

# Karen E. Daniels

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## EDUCATION

- 1997 – 2002      **Cornell University, Ithaca, NY**  
MS in Physics  
PhD in Experimental Condensed Matter Physics  
Thesis title: *Pattern Formation and Dynamics in Inclined Layer Convection*
- 1990 – 1994      **Dartmouth College, Hanover, NH**  
AB in Physics with high honors; minor in Mathematics  
Thesis title: *Atmospheric Electroglow in the Equatorial Region of Jupiter*

## PROFESSIONAL EXPERIENCE

- 2005 –            **Department of Physics, North Carolina State University, Raleigh, NC**  
Assistant Professor
- 2002 – 2005      **Department of Physics, Duke University, Durham, NC**  
Postdoctoral Research Associate

## TEACHING EXPERIENCE

- 2006 –            **North Carolina State University, Raleigh, NC**  
Physics 205, *Matter and Interactions I*, Spring-Fall 2006 Physics 208, *Matter and Interactions II*, Fall 2007
- Fall 2004          **Duke University, Durham, NC**  
Recitation instructor, Physics 53, *General Physics I*.
- 1998 – 1999      **Department of Physics, Cornell University, Ithaca, NY**  
Teaching assistant training program instructor (1998), chair (1999).
- 1997              **Department of Physics, Cornell University, Ithaca, NY**  
Teaching Assistant, Physics 201, *Why the Sky is Blue*.
- 1994 – 1997      **Saint Ann's School, Brooklyn, NY**  
Physics teacher

## AWARDS

NSF Faculty Early Career Development Program (CAREER) Award (2007)

## CURRENT RESEARCH INTERESTS

Experimental studies of nonequilibrium and nonlinear systems, including:

- sound propagation in granular materials
- mixing and segregation in granular materials
- morphological instabilities in spreading surfactants
- fracture in gels
- geological implications of granular physics (earthquakes, meteor impacts)
- pattern formation, chaos, and dynamics in Raleigh-Bénard convection

**PUBLICATIONS**

\* denotes undergraduate coauthor

1. K. E. Daniels, N. W. Hayman, and P. E. Malin. "A granular stick-slip experiment with earthquake parameter implications." In review at *Geophysical Review Letters*, 2007.
2. K. E. Daniels, O. Brausch, W. Pesch, and E. Bodenschatz. "Competition and bistability of ordered undulations and undulation chaos in inclined layer convection." To appear in *Journal of Fluid Mechanics*.  
nlin.PS/0702006
3. K. E. Daniels, S. Mukhopadhyay, P. J. Houseworth\*, and R. P. Behringer. "Instabilities in droplets spreading on gels." *Physical Review Letters*, **99**: 124501 (2007).
4. R. P. Behringer, K. E. Daniels, T. S. Majmudar, and M. Sperl. "Fluctuations, correlations and transitions in granular materials: statistical mechanics for a non-conventional system." *Philosophical Transactions of the Royal Society A*, Proceedings of the 9th Experimental Chaos Conference, 2007
5. K. E. Daniels and R. P. Behringer, "Characterization of a freezing/melting transition in a vibrated and sheared granular medium." *Journal of Statistical Physics*. July 2006.
6. K. E. Daniels and R. P. Behringer. "Hysteresis and competition between disorder and crystallization in sheared and vibrated granular flow." *Physical Review Letters*, **94**: 168001 (2005).
7. C. Huepe, H. Riecke, K. E. Daniels, and E. Bodenschatz. "Statistics of defect trajectories in spatio-temporal chaos in inclined layer convection and the complex Ginzburg-Landau equation." *Chaos*, **14**: 864 (September 2004).
8. K. E. Daniels, C. Beck, and E. Bodenschatz. "Defect turbulence and generalized statistical mechanics." *Physica D*, **193**: 208 (15 June 2004).
9. K. E. Daniels, R. J. Wiener, and E. Bodenschatz. "Localized transverse bursts in inclined layer convection." *Physical Review Letters*, **91**: 114501 (12 Sep 2003).
10. K. E. Daniels and E. Bodenschatz. "Statistics of defect motion in spatiotemporal chaos in inclined layer convection." *Chaos*, **13**: 55 (March 2003).
11. K. E. Daniels and E. Bodenschatz. "Defect turbulence in inclined layer convection." *Physical Review Letters*, **88**: 034501 (21 Jan 2002).
12. K. E. Daniels, B. B. Plapp, and E. Bodenschatz. "Pattern formation in inclined layer convection." *Physical Review Letters*, **84**:5320 (5 June 2000).

