# Katherine Newhall

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### Institute Affiliation

University of North Carolina at Chapel Hill
Department of Mathematics
CB# 3250 Chapel Hill, NN 27599-3250

### Education

Ph.D. Rensselaer Polytechnic Institute, Mathematics (Aug 2011)
M.S. Rensselaer Polytechnic Institute, Aeronautical Engineering (Aug 2006)
B.S. Rensselaer Polytechnic Institute, Applied Physics and Applied Math (Dec 2004)

### Advisors

Eric Vanden-Eijnden, Postdoc mentor; Peter Kramer, Gregor Kovačič and David Cai, Ph.D. co-advisors; Luciano Castillo, M.S. advisor

### Employment

July 2014 - Present, Assistant Professor
Department of Mathematics, University of North Carolina at Chapel Hill
Sept 2011 - June 2014, Courant Instructor/Assistant Research Professor
Courant Institute for Mathematical Sciences, New York University
June 2011 - Sept 2011, Assistant Research Professor
Department of Physics, New York University, under the direction of Jasna Brujic

### Visiting Positions

- September to December of 2009: Visiting graduate student actively participating in the year long Stochastic Dynamics workshop at the Statistical and Applied Mathematical Sciences Institute (SAMSI), Durham, NC.
- July of 2005: Visiting graduate student designing an experiment for measuring turbulent boundary layers over rough surfaces at the Chalmers Institute of Technology, Göteborg, Sweden in the Turbulence Research Laboratory.

### Honors and Awards

2013 Cathleen S. Morawetz postdoctoral fellowship

2012 SIAM Postdoc Travel Award

2011 SIAM Student Travel Award; Joaquin B. Diaz Prize; Karen and Lester Gerhardt Prize

2010 SIAM Student Travel Award; Joint SIAM/RSME-SCM-SEMA DSPDE Travel Award; CIRM Travel Award

2009 SIAM Student Travel Award

2005 NSF Graduate Research Fellowship

2004 Founders Award of Excellence; Undergraduate student presentation award TREND REU program

2003 Academic Achievement Award for Foundations in Applied Mathematics; Inducted into Sigma Pi Sigma, Physics Honor Society; Inducted into the Order of Omega, Greek Honor Society

**Refereed Publications**

- M. Erdogan, J. Marzuola, K. Newhall, N. Tzirakis (preprint) *The Structure of Global Attractors for Dissipative Zakharov Systems with Forcing on the Torus.* ArXiv:1304.1596
- K. Newhall, M. Shkarayev, P. Kramer, G. Kovačič, D. Cai (2015) *Synchrony in stochastically driven neuronal networks with complex topologies*, accepted Phys. Rev. E
- J. Zhang, K. Newhall, D. Zhou, A. Rangan (2013) *Distribution of correlated spiking events in a population-based approach for Integrate-and-Fire networks*, J. Comput. Neurosci., Vol. 36, No. 2, pp. 279-295 (17 pages)
- K. Newhall, E. Vanden-Eijnden (2013) *Averaged equation for energy diffusion on a graph reveals bifurcation diagram and thermally assisted reversal times in spin-torque driven nanomagnets*, J. Appl. Phys., Vol. 113, No. 18, 184105 (12 pages)
- K. Newhall, E. Atkins, P. Kramer, G. Kovačič, I. Gabitov (2013) *Random polarization dynamics in a resonant optical medium*, Optics Letters, Vol. 38, No. 6, pp. 893-895
- K. Newhall, L. L. Pontani, I. Jorjadze, S. Hilgenfeldt, J. Brujić (2012) *Size-topology relations in Packings of Grains, Emulsions, Foams, and Biological Cells*, Phys Rev Lett, Vol. 108, 268001 (5 pages)
- K. Newhall, I. Jorjadze, E. Vanden-Eijnden, and J. Brujić (2011) *A statistical mechanics framework captures the packing of monodisperse particles*, Soft Matter, Vol. 7, pp. 11518-11525
- I. Jorjadze, L. Pontani, K. Newhall, and J. Brujić (2011) *Attractive emulsion droplets probe the phase diagram of jammed granular matter*, PNAS, Vol. 108, No. 11, pp. 4286-4291
- K. Newhall, G. Kovačič, P. Kramer, A. Rangan, and D. Cai (2010) *Cascade-induced synchrony in stochastically-driven neuronal networks*, Phys Rev E, Vol. 82, 041903 (17 pages)
- K. Newhall, G. Kovačič, P. Kramer, D. Zhou, A. Rangan, and D. Cai (2010) *Dynamics of Current-Based, Poisson Driven, Integrate-and-Fire Neuronal Networks*, Comm in Math Sci, Vol. 8, No. 2, pp. 541-600

