

BRIAN C. UTTER

Department of Physics & Astronomy
One Dent Drive
Bucknell University
Lewisburg, PA 17837

570-577-3767
brian.utter@bucknell.edu
(on leave 2018-19)

EMPLOYMENT *Professor, 2018-present*

Associate Professor 2015-2018

Department of Physics & Astronomy, Bucknell University, Lewisburg, PA

Visiting Scholar 2018-2019

Department of Physics & Astronomy, University of Pennsylvania, Philadelphia, PA

Host: Doug Durian

Associate Professor 2010-2015

Assistant Professor 2004-2010

Department of Physics & Astronomy, James Madison University, Harrisonburg, VA

Visiting Scientist, 2012-13

Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany

Postdoctoral Research Associate 2001 - 2004

Department of Physics and Center for Nonlinear and Complex Systems,

Duke University, Durham, NC

In collaboration with Robert P. Behringer

EDUCATION *Ph.D., Physics (2001)*

Cornell University, Ithaca, NY

Minor: Materials Science and Engineering

Dissertation: Low Anisotropy Growth in Directional Solidification

Advisor: Eberhard Bodenschatz

M.S., Physics (1998)

Cornell University, Ithaca, NY

B.S., Physics (1995)

Rutgers College, Rutgers University, New Brunswick, NJ

Minor: Philosophy, summa cum laude

COURSES TAUGHT

PHYS 140: *Physics for Future Leaders*, S16, S17, S18

PHYS 221: *Classical Mechanics*, F15, F16, F17

PHYS 211: *Classical and Modern Physics I (problem session instructor)*, F15

PHYS 246: *Data Acquisition & Analytical Tech. in Physics*, S14, S15

GSCI 104: *Science Outreach in Schools*, S15

PHYS 340: *Mechanics*, F13, F14

PHYS 240: *University Physics I*, F13, F14

MATH/PHYS 341: *Nonlinear Dynamics and Chaos*, F02, S08, S12, S14

GSCI 101: *Physics, Chemistry, and the Human Experience*, F04, F05, F06, F07, F09, F10, S12

PHYS 260: *University Physics III*, F11

PHYS 380: *Thermodynamics and Statistical Mechanics*, F10, F11
 GSCI 121: *Physical Nature of Light and Sound*, S11
 PHYS 337: *Solid State Physics*, S05, S07, S09, S11
 PHYS 250: *University Physics 2*, S06, S07, S08, S09, S10
 PHYS 247: *Data Acquisition & Analytical Tech. in Physics*, S10
 PHYS 347: *Advanced Physics Lab*, F08
 PHYS 390: *Computer Applications in Physics*, F07
 PHYS 140L-150L: *Introductory Physics Lab*, F04, S05, F05, S06, F07

RESEARCH My research interests are in the fields of experimental complex systems, nonlinear dynamics, and materials science, specifically in granular and multiphase flows. In particular, we study shearing and jamming in granular materials and granular-fluid systems with the ultimate goal of developing a statistical (e.g. thermodynamic) description of dense granular flows. Specific studies focus on the jamming transition, effect of external vibrations, stability, emergent behavior in particle dynamics, and force transmission via photoelastic (stress-induced birefringent) grains as model systems of dense granular flows. Related experiments on multiphase flows include erosion due to fluid flows, effects of surface chemistry on suspensions, and dispersion of powders.

GRANTS AND FUNDING PI, NSF CBET, *Flow and Rheology of Particle-Fluid Suspensions with Variable Hydrophobicity* (\$135,103, 7/2011–6/2017)

co-PI, Office of Naval Research (PI: Giovanna Scarel), *The exploitation of electric contributions in infrared power generation* (\$105,111, 3/10/2015–10/31/2017)

co-PI, NSF Noyce Capacity Building (PI: Eric Pyle, co-PIs: John Almarode, Kerry Cresawn, Barbara Reisner), *James Madison University EPIC (Expanding Pathways, Identity and Capacity) Science Education*, (\$299,744, 10/1/14–9/30/16).

co-PI, Office of Naval Research (PI: Giovanna Scarel), *Infrared power generation: study in an insulated compartment* (\$30,000, 8/1/2014–8/31/2015)