**PROCEEDINGS**

1. R. P. Behringer, K. E. Daniels, T. S. Majmudar, and M. Sperl. "Fluctuations, correlations and transitions in granular materials: statistical mechanics for a non-conventional system." to appear in *Philosophical Transactions of the Royal Society A*, Proceedings of the 9th Experimental Chaos Conference, 2007.
2. K. E. Daniels, S. Mukhopadhyay, and R. P. Behringer. "Starbursts and Wispy Drops: Surfactants Spreading on Gels." Gallery of Nonlinear Images, *Chaos*, **15**: 041107 (Dec 2005).
3. K. E. Daniels, M. Eblen-Zayas, A. Michelman-Ribeiro, and J. M. Valentine. "Research Funding and Women in Physics." Women in Physics: Second IUPAP International Conference on Women in Physics. AIP Conference Proceedings **795**. B. K. Hartline and A. Michelman-Ribeiro, eds. p. 41, 2005.
4. K. E. Daniels and R. P. Behringer. "Characterization of a Freezing/Melting Transition in a Vibrated and Sheared Granular Medium." *Powders and Grains 2005*. Balkema, 2005.
5. K. E. Daniels, J. E. Coppock\*, and R. P. Behringer. "Dynamics of Meteor Impacts." Gallery of Nonlinear Images, *Chaos*, **14**: S4, (December 2004).
6. K. E. Daniels, B. B. Plapp, and E. Bodenschatz. "Inclined layer convection." *Proceedings of the International Congress of Theoretical and Applied Mechanics, Chicago, IL, 27 August – 1 September 2000*. Kluwer Academic Publishers, 2000.

**INVITED TALKS**

1. "Sound Propagation and Force Chains in Granular Materials." Opening Workshop: Program on Random Media September 2007, SAMSI, Research Triangle Park, NC
2. "Faults & Earthquakes as Granular Phenomena: Controls on Stick-Slip Dynamics." Leiden Institute of Physics, Leiden, Netherlands, June 2007.
3. "Force chains in granular materials: failure and acoustics." Dept. of Mechanical Engineering, Yale University, New Haven, CT, April 2007
4. "The Physics of Granular Materials: Complex Behavior from a Simple Material" Los Alamos National Lab, Los Alamos, NM, March 2007
5. "What can we learn about granular materials from the geometry and topology of force chain networks?" Computational Homology and Fluid Dynamics Workshop, Georgia Tech, Atlanta, GA, March 2007.
6. "Freezing, Melting, and Fluctuations in Granular Materials." Molecular Theory and Simulation Seminar, NCSU Department of Chemical Engineering. September 2006.
7. "Mixing and Segregation in Sheared Granular Materials." Opening Workshop: "Program on Development, Assessment and Utilization of Complex Computer Models." September 2006, SAMSI, Research Triangle Park, NC
8. "Earthquakes and Faults as Granular Processes." Complex and Nonlinear Systems Seminar, Duke University, Durham, NC, April 1006. Joint with Peter Malin and Nicholas Hayman (Duke).
9. "Freezing and Melting in Granular Materials." Focus Session: Granular Materials Near Jamming, APS March Meeting, Baltimore, MD, March 2006.
10. "Starbursts and Wispy Drops: Surfactants Spreading on Gels." UCLA-IPAM-NSF workshop on Thin Films and Fluid Interfaces, IPAM, UCLA, Los Angeles, CA, January 2006.
11. "Freezing and melting in granular materials." Department of Physics and Physical Oceanography, University of North Carolina – Wilmington, Wilmington, NC, November 2005.
12. "Freezing and melting in granular materials." Department of Mechanical Engineering and Materials Science, Duke University, Durham, NC, March 2005.
13. "Freezing and melting in granular materials." Solid State Seminar, Physics Department, Cornell University, Ithaca, NY, March 2005.
14. "Fluids, Strange and Beautiful." Physics Department, Occidental College, Los Angeles, CA, February 2005.
15. "Freezing and melting in granular materials." Colloquium, Physics Department, North Carolina State University, Raleigh, NC, February 2005.
16. "Fluids, Strange and Beautiful." Physics Department, Vassar College, Poughkeepsie, NY, February 2005.
17. "Fluids, Strange and Beautiful." Physics Department, Mount Holyoke College, South Hadley, MA, February 2005.
18. "Freezing and melting in granular materials." Colloquium, Physics Department, University of Utah, Salt Lake City, UT, January 2005.
19. "Fluids, Strange and Beautiful." Physics Department, Guilford College, Greensboro, NC, January 2005.
20. "Freezing and melting in granular materials." Special Colloquium, Physics Department, The Ohio State University, Columbus, OH, January 2005.
21. "Freezing and melting in granular materials." Condensed Matter Physics Seminar, Physics Department, University of California, San Diego, CA, January 2005.