- K. Newhall and D. Durian (2003) *Projectile-shape Dependence of Impact Craters in Loose Granular Material*, Phys Rev E, 68, 060301(R) (3 pages)

**Non-Refereed Publications**

- B. Brzek, R. B. Cal, K. Newhall, G. Johansson, and L. Castillo (2006) *LDA Measurements in Rough Surface ZPG Turbulent Boundary Layers*, Proceedings of 2006 ASME Joint US-European Fluids Engineering Summer Meeting, FEDSM2006-98508, (10 pages) July 17-20 Miami, FL

- K. Newhall, R. B. Cal, B. Brzek, G. Johansson, L. Castillo (2006) *Smooth and Rough Turbulent Boundary Layers: A look at Skin Friction, Pressure Gradient and Roughness*, Proceedings of 2006 ASME Joint US-European Fluids Engineering Summer Meeting, FEDSM2006-98517, pp. 1013-1021, July 17-20 Miami, FL

- K. Newhall, B. Brzek, R. B. Cal, G. Johansson, and L. Castillo (2006) *Skin Friction and the Inner Flow in Pressure Gradient Turbulent Boundary Layers*, 36th AIAA (11 pages) Fluid Dynamics Conference and Exhibit, AIAA-2006-2887, June 5-8 San Francisco, CA

**Invited University Talks Given**

- Probability Seminar (Apr 2015) Cornell University, NY, The Causes of Metastability and Their Effects on Transition Times

- Applied Math Seminar (Sept 2014) Duke University, NC, The Causes of Metastability and Their Effects on Transition Times

- Mathematical Science Colloquium (Apr 2014) RPI, NY, Dynamics of Ferromagnets: averaging methods, bifurcation diagrams, and thermal noise effects

- Applied Math Seminar (Apr 2014) Courant Institute NYU, NY, The Causes of Metastability and Their Effects on Transition Times

- Applied Math Colloquium (Dec 2013) U Arizona, AZ, Synchronous Firing Events in Stochastic Neuronal Network Models

- Dynamical Systems Seminar (Jan 2013) RPI, NY, Dynamics of Nanomagnets with Spin-Transfer Torques

- Mathematical Biology Seminar (Jan 2013) NJIT, NJ, Synchronous Firing Events in Stochastic Neuronal Network Models

- Applied Mathematics Seminar (Oct 5, 2012) UNC Chapel Hill, NC, Dynamics of Nanomagnets with Spin-Transfer Torques

- Grad Student/Postdoc Seminar (Apr 2012) Courant Institute NYU, NY, Why go Random?

- O'Hern Group Meeting (Mar 2012) Yale, CT, Granular Matter, Foams, and Beyond: Applications of the Granocentric Model

- Applied Math Seminar (Nov 2011) Courant Institute NYU, NY, Investigating Jammed Matter from the Granocentric Point of View
- Mathematical Biology Colloquium Seminar (Jan 2011) Duke University, NC, Synchrony in Stochastic Pulse-coupled Neuronal Network Models
- Applied Math Lab Seminar (Oct 2009) Courant Institute NYU, NY, Synchrony in Stochastic Pulse-coupled Neuronal Network Models
- Neurodynamics Group Seminar (July 2009) Boston University, MA, Synchronous Dynamics of a Current-Based Integrate-and-Fire Neuronal Network

**Conference Talks Given**

- IMACS Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory (Apr 2015) Athens, GA, Low-Damping Transition Times in a Ferromagnetic Model System
- SIAM Annual Meeting (July 2014) Chicago, IL, Dynamics of Ferromagnets
- AMS Western Spring Sectional Meeting (April 2014) Albuquerque, NM, Transitions and Recurrence in a Nonlinear Wave Equation and Their Application to Magnetization Reversals
- APS March Meeting (March 2014) Denver, CO, Universality in Size-Topology Relationships of Packings, Despite their History Dependence
- SIAM Conference on Applications of Dynamical Systems (May 2013) Snowbird, UT, Dynamics of Nanomagnets with Spin-Transfer Torques
- SIAM Conference on Computational Science and Engineering (Feb 2013) Boston, MA, Thermally Induced Magnetization Reversals
- SIAM Conference on the Life Sciences (Aug 2012) San Diego, CA, Synchronous Firing Events in Stochastic Model Neuron Systems
- AIMS 9th Conference on Dynamical Systems (July 2012) Orlando, FL, Synchrony in Stochastic Pulse-Coupled Neuronal Network Models, and also Magnetization Reversal in Thin Film Magnetic Elements
- SIAM Conference on Nonlinear Waves (June 2012) Seattle, WA, Monte-Carlo Simulations of a Stochastic Maxwell-Bloch System
- SIAM Conference on Uncertainty Quantification (Apr 2012) Raleigh, NC, Size of Synchronous Firing Events in Model Neuron Systems
- APS March Meeting (Feb 2012) Granular Matter, Foams, and Beyond: Applications of the Granocentric Model
- SIAM Conference on Applications of Dynamical Systems (May 2011) Snowbird UT, Dynamical regimes of integrate-and-fire neuronal network models, Invited Speaker in Mini Symposium