PI, VA DOE Math Science Partnership Grant (co-PIs: Joseph Mahler and David Slykhuis), *Enhancing Student Achievement Across Virginia Through Modeling Instruction*, (\$235,819, 4/2014–9/2015)

PI, PhysTEC, Physics Teacher Education Coalition (co-PIs: Scott Paulson, David Daniel, David Slykhuis, Andy Jackson, and Mark Mattson), *Proposal for a PhysTEC Comprehensive Site at James Madison University*, (\$297,012 8/2013–7/2016)

PI, NSF MRI (co-PIs: Kevin Caran, Klebert Feitosa, and Kyle Gipson), *Acquisition of a Rheometer for Undergraduate Materials Research* (\$185,500, 8/2012–7/2015)

PI, Research Corporation, *Effect of Imposed Force Fluctuations on the Jamming Transition in Granular Materials* (\$44,918, 7/2007–6/2011)

PI, National Institute of Standards and Technology, *Summer Undergraduate Research Fellowship* (\$7034, 5/2007–9/2007)

PI, JMU Summer Faculty Assistance Grant, *Study of the force response of granular materials under imposed vibrations* (\$4,000, 6/2006–8/2006)

RESEARCH ADVISEES

Chris Barber, Summer 2018
 John Buggeln, Summer 2018
 Weilun Tan‡, Summer 2017–Dec. 2017
 Emily Hobbs, STEM Scholar, Summer 2016, Summer 2017
 Eddie Davis, Summer 2016, 2016–2017
 Alex Christensen, Summer 2016, 2016
 Harry Mandeles, Summer 2015
 Jacob Parkhouse, Summer 2015
 George Wilkes‡, 2013–2014
 Thomas Benns‡, Summer 2012, 2013
 Chet Szwejkowski‡, Summer 2012
 Liz Visosky‡, 1/10–12/12
 Nora Swisher‡, 3/09–5/12 (+ summer '09, summer '10, summer '11)
 Christina Hanks‡, 9/11–5/12
 Rachel Derby‡ (UMBC, Summer REU '11)
 Ben Foltz, 5/10–9/11 (+ summer '10, summer '11)
 Richard Knoche‡, 1/09–5/11 (+ summer '09)
 Ibraheem Rasoul‡, 1/09–8/09 (+ summer '09)
 Doyle Baker, Summer REU 2009 (+ summer '09)
 Stephen McGinley, 9/07–5/08
 Rick Dunlap, 9/05–4/06, 1/08–5/09
 Lily Baldwin, 9/07–5/09
 Glenn Young, 6/08–12/08 (+ summer '08)
 Alex Nycum, 1/08–12/10 (+ summer '08)
 Ralph Herman 6/07–5/09 (+ summer '07, summer '08)
 Dan Amon, 6/06–5/08 (+ summer '06, summer '07)
 Eric Hoppmann‡, 7/05–5/08 (+ summer REU)
 Tatiana Niculescu‡ (HS student, summer '06, summer '07, summer '08)
 Anna Cannon, summer REU 2006
 Chase Maitland, 9/05–4/06
 Martin Lehman, '05 (summer REU)
 Sean Geary‡, 9/04–5/05

‡ Attended graduate school in physics or a closely related field.

Member of doctoral defense examination board for Song-Chuan Zhao, Georg-August-Universität Göttingen, 2013. Thesis: “*Length scales in granular matter.*”

PROFESSIONAL SERVICE Council on Undergraduate Research, *member*

- elected *Councilor, Physics & Astronomy Division* (2014–2020).
 - *CUR P&A Secretary* (2018–2019).
- AP Physics, *Chief Reader Associate* and *AP Physics Exam Development Committees* (2017–)
Exam Leader (2016–17), *Table Leader* (2013–15), *Reader* (2009–10, 2012–13)
 [AP Physics exam grading]
Question writer, Physics I & II, Physics C (2012–)
AP Physics II Syllabus Reviewer (2014–)
- American Association of Physics Teachers, *member*
- Committee on Undergraduate Education, *appointed member* (2013–2016).
- American Physical Society, *member*
- Member, Task Force on Ethics Education (2005–7)
 - Elected as Member-at-Large, Forum on Graduate Student Affairs (2001–2003).

