

Matthew J. (Matt) Harrington

Curriculum Vitae

University of Pennsylvania
Department of Physics and Astronomy
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Education

Ph.D. Physics
University of Maryland: May 2015
GPA: 4.0/4.0

“Microscopic Rearrangements within Granular Shear Flows: Segregation, Subdiffusion, & Rotation”

Thesis Advisor: Wolfgang Losert

B.S. Applied Mathematics, Engineering, and Physics (AMEP)
University of Wisconsin-Madison: May 2010
GPA: 4.0/4.0

Research Interests

Soft Condensed Matter

Granular Materials

Failure, Fracture, and Flow of Amorphous Materials

Nonlinear Dynamics

Physics Education

Professional Appointments

Postdoctoral Fellow, Department of Physics and Astronomy, University of Pennsylvania, Philadelphia, PA: November 2015-Present.

Postdoctoral Research Associate, Institute for Research in Electronics and Applied Physics, University of Maryland, College Park, MD: June 2015-October 2015.

Graduate Research Assistant, Institute for Research in Electronics and Applied Physics, University of Maryland, College Park, MD: June 2011-May 2015.

Visiting Scholar, Institut de Physique de Rennes, Université de Rennes I, Rennes, France: September 2012-March 2013.

Undergraduate Research Assistant, Department of Mathematics, University of Wisconsin-Madison, Madison, WI: March 2009-August 2009.

Research Assistant, Hyperion Scientific, Inc., Madison, WI: May 2008-August 2008.

Publications

- M. Harrington** and D. J. Durian, “Anisotropic particles strengthen granular pillars under compression,” *Physical Review E* **97**, 012904 (2018).
- S. M. Salili, **M. Harrington**, and D. J. Durian, “Eliminating Stripe Artifacts in Light-Sheet Fluorescence Imaging,” *submitted to Review of Scientific Instruments*, arXiv:1711.07393 [physics.ins-det] (2017).
- S. Aghayee, D. E. Winkowski, Z. Bowen, E. E. Marshall, **M. J. Harrington**, P. O. Kanold, and W. Losert, “Particle Tracking Facilitates Real Time Capable Motion Compensation in 2D or 3D Two-Photon Imaging of Neuronal Activity,” *Frontiers in Neural Circuits* **11**, 56 (2017).
- K. N. Nordstrom, E. Lim, **M. Harrington**, and W. Losert, “Granular Dynamics during Impact,” *Physical Review Letters* **112**, 228002 (2014).
- M. Mailman, **M. Harrington**, M. Girvan, and W. Losert, “Consequences of Anomalous Diffusion in Disordered Systems under Cyclic Forcing,” *Physical Review Letters* **112**, 228001 (2014).
- 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**, 185-191 (2014).
- M. Harrington**, J. H. Weijs, and W. Losert, “Suppression and Emergence of Granular Segregation under Cyclic Shear,” *Physical Review Letters* **111**, 078001 (2013).

Patents

- S. M. Salili, **M. Harrington**, and D. J. Durian, U.S. Provisional Patent Ser. No. 62/585,142, filed November 13, 2017.

Scholarships, Honors, and Grants

- Research Grant**, NSF-Division of Materials Research, Award no. 1507964 (PI: W. Losert, Co-PI: M. Girvan): 2015.
- FGSA Travel Award for Excellence in Graduate Research**, American Physical Society, Forum on Graduate Student Affairs: 2014.
- Thomas Mason Fellowship for Interdisciplinary Research**, Department of Physics, University of Maryland: 2014.
- Burgers Symposium Poster Prize**, Burgers Program for Fluid Dynamics, University of Maryland: 2013.
- Chateaubriand Fellowship - Science, Technology, Engineering & Mathematics**, Office for Science and Technology, Embassy of France in the United States: 2012.
- AMEP Leadership Prize**, Department of Mathematics, University of Wisconsin-Madison: 2009.

Conference, Seminar, and Workshop Participation

Invited Talks

- “Characterizing microscopic rearrangements and interactions within granular flows,” *Informal Statistical Physics Seminar*, University of Maryland, College Park, MD: September 22, 2015.
- “3D dynamics of granular materials: shear, segregation, and rotation,” *Applied Dynamics Seminar*, University of Maryland, College Park, MD: April 17, 2014.

“3D Imaging of Segregation in Granular Shear Flows,” *2013 National Energy Technology Laboratory Workshop on Multiphase Flow Science*, Morgantown, WV: August 7, 2013.

Contributed Talks

“Soundbite: Compression of Noncircular Grains: Structural and Dynamical Features,” *7th Northeast Complex Fluids and Soft Matter Workshop*, Princeton University, Princeton, NJ: May 26, 2017.