22. "Hysteresis and competition between disorder and crystallization in granular flow." Southeastern Section of the American Physical Society Annual Meeting, Oak Ridge, TN, November 2004.
23. "Freezing, melting, and novel dynamics in granular materials." Condensed Matter Seminar. Physics Department. Duke University, Durham, NC, October 2004.
24. "Freezing, melting, and novel dynamics in granular materials." Joint Applied Math/Condensed Matter Seminar. University of North Carolina, Chapel Hill, NC, September 2004.
25. "Pattern Formation in Inclined Layer Convection." Physics Department Colloquium, Dartmouth College, Hanover, NH, February 2004.
26. "Shearing and Disorder in a Vibrationally Fluidized 3D Granular Flow." Workshop on Multi-scale Challenges in Soft Matter Materials, Statistical and Applied Mathematical Sciences Institute, Research Triangle Park, NC, February 2004.
27. "Pattern Formation in Inclined Layer Convection." Physics Department Colloquium, Dickinson College, Carlisle, PA, October 2003.
28. "Shearing and Order in Vibrationally Fluidized 3D Granular Media." Flow Regimes, Transitions, and Segregation in Granular and Particle-Laden Flows Conference. Isaac Newton Institute for Mathematical Sciences, Cambridge, UK, September 2003.
29. "Order, Chaos, and Defect Statistics in Inclined Layer Convection." Trends in Pattern Formation: From Amplitude Equations to Applications Conference, Max-Planck-Institut für Physik komplexer Systeme, Dresden, Germany, August 2003.
30. "Order, Chaos, and Defects in Inclined Layer Convection." Pattern Formation in Physics and Biology Conference. Kavli Institute for Theoretical Physics, Santa Barbara, CA, August 2003.
31. "Pattern formation in Inclined Layer Convection." Center for Nonlinear Dynamics, University of Texas at Austin, February 2002.
32. "Pattern Formation and Defect Turbulence in Inclined Layer Convection." Condensed matter and statistical physics seminar, Department of Physics, Syracuse University, October 2001.
33. "Pattern Formation in Inclined Layer Convection." Center for Nonlinear and Complex Systems, Duke University, March 2001.

## **PUBLIC LECTURES**

### **CURRENT FUNDING**

"Thin Layer Flow: Experiments, Modeling and Analysis." (with Michael Shearer, NC State Mathematics) *National Science Foundation, Division of Mathematical Sciences: DMS-0604047* \$482,771. 09/01/2006 to 08/30/2009.

"CAREER: State Variables in Dense Granular Materials." National Science Foundation, Division of Materials Research: DMR-0644743. \$505,036. 08/01/2007 to 07/31/2012.

### **POPULAR PRESS COVERAGE**

Cho, A. "In a Jumble of Grains, A Good Hard Shake Restores Order." *Science*, 31 March 2006, p. 1860.

Minkel, J. R. "Grain Freeze." *Scientific American* (News Scan item), July 2005, p. 26.

Svitil, K. A. "New Physics: Beads Clump When Shaken." *Discover*, October 2005, Vol 26, No. 10.