- Member, US Advisory Committee for the Canadian, American, and Mexican (CAM) First Graduate Student Conference (2003).

National Science Teachers Association, *member*

Honors Evaluator, Swarthmore Honors Program (2017)

Reviewer for National Science Foundation, ACS Petroleum Research Fund, Physical Review Letters, Physical Review E, Granular Matter, Physica D, SIAM Review, ASME: Journal of Dynamic Systems, Measurement and Control, National Conference on Undergraduate Research, and CUR Posters on the Hill.

Reviewer for texts by Knight (2007), Tillery (2008), Katz (2008, 2010), and Ostdiek (2015).
Shenandoah Valley Regional Science Fair

—*Prize Coordinator* (2010, 2011, 2012, 2014)

—*Juror* (2007, 2009)

Juror, USA Young Physicists Tournament (2009-10, 15), First Lego League Tourn. (2009-10).

Standard Setting Committee, American Board for the Certification of Teacher Excellence (2007)

**BUCKNELL
SERVICE**

CAS Curriculum Committee (2016–19)

Committee on Assessment (2016–17, leave replacement)

**JMU
SERVICE**

CSM Science Teacher Preparation Committee (2013–15)

JMU Assessment Advisory Committee (2011–12, 2013–15)

Search Committee member, Center for Assessment and Research Studies Director (2014)

Madison Career Fellow, Mid-Career Faculty Issues (2012, Center for Faculty Innovation, JMU)

Task Force on Student Evaluation of Teaching (2011–12)

JMU Assessment Fellow (2011)

Madison Institute on Academic Rigor (2011)

Panelist, Liberal Education Institute (2011)

College Council, College of Science and Mathematics (2008–11)

Stem Sell, WXJM, Radio show host (30 episodes, 2010–11)

JMU STEM Fellow (2010)

Madison Teaching Fellow, General Education (2009, Center for Faculty Innovation, JMU)

DEPARTMENTAL

SERVICE

PAC (Personnel Action Committee), *chair* (2014–15), *member* (2010–15)

(JMU)

Hiring and supervising HS Physics Teacher in Residence (Joseph Mahler 2013–14,

Thomas O’Neill 2014–15)

Physics Department Assessment Coordinator (2012–15)

Secondary Education Track Advisor (2011–15)

Physics Search Committees *Chair* (2008, 2009), *Member* (2006, 2007)

Physics 140 Lab Re-Write Committee, *Chair* (2008)

MANUSCRIPTS

IN PREP

*B. W. Foltz** and **B. C. Utter**, “Flow of hydrophobic granular suspensions in a rotating drum”

*R. D. Herman** and **B. C. Utter**, “Shear-stress of vibrated granular fluid mixtures”

*H. Mandeles**, *J. Parkhouse**, and **B. C. Utter**, “Impact of a hydrophobic granular jet in water”
(to be submitted to *Physical Review Jan. 2018*).

MANUSCRIPTS

SUBMITTED

B. C. Utter, “Nonlinearity and complexity for non-science majors: Chaos, populations, and climate modeling”, submitted to the *Journal of College Science Teaching* and revising based on referee feedback.

PUBLICATIONS Undergraduate co-authors in *italics**

B. C. Utter, Scott A. Paulson, John T. Almarode, David B. Daniel, “My science is better than your science: Conceptual change as a goal in teaching science majors about the science of learning”, *The Teacher Educators' Journal* **11**, 12 (2018).

B. C. Utter, “Review of *Teaching and Learning STEM: A Practical Guide* by Felder and Brent,” peer reviewed book review solicited by *The Physics Teacher*, **56**, 26 (2018).

*E. P. Hoppmann** and **B. C. Utter**, “Planar granular shear flow under external vibration”, *Physical Review E*, **96**, 022903 (2017).

R.P. Given*, K.S. Wenger*, V.D. Wheeler, **B. C. Utter**, and G. Scarel, “*Fabrication of nano-power generators using thin atomic layer deposited films*,” *Journal of Vacuum Science and Technology A* **35**, 01B120 (2016).