“Soundbite: Compression of Noncircular Grains: Structural and Dynamical Features,” *18th Mid-Atlantic Soft Matter Workshop*, University of Pennsylvania, Philadelphia, PA: May 19, 2017.

“Effects of Particle Shape on the Deformation of Granular Pillars,” *APS March Meeting 2017*, New Orleans, LA: March 13-17, 2017.

“3D imaging of particle-scale rotational motion in cyclically driven granular flows,” *APS March Meeting 2016*, Baltimore, MD: March 14-18, 2016.

“Soundbite: 3D imaging of particle-scale rotational motion in granular flows,” *15th Mid-Atlantic Soft Matter Workshop*, University of Maryland, College Park, MD: July 29, 2015.

“3D imaging of particle-scale rotational motion in granular flows,” *Research Symposium on Environmental and Applied Fluid Dynamics*, George Washington University, Washington, DC: May 26, 2015.

“3D imaging of particle-scale rotational motion in granular flows,” *APS March Meeting 2015*, San Antonio, TX: March 2-6, 2015.

“Soundbite: Characterizing arbitrary 3D particle-scale rotations in granular flows,” *14th Mid-Atlantic Soft Matter Workshop*, Georgetown University, Washington, DC: January 16, 2015.

“Particle scale 3D flow field, rotations, and segregation in granular flows,” *UMD/JHU/GWU Joint Graduate Student and Post-Doc Showcase Symposium*, University of Maryland, College Park, MD: May 28, 2014.

“Soundbite: Local rotational dynamics in sheared 3D granular materials,” *12th Mid-Atlantic Soft Matter Workshop*, University of Pennsylvania, Philadelphia, PA: January 17, 2014.

“Suppression and emergence of granular segregation under cyclic shear,” *66th Annual Meeting of the APS Division of Fluid Dynamics*, Pittsburgh, PA: November 24-26, 2013.

“Soundbite: Three dimensional imaging of slow shear-driven segregation of a granular material,” *9th Mid-Atlantic Soft Matter Workshop*, University of Maryland, College Park, MD: July 20, 2012.

Posters

“Structural Defects in Disordered Solids Made from Noncircular Grains - A machine learning approach,” *Gordon Research Conference & Seminar: Soft Condensed Matter*, Colby-Sawyer College, New London, NH: August 12-18, 2017.

“Effects of Particle Shape on the Deformation of Granular Pillars,” *Gordon Research Conference & Seminar: Granular Matter*, Stonehill College, Easton, MA: July 23-29, 2016.

“3D imaging of rotational motion in granular flows,” *Gordon Research Conference & Seminar: Granular & Granular-Fluid Flow*, Stonehill College, Easton, MA: July 20-25, 2014.

“Suppression and emergence of granular segregation under cyclic shear,” *10th Annual Symposium of the Burgers Program for Fluid Dynamics*, University of Maryland, College Park, MD: November 20, 2013.

“Three dimensional imaging of slow cyclic shear-driven segregation,” *Dynamics Days US 2013*, Denver, CO: January 3-6, 2013.

“Three dimensional imaging of slow cyclic shear-driven segregation,” *Gordon Research Conference: Granular & Granular-Fluid Flow*, Davidson College, Davidson, NC: July 22-27, 2012.

Conferences and Workshops Attended

Penn I-CORPS Site Fall Short Course, Philadelphia, PA: November 6 and November 20, 2017.

CISM Mechanics and Physics of Failure: Multi-scale Modeling of the Failure Behavior of Solids, Udine, Italy: September 26-30, 2016.

Dynamics Days US 2012, Baltimore, MD: January 4-7, 2012.

Summer School: Granular Flows: From Simulations to Astrophysical Applications, University of Maryland, College Park, MD: June 13-17, 2011.

Nonlinear Dynamics and Fluid Instabilities in the 21st Century, Haverford College, Haverford, PA: May 19-20, 2011.

Teaching Experience

Head Teaching Assistant, Department of Physics, University of Maryland, College Park, MD: January 2015-May 2015.

PHYS132: Fundamentals of Physics for Life Sciences, 278 students: January 2015-May 2015.

Coordinated course logistics and administrative tasks between the instructor and the TAs; Trained TAs and undergraduate learning assistants (LAs) to lead recitation sections; Managed TA grading assignments; Created solutions and rubrics for newly written HW problems; Aggregated exam, HW, and quiz grades for two large lecture sections

Adjunct Instructor, Biological Sciences Program, University of Maryland, The Universities at Shady Grove, Rockville, MD: September 2014-December 2014.

