 1033 (2017)
13. K. N. Nordstrom, D. S. Dorsch, W. Losert, A. G. Winter, V, "A Microstructural View of Burrowing with Roboclam," *Physical Review E* **92** 044202 (2015).
12. (Invited Book Chapter) K.N. Nordstrom and W. Losert, "Microstructure Evolution During Impact using Refractive Index Matched Granular Matter," part of *Rapid Penetration into Granular Media*, Elsevier (2015), M. Iskander editor.
11. A. Basu, Y. Xu, T. Still, P. E. Arratia, Z. Zhang, K. N. Nordstrom, J. P. Gollub, D. J. Durian, and A. G. Yodh, "Rheology of Soft Colloids Near Rigidity Onset: Critical Scaling, Thermal, and Non-thermal Responses," *Soft Matter* **10**, 2017 (2014).
10. M. Harrington, M. Lin\*, K. N. Nordstrom, and W. Losert, "Experimental Measurements of Orientation and Rotation of Dense 3D Packings of Spheres," *Granular Matter* **16**, 185 (2014).
9. K. N. Nordstrom, E. Lim\*, M. Harrington, and W. Losert, "Granular Dynamics During Impact," *Physical Review Letters* **112**, 228002 (2014).
8. R.M. Lee, D.H. Kelley, K.N. Nordstrom, N.T. Ouellette, and W. Losert, "Quantifying stretching and rearrangement in epithelial sheet migration," *New Journal of Physics* **15** 025036 (2013).
7. N. Murdoch, B. Rozitis, K. Nordstrom, S.F. Green, P. Michel, T-L. de Lophem, and W. Losert, "Granular Convection in Microgravity," *Physical Review Letters* **110**, 018307 (2013).
6. N. Murdoch, P. Michel, D.C. Richardson, K. Nordstrom, C.R. Berardi\*, S.F. Green, and W. Losert, "Numerical simulations of granular dynamics II. Particle dynamics in a shaken granular material," *Icarus*, **219**, 321 (2012).
5. K.N. Nordstrom, J.P. Gollub, and D.J Durian, "Dynamical Heterogeneities in Sheared Suspensions," *Physical Review E*, **84**, 021403 (2011).

4. K.N. Nordstrom, E. Verneuil, W.G. Ellenbroek, T.C. Lubensky, J.P. Gollub, and D.J. Durian, "Centrifugal compression of soft particle packings: theory and experiment," *Physical Review E*, **82**, 041403 (2010).
3. K.N. Nordstrom, E. Verneuil, P.E. Arratia, A. Basu, Z. Zhang, A.G. Yodh, J.P. Gollub, and D.J. Durian, "Microfluidic Rheology of Soft Colloids Above and Below Jamming," *Physical Review Letters*, **105**, 175701 (2010).
2. F.J. Byfield, Q. Wen, I. Levental, K. Nordstrom, P.E. Arratia, R.T. Miller, and P.A. Jamney, "Absence of Filamin A Prevents Cells from Responding to Stiffness Gradients on Gels Coated with Collagen but not Fibronectin," *Biophysical Journal*, **96**, 5095 (2009).
1. P.A. Beckmann, J. Rosenberg\*, K. Nordstrom\*, C.W. Mallory, and F.B. Mallory, "CF3 rotation in 3-(trifluoromethyl)phenanthrene: Solid state F-19 and H-1 NMR relaxation and Bloch-Wangsness-Redfield theory," *Journal of Physical Chemistry A*, **110**, 3947 (2006).

OTHER  
PUBLICATIONS

3. Kerstin Nordstrom, "Harassment Experiences of LGBTQ+ Physicists (And What To Do About It)," *CSWP and COM Gazette*, 38(1), 2019.
2. K. N. Nordstrom, J. C. Conrad, K. E. Daniels, and J. L. Ross, "For SHE's a Jolly Good Fellow?" *APS News*, 27(4), (2018)
1. C.D. Jones, K. N. Nordstrom, and D.J. Durian, "Rheology of Nearly Ideal 3D Foams." arXiv:1404.2857 (2014)