*N. C. Swisher** and **B. C. Utter**, “Flow profile of granular avalanches with imposed vertical vibration,” *Granular Matter* **16**, 175 (2014).

*D. L. Amon**, *T. Niculescu**, and **B. C. Utter**, “Granular avalanches in a two-dimensional rotating drum with imposed vertical vibration,” *Physical Review E*, **88**, 012203 (2013).

B. Utter, “Photoelastic Materials,” Chapter in *Experimental and Computational Techniques in Soft Condensed Matter Physics* (Cambridge University Press, 2010).

B. Utter and R.P. Behringer, “Experimental measures of affine and nonaffine deformation in granular shear,” *Physical Review Letters*, **100**, 208302 (2008).

B. Utter and E. Bodenschatz, “Double dendrite growth in solidification,” *Physical Review E*, **72**, 011601 (2005).

B. Utter, R. Ragnarsson, and E. Bodenschatz, “An experimental apparatus and sample preparation for directional solidification,” *Review of Scientific Instruments*, **76**, 013906 (2004).

B. Utter and R.P. Behringer, “Transients in sheared granular matter,” *European Physical Journal E*, **14**, 373 (2004).

B. Utter and R.P. Behringer, “Self-diffusion in dense granular shear flows,” *Physical Review E*, **69**, 031308 (2004).

B. Utter and E. Bodenschatz, “Dynamics of low anisotropy morphologies in directional solidification,” *Physical Review E*, **66**, 051604 (2002).

B. Utter, R. Ragnarsson, and E. Bodenschatz, “Alternating tip splitting in directional solidification,” *Physical Review Letters*, **86**, 4604 (2001).

R. Ragnarsson, **B. Utter**, and E. Bodenschatz, “Superdendrites in directional solidification of polymer-solvent mixtures,” in *Phase Transitions and Systems Driven Far from Equilibrium*, ed. En Ma, Materials Research Society Symposium Proceedings, **481**, 65 (1998).

B. Utter and R. A. Bartynski, "Photoelectron diffraction at low energies: the applicability of single scattering calculations," *Surface Science Letters*, **370**, 65 (1998).

CONFERENCE PROC. T. C. St. John*, Z. J. Marinelli*, J. M. Kaczmar*, R. P. Given*, K. S. Wenger*, **B. C. Utter**, and G. Scarel, "Conversion of infrared light into usable energy." *SPIE Proceedings*, N. 9927-12 (2016).

B. Utter and R. P. Behringer, "Multiscale Motion in the Shear Band of Granular Couette Flow," *Powder and Grains 2009 Proceedings*, AIP Conference Proceedings, Volume 1145, pp. 339-342 (2009).

B. Utter and R. P. Behringer, "Diffusion, transients, and non-affine deformations for granular Couette shear flow," *Powder and Grains 2005 Proceedings*, R. Garca-Rojo, H.J. Hermann, and S. McNamara, Eds., A.A Balkema, Rotterdam (2005).

R.P. Behringer, E. Clément, J. Geng, R. Hartley, D. Howell, G. Reydellet, and **B. Utter**, Statistical properties of dense granular matter, *Proceedings of the Workshop on Traffic and Granular Flow*, Delft (2004).

L. Kondic, **B. Utter**, and R.P. Behringer, Dynamics of Sheared Granular Materials, *Proceedings of the Sixth Microgravity Fluids Physics and Transport Phenomena Conference* p. 453 (2002).

BOOK B. Utter and E. Mandell, *S Student Solutions Manual for Katz's Physics for Scientists and Engineers: Foundations and Connections* (Cengage Learning, 2015, ISBN Volume 1: 978-0534466763. Volume 2: 978-0534467678)

SELECTED PRESENTATIONS Jamming, jetting, and flow: Complexity in the flow of granular-fluid systems, Haverford College physics colloquium (2018) (**invited**).

Impact and interaction of granular streams in water, talk presented at American Physical Society March Meeting (2017).

Clogging transition in counter-flowing suspensions, poster presented at Granular Matter Gordon Conference (2016).

