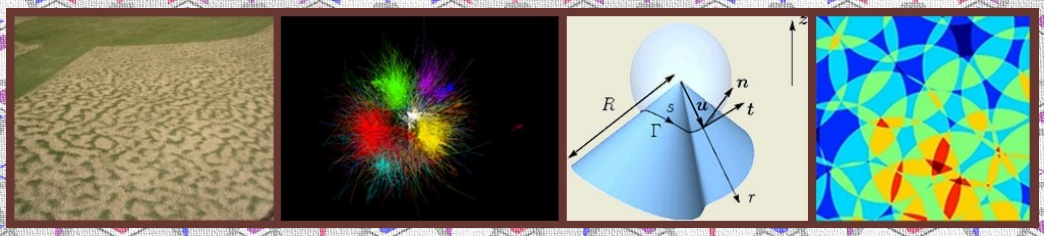
Program
(final version)



Dynamics Days 2011

30th Annual International Conference on Nonlinear Dynamics

January 5-8, 2011

The Carolina Inn
Chapel Hill, North Carolina

Invited Speakers

Rosalind Allen
Bruno Andreotti
Martine Ben Amar
Andrea Bertozzi
Karen Daniels
Barbara Drossel
Jerry Gollub
Philip Holmes
Edgar Knobloch
Jurgen Kurths
Wolfgang Losert
Amala Mahadevan
Takashi Nishikawa
Corey O'Hern
Ed Ott
Jeffrey Rogers
Leah Shaw
Lawrie Virgin

http://www.math.duke.edu/conferences/DDays2011

Deadlines:

Contributed presentations: November 15, 2010

Conference registration: December 1, 2010

Duke UNIVERSITY

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

NC STATE UNIVERSITY

ONR Office of Naval Research

ARL

Schedule

Wednesday, January 5, 2011[1]

8:45 Opening Remarks

9:00 – 10:40 **Session 1**, Chair: Joshua Socolar, Duke University

- 9:00 **I3** – Statistical Mechanics of Packing: From Proteins to Cells to Grains
  Corey O'Hern, Yale University
- 9:40 **I2** – Spatially localized structures in two dimensions
  Edgar Knobloch, University of California, Berkeley
- 10:20 **C1** – An Elementary Model of Torus Canards
  Anna Barry, Boston University

10:40 Break

11:00 – 12:40 **Session 2**, Chair: Thomas Witelski, Duke University

- 11:00 **I6** – The Path to Fracture: Dynamics of Broken Link Networks in Granular Flows
  Wolfgang Losert, University of Maryland
- 11:40 **C2** – Flexibility Increases Energy Efficiency of Digging in Granular Substrates
  Dawn Wendell, MIT
- 12:00 **I4** – Ripples, dunes, bars and meanders
  Bruno Andreotti, ESPCI

12:40 Lunch

2:00 – 4:00 **Session 3**, Chair: Joshua Socolar, Duke University

- 2:00 **I5** – The Nonlinear Population Dynamics of Pacific Salmon
  Barbara Drossel, University of Darmstadt
- 2:40 **I8** – Erosional Channelization in Porous Media
  Amala Mahadevan, Boston University
- 3:20 **C3** – Determining the onset of chaos in large Boolean networks
  Andrew Pomerance, University of Maryland
- 3:40 **C4** – Exploring mesoscopic network structure with communities of links
  James Bagrow, Northeastern University

4:00 Break

4:20 – 5:20 **Session 4**, Chair: Thomas Witelski, Duke University

- 4:20 **I7** – Swarming by Nature and by Design
  Andrea Bertozzi, UCLA
- 5:00 **C5** – Sub-wavelength position-sensing using a wave- chaotic cavity with nonlinear feedback
  Hugo Cavalcante, Duke University

5:20 Break for Dinner

[1] General Guidelines: Invited presentations are 40 minutes total (35 minutes presentation, 5 minutes questions), Contributed presentations are 20 minutes total (16 minutes presentation, 4 minutes questions), space for poster presentations is limited to a maximum size of 4 feet by 4 feet for each poster.

Thursday, January 6, 2011

9:00 – 9:40 **Session 5**, Chair: Robert Behringer, Duke University

9:00 **I1** – Still Running! Recent Work on the Neuromechanics of Insect Locomotion
Phillip Holmes, Princeton University

9:40 **C6** – Fluid rope tricks
Stephen Morris, University of Toronto

10:00 **C7** – Three-dimensional structure of a sheet crumpled into a sphere
Anne Dominique Cambou, University of Massachusetts, Amherst

10:20 Break

10:40 – 12:00 **Session 6**, Chair: Edward Ott, University of Maryland

10:40 **I9** – Evolutionary Dynamics for Migrating Populations
Rosalind Allen, University of Edinburgh

11:20 **C8** – Predicting criticality and dynamic range in complex networks: effects of topology
Daniel Larremore, University of Colorado at Boulder

11:40 **C10** – Creating Morphable Logic Gates using Logical Stochastic Resonance in an Engineered Gene Regulatory Network
Anna Dari, Arizona State University

12:00 Lunch

2:00 - 3:40 **Session 7**, Chair: Brian Utter, James Madison University

2:00 **I10** – Stochastic Extinction along an Optimal Path
Leah Shaw, College of William and Mary

2:40 **C9** – Chaos Elimination of Fluctuations in Quantum Tunneling Rates
Louis Pecora, Naval Research Laboratory

3:00 **I14** – Dynamics and Interactions of Swimming Cells
Jerry Gollub, Haverford College

3:40 – 7:30 Break for afternoon and dinner

7:30 – 8:10 **Session 8**, Chair: Karen Daniels, NCSU

7:30 **I12** – Low Dimensional Dynamics in Large Systems of Coupled Oscillators
Edward Ott, University of Maryland