INVITED TALKS

**17th Annual Northeastern Granular Materials Workshop**

–June 14, 2019, New York University

**Soft Matter Seminar**

–April 26, 2019, Syracuse University

**Undergraduate Colloquium**

–April 25, 2019, Syracuse University

**Condensed Matter Seminar**

–April 10, 2019, Tufts University

**Physics Colloquium (Note, not research talk. Same diversity talk given at BNL)**

–February 12, 2019, University of Pennsylvania

**Physics Colloquium**

–February 11, 2019, Bryn Mawr College

**Physics Colloquium**

–October 31, 2018, Rochester Institute of Technology

**"Diversity in Physics: Data, Analysis, and What to Do About It"**

–Annual User's Meeting, June 13 2018, Brookhaven National Lab

**Physics Colloquium**

–November 29 2017, University of Rochester

**Physics Colloquium**

–November 8 2017, Clark University

**Physics Colloquium**

–February 7, Worcester Polytechnic Institute

**Physics Colloquium**

–December 1, 2016, Wesleyan University

**Physics Colloquium**

–March 25, 2016, Smith College

**Condensed Matter Seminar**

–February 23, 2016, University of Massachusetts

**Physics Colloquium**

–February 16, 2016, Amherst College

**Condensed Matter and Biophysics Seminar**

–September 24, 2013, NC State University

**Applied Dynamics Seminar**

–November 8, 2012, University of Maryland

**NSF-MRSEC seminar**

–January 21, 2011, University of Pennsylvania

**Princeton Soft Matter Meeting**

–December 16, 2010, Princeton University

**NYU Soft Matter Meeting**

–May 1, 2009, New York University

**NSF-MRSEC seminar**

–June 29, 2007, University of Pennsylvania

TEACHING AT  
MOUNT HOLYOKE

**PHYS 100: Foundations of Physics**

–F16, F18 [ $n = 2$ ]

–Algebra-based course intended for pre-health students. (Mechanics, fluids, thermodynamics)

–Developed new laboratories with T. Herd.

–Used many ideas and methods developed in NEXUS project at UMD.

**PHYS 150: Phenomena of Physics**

–S17, S19 [ $n = 2$ ]

–Second semester of the pre-health sequence. (Electricity, magnetism, light, nuclear physics)

–Developed new laboratories with T. Herd.

–Used many ideas and methods developed in NEXUS project at UMD.

–In addition to lecturing, developed and co-taught (S19) laboratories with T. Herd.

**PHYS 110: Force, Motion and Energy**

–F14, S15, F15, S16 [ $n = 4$ ]

–Calculus-based mechanics course required for majors.

–In addition to lecturing, developed and co-taught (F14, S15) laboratories with T. Herd.

**PHYS 201: Electromagnetism**

- S15 [ $n = 1$ ]
- Developed and taught laboratories only (A. Arango lecture instructor).

**PHYS 315: Analytical Mechanics**

- S16, S17 [ $n = 2$ ]
- Upper-level classical physics course, required for those considering graduate school, and highly recommended for those with interests in fluids or mechanical engineering.
- Developed computational physics modules to complement analytical problem sets.

**PHYS 326: Statistical Mechanics**

- F15, F16, F18 [ $n = 3$ ]
- Upper-level course, required for those considering graduate school and highly recommended for those with interests in materials science or micro-biological systems.
- Developed computational physics modules to complement analytical problem sets.

**COLL 115: The Future of Jobs: The Dual Challenges of Globalization & Robotization**

- S16. Two-credit general education course. Co-taught with 7 other instructors.
- In addition to lecturing and facilitating discussion about robotics during the lecture, I developed a laboratory to teach students the principles of actuation and grip in various kinds of robot arms (i.e. electro-mechanical, pneumatic). My colleagues in computer science developed complementary labs about sensing/sensors (L. Ballasteros) and programming robots (A. St. John).