Impact of a hydrophobic granular stream in water, talk presented at American Physical Society March Meeting (2016).

Avalanching and flow of granular and granular-fluid mixtures, talk presented at
 — Providence College (2015) (**invited**).
 — American Physical Society March Meeting (2015).
 — 14th Mid-Atlantic Soft Matter Meeting (soundbite) (2015).
 — Virginia Soft Matter Workshop (2014) (**invited**).

Enhancing Student Achievement Across Virginia Through Modeling Instruction
 — talk presented at National Science Teacher Association regional conference (2014).
 — talk presented at Virginia Academy of Science Teachers Professional Development Institute (2014).

Rheology and flow of hydrophobic granular mixtures, talk presented at

- American Physical Society Division of Fluid Dynamics Meeting (2013)
- Granular Day Research Symposium, Göttingen, Germany (2013) **(invited)**.

Electrotaxis in Dictyostelium

- Dicty Retreat (2012)
- Hahnenklee Meeting on Self-Organization in Biology (2013)
- Patterns in Biophysics Research Seminar (2013)

Flow and Rheology of Hydrophobic Granular-Fluid Mixtures, poster presented at Gordon Conference on Granular and Granular-Fluid Flow (2012)

Imaging and Rheology of Complex Granular & Granular-Fluid Flows, talk presented at Science Enabled by Photon Sources (2012).

Jamming and Fluidization in Granular Flows

- Rochester Institute of Technology (2012) **(invited)**.
- SESAPS (Southeastern Section of the American Physical Society) (2011) **(invited)**.
- Max Planck Institute for Dynamics and Self-Organization (Göttingen, GER) (2011) **(invited)**.
- James Madison University, Department of Mathematics and Statistics (2011) **(invited)**.

Surface Chemistry Effects in Submerged Granular Flows of Hydrophobic Grains, talk presented at American Physical Society Division of Fluid Dynamics Meeting (2011).

Shear strength of vibrated granular/granular-fluid mixtures, talk presented at American Physical Society March Meeting (2011).

Jamming in Vibrated Granular and Granular-Fluid Systems, poster presented at

- Gordon Conference on Granular and Granular-Fluid Flow (2010)
- Complex Driven Systems – From Statistical Physics to the Life Sciences (2010)
- Dynamics Days (2011)

Jamming in Vibrated Granular Systems, talk presented at American Physical Society March Meeting (2009) **(invited)**.

Multiscale motion in the shear band of granular Couette flow, talk presented at Powders and Grains 2009.

Jamming in Granular Systems, (2009).

- Davidson College **(invited)**
- Naval Research Lab **(invited)**
- JMU Physics Colloquium
- SESAPS 2008 (Southeastern Section of the American Physical Society) **(invited)**

Jamming in Granular Systems with Imposed Vibrations, poster presented at Gordon Conference on Granular and Granular-Fluid Flow (2008).

2D Granular Avalanches with Imposed Vibrations, talk presented at APS March Meeting (2008).

Granular Shear Flow with Imposed Vibrations, poster presented at Gordon Conference on Granular and Granular-Fluid Flow (2006).

Granular Shear Flow with Imposed Vibrations, talk presented at APS March Meeting (2006).

Diffusion, Elastic Energy, and Force Measurements in Sheared Granular Materials, talk presented at Dynamics Days (2004).

Granular Physics: Scientist in a Sandbox, (2004).

- James Madison University
- Emory University
- Washington and Lee College
- Kalamazoo College
- DePauw University
- Austin College

Elastic Energy and Force Measurements in Sheared Granular Materials, talk presented at the APS Division of Fluid Dynamics Meeting (2003).

Diffusion and Elastic Energy Measurements in Sheared Granular Materials, talk presented at the Canadian, American, and Mexican (CAM) First Graduate Student Conference (2003).

Diffusion and Elastic Energy Measurements in Dense Granular Shear Flows, talk presented at the Newton Institute Flow Regimes, Transitions, and Segregation in Granular and Particle-Laden Flows (2003).

Diffusion and Elastic Energy Measurements in Dense Granular Matter, talk presented at the APS March Meeting (2003).