PHYS131: Fundamentals of Physics for Life Sciences, 7 students: September 2014-December 2014.

Instructor of a reformed Introductory Physics for Life Science (IPLS) course that includes innovative pedagogical aspects of active learning and interdisciplinary course material; Taught at a satellite campus to UMD whose student body mostly comprises of non-traditional college students; Graded all assignments, quizzes, and exams; Initiated and led the first semester of biologically relevant labs and recitation sections and graded resulting lab reports

Graduate Teaching Assistant, Department of Physics, University of Maryland, College Park, MD: January 2014-May 2014, August 2010-May 2011.

PHYS132: Fundamentals of Physics for Life Sciences, 39 students: January 2014-May 2014.

Lab and Discussion TA for a reformed IPLS course that includes innovative pedagogical aspects of active learning and interdisciplinary course material; Graded some assignments, quizzes and exams; Led biologically relevant labs and discussions with undergraduate LAs for two sections and graded resulting lab reports

PHYS161: General Physics: Mechanics and Particle Dynamics, 172 students: January-May 2011.

Discussion TA for 6 sections of a traditional first semester physics for engineers course; Developed and graded quizzes for two of the sections; Led sections through worked examples and answered student questions; Graded some assignments and exams

PHYS271: Electrodynamics, Light, Relativity & Modern Physics: Laboratory, 98 students: August-December 2010.

Lab TA for 4 sections of a traditional third semester physics for engineers course; Led labs on electricity, magnetism, DC and AC circuits, and optics; Graded resulting lab notebooks/spreadsheets

Student Mentorship

Dylan Powers (U. Maryland) & Eric Cooper (Pomona College), Training and Research Experiences in Nonlinear Dynamics (TREND) REU Program: June 2015-August 2015.

“Reversibility of translational and rotational motion in a cyclically driven granular system”

Shola Wylie (Mount Holyoke College), TREND REU Program: June 2014-August 2014.

“Impact of cone-shaped intruders into granular media”

Michael Lin (U. Maryland): June 2011-December 2013.

“Measuring rotations of spheres in a dense granular system”

Allyson Rice (U. Texas at Austin), TREND REU Program: June 2013-August 2013.

“Effects of pressure on secondary flow profiles in a cyclically driven granular system”

Emily Lim (Duke U.), TREND REU Program: June 2012-August 2012.

“Nonaffine motion of granular media during impact”

Professional Memberships

American Physical Society (APS)

APS Topical Group on Soft Matter (GSOFT)

APS Topical Group on Statistical and Nonlinear Physics (GSPNP)

Outreach & Service

Webmaster, *Durian Group*, University of Pennsylvania, Philadelphia, PA: January 2016-Present.

Webmaster, Granular Research Projects, *Losert Lab*, University of Maryland, College Park, MD: August 2013-October 2015.

Co-organizer and Instructor, *Losert Lab MATLAB Boot Camp*, University of Maryland, College Park, MD: June 2013, June 2014, June 2015.

Coordinator and Volunteer, Sand Physics Demonstrations: What Grown-Ups Learn by Playing with Sandpiles, *Maryland Day*, University of Maryland, College Park, MD: 2011-2014.

Volunteer, General Physics Demonstrations, *Physics is Phun*, University of Maryland, College Park, MD: January 2011.

AMEP Newsletter Editor, University of Wisconsin-Madison, Madison, WI: May-August 2010.

Professional Skills

Instrumentation: Apparatus Design and Construction, Linear and Rotary Motion Control, Force Sensing, 3D Printing

Imaging Techniques: Bright-field Photography & Microscopy, Refractive Index Matching with Laser Sheet Scanning, High Speed Imaging

Computer Vision: Particle Tracking Velocimetry, Motion Analysis in 2D and 3D, Locating Circular and Non-circular Objects, Image Registration, Motion Compensation in 2D and 3D, Artifact Removal

Numerical Techniques: Network Analysis, Molecular Dynamics Simulation, Machine Learning, Support Vector Machine

Computer Skills

Office/Data Management Software: Box, Dropbox, Google Drive, Microsoft Office

Design Software: AutoCAD, Inkscape, LabVIEW

Scientific Computing Software: Cygwin, ImageJ/Fiji, Mathematica, MATLAB/Octave

Programming Languages: C++, Java, HTML, L^AT_EX, Python

Operating Systems: Windows, Mac OS X

References

Douglas Durian, Current Advisor
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Wolfgang Losert, Graduate Dissertation Advisor
Department of Physics, University of Maryland
(301) 405-0629
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Michelle Girvan, Graduate Collaborator
Department of Physics, University of Maryland
(301) 405-1610
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