UNDERGRADUATE  
RESEARCH AT  
MOUNT HOLYOKE

**Independent Study Students**

- Pa Chia Thao (F15, S16, F16) “Investigation of Granular Avalanches in Reduced Gravity”
- Kiera McCabe (F17, S18) “Video analysis of impact into granular fluids”
- Phoebe Seltzer (F16) “Culturing and Observing Flagellated Swimmers”
- Haley Lucian (F16, S17) “Active Colloids: The Collective Dynamics of *C. reinhardtii*”
- Lilliana Beckmann (S16, F17, S18, F18) “Microfluidic Investigation of Particulate Fluids”
- Keelin Quirk (S18, F18, S19) “Microfluidic flows of soft particles”
- Grace Cai (F17, S18) “Molecular dynamics simulation of granular flows in a quasi-two-dimensional silo” (HONORS THESIS)
- Emma Thackray (F16, S17, F17, S18) “Linking flow intermittencies to material structure in a quasi-two-dimensional granular silo” (HONORS THESIS)
- Tamia Williams (F17, S18) “The Intersection of Identity and Performing Arts of Black Physicists” (HONORS THESIS)
- Nina Gilkyson (S19) “Quantifying Stress in Photoelastic Particles”
- Juniper Glass-Klaiber (S19) “Quantifying Stress in Photoelastic Particles”

**Summer Research Students (Funding Source)**

- 2018: N. Gilkyson (NSF), J. Glass-Klaiber (NSF), Anissa Aamoum (FtF), Keelin Quirk (CBL)
- 2018: Grace Cai (PRF), Anna Belle Harada (PRF)
- 2017: Grace Cai (PRF), Ariel Kane-Esrig (PRF), Kiera McCabe (CBL), AB Harada (CBL)
- 2016: Emma Thackray (CBL), Lilliana Beckmann (CBL), Isabelle Kim (LYNK)
- 2015: Emma Thackray (CBL), Lilliana Beckmann (CBL)

INSTITUTIONAL  
SERVICE

**NCAA Faculty Athletics Representative, 2018-2021****Phi Beta Kappa Prize Committee, Spring 2018****Faculty Planning and Budget Committee, Spring 2016**

- Semester leave replacement

### **Student Experience Working Group, Fall 2015**

- Part of Strategic Planning Process
- Subcommittee on Retention

### **Goldwater Selection Committee, Fall 2015 and Fall 2016**

#### DEPARTMENTAL SERVICE

#### **Academic Advising**

- 2018-19: 17 total (10 majors)
- 2017-18: 0 (on leave)
- 2016-17: 19 total (16 majors)
- 2015-16: 12 total (10 majors)

#### **Search Committees**

- Fall 2015: Assistant Professor
- Spring 2016: Visiting Professor
- Summer 2018: Physics Technician
- Spring 2019: Physics Lab Director

#### **Society of Physics Students Advisor, 2014-2018** (replaced by A. Burger during leave)

#### PROFESSIONAL SERVICE

#### **Referee**

- PLoS One*, *Physical Review Letters*, *Physical Review E*, *Granular Matter*, *Physica D*
- (grants) NASA, Army Research Office, ACS Petroleum Research Fund, Research Corp

#### **APS Committee on the Status of Women in Physics (CSWP)**

- Selected as a member in 2013, three year term 2014-2017.
- Maria Goeppert Mayer Award Selection Committee, Vice Chair (2014); Chair (2015)
- March Meeting CSWP Invited Session, Panelist (2016), Session Chair (2017)
- Subcommittee on sexual harrasment, 2016-present
- In 2018, the subcommittee drafted and published new “Effective Practices for Recruiting and Retaining Women in Physics” on APS website.
- Trained to run Communication and Negotiation Skills Workshops in 2017.
  - January 22, 2019, Rensselaer Polytechnic Institute
  - January 19, 2019, CUWiP @ UMass
  - March 7 2018, APS March Meeting, Los Angeles, CA
  - January 13 2018, Conference for Undergraduate Women in Physics, RIT
  - November 28 2017, University of Rochester

#### CONFERENCE AND WORKSHOP PARTICIPATION SINCE 2014

#### **APS March Meeting**

- 2 Contributed Talks
- Anna Belle Harada (MHC '19) was the presenting author on one talk.
- March 4-8, 2019, Boston, MA

#### **Gordon Research Conference, Granular Matter**

- Poster
- July 2018, Stonehill College

#### **APS March Meeting**

- Communication and Negotiation Skills Workshop
- Organizer and Facilitator: LGBT+ Roundtable Discussion
- March 5-9, 2018, Los Angeles, CA