Shearing of Granular Materials: Probing a New State of Matter, colloquium, Swarthmore College (2002).

Shearing in Dense Granular Matter, talk presented at the APS Division of Fluid Dynamics Meeting (2002).

Shearing in Dense Granular Matter, poster presented at Gordon Conference on Granular and Granular Fluid Flow (2002).

Low Anisotropy Growth in Directional Solidification, poster presented at Dynamics Days (2002).

Dynamics of “Seaweed” Growth in Directional Solidification, invited talk at Thin Films Seminar, Duke University (2001).

Granular Physics, talk presented at ADVANCE Seminar for Women in Science, Duke University (2001). **(invited)**

Tip Splitting and Seaweed Growth in Directional Solidification, talk presented at the American Physical Society March Meeting (2001).

Tip Splitting and Seaweed Growth in Directional Solidification, (2001).
 — Duke University
 — University of Chicago
 — Georgetown University
 — Gettysburg College
 — Washington and Mary University

Dynamics of Seaweed Growth, talk presented at the American Physical Society March Meeting (2000).

Weed Morphology in Directional Solidification Experiments of Succinonitrile-poly(ethylene oxide), talk presented at the American Physical Society March Meeting (1999).
 Superdendrites in Directional Solidification of Polymer-Solvent Mixtures, poster presented at the Materials Research Society Fall Meeting (1998).

STUDENT Undergraduate co-authors in *italics**

PRESENTATIONS Optimization of a Universal Granular Gripper Using Geometrical Inserts, Eddie Davis*,
(SELECTED) Brian Utter, Kaixiang Shi*, Ryder Winans*, Charles Kim, poster presented at the APS March Meeting (2017).

Plate Tracking for a Granular Casimir Effect, George Wilkes* & Brian Utter,
 — poster presented at APS March Meeting (2015)
 — poster presented at NCUR (National Conference on Undergraduate Research) (2015)
 — talk presented at 2nd Virginia Soft Matter Workshop (2014)

Effective Interactions Between Intruders in Vibrated Granular Materials, Rachel Derby* & Brian Utter
 — poster presented at American Physical Society Division of Fluid Dynamics Meeting (2011).
 — poster presented at CUR Posters on the Hill (Washington DC) (2011).

Characterizing the motion of grains in a 2D rotating drum with imposed vibrations, Nora Swisher* & Brian Utter
 — talk presented at Southeastern Conference of Undergraduate Women in Physics (Knoxville, TN) (2011).
 — poster presented at American Physical Society March Meeting (2011).

Rheology of Partially Submerged Hydrophobic Sands, Elizabeth Visosky* & Brian Utter, poster presented at Southeastern Conference of Undergraduate Women in Physics (Knoxville, TN) (2011).

Flow of Monodisperse and Bidisperse Circular Grains, Christina Hanks* & Brian Utter, Southeastern Conference of Undergraduate Women in Physics (Knoxville, TN) (2011).

Submerged granular flow of hydrophobic and hydrophilic sand, Ben Foltz* & Brian Utter, poster presented at American Physical Society March Meeting (2011).

Particle trajectories in 2D granular avalanches with imposed vibrations, Nora Swisher* & Brian Utter, poster presented at American Physical Society March Meeting (2011).

Behavior of granular slopes under vertical vibration, Nora Swisher* & Brian Utter, talk presented at Southeastern Women in Physics Conference (2010).

Shear Stresses in a water/sand system partially fluidized by low-intensity vertical vibration, Ralph Herman* & Brian Utter

— talk presented at NCUR (National Conference on Undergraduate Research) (2009).

Granular Avalanches in a Rotating Drum with Imposed Vibrations, Dan Amon* & Brian Utter, talk presented at NCUR (National Conference on Undergraduate Research) (2008).

Imposed Vibration in Sheared Granular Systems, Eric Hoppmann* & Brian Utter, talk presented at NCUR (National Conference on Undergraduate Research) (2007).

Granular Shear Flow with Imposed Vibrations, Eric Hoppmann* & Brian Utter, poster presented at American Physical Society March Meeting (2006).