- Invited Speaker, Biomathematics Conference (Mar 2011) University of Florida, Synchrony in Stochastic Pulse-coupled Neuronal Network Models
- SIAM Conference on Nonlinear Waves and Coherent Structures (Aug 2010) Philadelphia PA, Synchrony in Stochastic Pulse-coupled Neuronal Network Models
- SIAM Conference on Life Sciences (July 2010) Pittsburgh PA, Synchrony in Stochastic Pulse-coupled Neuronal Network Models
- Joint SIAM/RSME-SCM-SEMA DSPDE (June 2010) Barcelona Spain, Synchrony in Stochastic Pulse-coupled Neuronal Network Models
- Invited Speaker, Frontiers in Nonlinear Waves Conference (Mar 2010) University of Arizona, Synchrony in Stochastic Pulse-coupled Neuronal Network Models
- Applied Math Days (Mar 2010) RPI, Synchrony in Stochastic Pulse-coupled Neuronal Network Models
- Stochastic Models in Neuroscience (Jan 2010) CIRM Marseille France, Synchrony in Stochastic Pulse-coupled Neuronal Network Models
- Invited Speaker, SAMSI Opening workshop on Stochastic Dynamics - Dynamics of Biological Networks Theme (Sep 2009) Synchrony in Stochastic Pulse-coupled Neuronal Network Models
- SIAM Conference on Applications of Dynamical Systems (May 2009) Snowbird UT, Synchronous Behavior in a Current-Based Neuronal Network Invited Speaker in Mini Symposium
- IMACS Nonlinear Evolution Equations and Wave Phenomenon (Mar 2009) Synchronous Behavior in a Current-Based Neuronal Network
- Applied Math Days (Oct 2008) Synchronous Behavior in Current-Based Neuronal Network
- APS $59^{\text{th}}$ DFD (Nov 2006) Power Law for Rough Favorable Pressure Gradient Turbulent Boundary Layers
- AIAA $36^{\text{th}}$ Fluid Dynamics (Jun 2006) Skin Friction and the Inner Flow in Pressure Gradient Turbulent Boundary Layers
- APS $58^{\text{th}}$ DFD (Nov 2005) Favorable Pressure Gradient Turbulent Boundary Layers: part 1. Wall Shear Stress Calculations
- APS $57^{\text{th}}$ DFD (Nov 2004) Particle Size Dependence in Granular Couette Flow

**Teaching Experience**

S 2014 Introduction to Mathematical Modeling - 36 students
F 2013 Mathematics of Finance - 40 students
S 2013 Ordinary Differential Equations - 40 students
F 2012 Calculus II - 35 students
S 2012 Calculus II - 35 students
F 2011 Mathematics of Finance - 40 students

**Conference Sessions Organized**

- SIAM Life Sciences (Aug 2014) Charlotte, NC, mini-symposium co-organizer, "Mechanisms and Computation in Neuronal Networks"
- SIAM Annual Meeting (July 2014) Chicago, IL, mini-symposium co-organizer, "Dynamics of Large Stochastic Neuronal Networks"
- SIAM Dynamical Systems (May 2013) Snowbird, UT, mini-symposium co-organizer, "Emergent Dynamics of Large Neural Networks"
- SIAM Computational Science and Engineering (Feb 2013) Boston, MA, mini-symposium co-organizer, "Computations of Stochastic Dynamics"
- SIAM Life Science (July 2012) San Diego, CA, 3 part mini-symposium co-organizer, "Coherent Dynamics of Neuronal Networks"
- SIAM Uncertainty Quantification (Apr 2012) Raleigh, NC, mini-symposium organizer, "Modeling Networks in Dynamic Systems"

**Miscellaneous Activities**

Starting 2012: Reviewer for MEMOCS (Mathematics and Mechanics of Complex Systems) and SIADS (SIAM Journal on Applied Dynamical Systems)
Starting 2011: Reviewer for Physical Review Letters and Physical Review E
June 2009: Mathematical Problems in Industry (MPI) workshop participant