#### **APS March Meeting**

- Invited Session Chair/Organizer: Women in Physics: Understanding and Improving the Climate
- Organizer and Facilitator: LGBT+ Roundtable Discussion
- March 13-17, 2017, New Orleans, LA

**68th Annual Meeting of the APS Division of Fluid Dynamics**

- Contributed Talk
- November 20-22, 2016, Portland, OR

**Gordon Research Conference, Granular Matter**

- Poster (Emma Thackray presenting)
- July 2016, Stonehill College

**APS March Meeting**

- 2 Contributed Talks
- Emma Thackray (MHC '18) was the presenting author on one talk.
- March 14-18, 2016, Baltimore, MD

**68th Annual Meeting of the APS Division of Fluid Dynamics**

- November 22-24, 2015, Boston, MA

**Gordon Research Conference, Soft Matter**

- Poster
- August 2015, Colby-Sawyer College

**67th Annual Meeting of the APS Division of Fluid Dynamics**

- Contributed Talk
- November 23-25, 2014, San Francisco, CA

**AAPT New Faculty Workshop**

- November 13-16, 2014, College Park, MD

**Gordon Research Conference, Granular and Granular-Fluid Flow**

- Poster
- July 2014, Stonehill College

**APS March Meeting**

- Contributed Talk
- March 3-7, 2014, Denver, CO

OUTREACH AND  
RELATED  
ACTIVITIES SINCE  
2014

**MHC Science Launch (ongoing)**

- Part of Cottrell Scholar Award, pilot in 2019, funded for five years, program leader.
- Pre-orientation program for first year students interested in physical science.
- Workshops and lab activities.

**SciTech Cafe (ongoing)**

- Monthly public lectures in Northampton, MA, attendance  $\approx$ 100-150
- Co-organizer in 2017-18 (with K. Aidala), took over in 2018-19 season.
- Funding is guaranteed through 2023-24 season.

**5C Physics Education Research Lunch (ongoing)**

- Co-organizer with Brokk Toggerson (UMass) and Gary Felder (Smith)
- Rotate campuses to discuss teaching research and best practices

**Conference for Undergraduate Women in Physics (CUWiP), January 18-20 2019**

- Organizing committee
- Communication and Negotiation Skills Workshop
- UMass Amherst

**“What can sandpiles tell us about traffic and cancer?” September 10, 2018**

- Public Lecture at Nerd Nite in Northampton, MA

**Soft Matter Day 3, July 27, 2018**

- Co-organizer in collaboration with UMass Physics
- Invited Research Talks, Posters, Demonstrations (open to public)
- UMass Amherst

**Emory-Tibet Science Initiative, 2017 and 2018**

- Traveled to India to teach Buddhist monks
- Topics: Electricity, magnetism, and light

**Conference for Undergraduate Women in Physics (CUWiP), January 12-14 2018**

- Communication and Negotiation Skills Workshop
- Rochester Institute of Technology

**“Particle Physics: From Grains To Cells,” August 2, 2017**

- CBL Lecture to Summer Research Students, Amherst College

**Soft Matter Day 2, July 21, 2017**

- Head Organizer in collaboration with UMass Physics
- Invited Research Talks, Posters, Demonstrations (open to public)
- Mount Holyoke College

**“You’re Never Too Old to Play in the Sandbox,” February 27, 2017**

- Public Lecture at SciTech Cafe in Northampton, MA

**Conference for Undergraduate Women in Physics (CUWiP), January 13-15 2017**

- Panelist: *Academic and Non-Academic Career Opportunities*
- Harvard University

**Soft Matter Day, July 22, 2016**

- Head Organizer in collaboration with UMass Physics
- Invited Research Talks, Posters, Demonstrations (open to public)
- Mount Holyoke College

**Conference for Undergraduate Women in Physics (CUWiP), January 15-17 2016**

- Panelist: *Diversity Panel, Careers in Education and Academia*
- Wesleyan University

**“The Physics of Superheroes,” August 5, 2015**

- Public Lecture at South Hadley Public Library

AFFILIATIONS

- American Physical Society (APS)
- American Association for the Advancement of Science (AAAS)
- LGBT+ Physicists