8:15 –10:00 **Poster Session 1 - Setup and Desserts**

Friday, January 7, 2011

9:00 – 10:20 **Session 9**, Chair: Joshua Socolar, Duke University

- 9:00 **I13** – Nonlinear programs and DARPA
  Jeffrey Rogers, DARPA
- 9:40 **C11** – Measuring Information Flow in Anticipatory Systems
  Shawn Pethel, U.S. Army RDECOM
- 10:00 **C12** – Time delays in the synchronization of chaotic coupled systems with feedback
  José Rios Leite, Universidade Federal de Pernambuco

10:20 Break

10:40 – 12:20 **Session 10**, Chair: Thomas Witelski, Duke University

- 10:40 **I11** – Compensatory structures in network synchronization
  Takashi Nishikawa, Clarkson University
- 11:20 **C13** – Folding: the nonlinear step in fluid mixing
  Douglas Kelley, Yale University
- 11:40 **C14** – Trapping of Swimming Particles in Chaotic Fluid Flow
  Nicholas Ouellette, Yale University

12:00 Lunch

2:00 – 4:00 **Session 11**, Chair: Joshua Socolar, Duke University

- 2:00 **I15** – Network of Networks and the Climate System
  Jurgen Kurths, University of Potsdam
- 2:40 **C15** – What is the front velocity in wave propagation without fronts? Epidemics on complex networks provide an answer
  Dirk Brockmann, Northwestern University
- 3:00 **I16** – Shape instability of growing tumors
  Martine Ben Amar, University of Paris
- 3:40 **C16** – Reconstruction of Cardiac Action Potential Dynamics using Computer Modeling with Feedback from Experimental Data
  Laura Munoz, Cornell University

4:00 – 6:00 **Poster Session 2**

6:00 Break for dinner

Saturday, January 8, 2011

9:30 – 10:30 **Session 12**, Chair: Robert Behringer, Duke University

9:30 **I17** – Faults & Earthquakes as Granular Phenomena: Controls on Stick-Slip Dynamics
Karen Daniels, North Carolina State University

10:10 **C17** – Effects of Shape on Diffusion
Rob Shaw, Santa Fe Complex

10:30 Break

10:50 – 11:50 **Session 13**, Chair: Michael Shearer, NCSU

10:50 **C18** – Crowd behavior: Synchronization of multistable chaotic systems by a common external force
Alexander Pisarchik, Centro de Investigaciones en Optica

11:10 **I18** – Rocking and Rolling
Lawrie Virgin, Duke Univ. Engineering

11:50 **End of Conference. Have a safe trip home!**

Invited Talks

- **Evolutionary Dynamics for Migrating Populations**
  Rosalind Allen, *University of Edinburgh*
- **Ripples, dunes, bars and meanders**
  Bruno Andreotti, *École Supéieure de Physique et de Chimie Industrielles*
- **Swarming by Nature and by Design**
  Andrea Bertozzi, *University of California, Los Angeles*
- **Shape instability of growing tumors**
  Martine Ben Amar, *University of Paris*
- **Faults & Earthquakes as Granular Phenomena: Controls on Stick-Slip Dynamics**
  Karen Daniels, *North Carolina State University*
- **The Nonlinear Population Dynamics of Pacific Salmon**
  Barbara Drossel, *University of Darmstadt*
- **The Path to Fracture: Dynamics of Broken Link Networks in Granular Flows**
  Wolfgang Losert, *University of Maryland*
- **Dynamics and Interactions of Swimming Cells**
  Jerry Gollub, *Haverford University*
- **Still Running! Recent Work on the Neuromechanics of Insect Locomotion**
  Philip Holmes, *Princeton University*
- **Spatially localized structures in two dimensions**
  Edgar Knobloch, *University of California, Berkeley*
- **Network of Networks and the Climate System**
  Jurgen Kurths, *University of Potsdam*
- **Erosional Channelization in Porous Media**
  Amala Mahadevan, *Boston University*
- **Compensatory structures in network synchronization**
  Takashi Nishikawa, *Clarkson University*
- **Statistical Mechanics of Packing: From Proteins to Cells to Grains**
  Corey O'Hern, *Yale*
- **Low Dimensional Dynamics in Large Systems of Coupled Oscillators**
  Edward Ott, *Maryland*
- **Nonlinear Programs and DARPA**
  Jeff Rogers, *DARPA*
- **Stochastic Extinction along an Optimal Path**
  Leah Shaw, *William and Mary*
- **Rocking and Rolling**
  Lawrie Virgin, *Duke*

Contributed Talks

Exploring mesoscopic network structure with communities of links,
James Bagrow, *Northeastern University*

An Elementary Model of Torus Canards,
Anna Barry, *Boston University*

What is the front velocity in wave propagation without fronts? - Epidemics on complex networks provide an answer,
Dirk Brockmann, *Northwestern University*

Sub-wavelength position-sensing using a wave-chaotic cavity with nonlinear feedback,
Hugo Cavalcante, *Duke University*

Three-dimensional structure of a sheet crumpled into a sphere,
Anne Dominique Cambou, *University of Massachusetts, Amherst*

Creating Morphable Logic Gates using Logical Stochastic Resonance in an Engineered Gene Regulatory Network,
Anna Dari, *Arizona State University*

Folding: the nonlinear step in fluid mixing,
Douglas Kelley, *Yale University*

Predicting criticality and dynamic range in complex networks: effects of topology,
Daniel Larremore, *University of Colorado at Boulder*

Fluid rope tricks,
Stephen Morris, *University of Toronto*

Reconstruction of Cardiac Action Potential Dynamics using Computer Modeling with Feedback from Experimental Data,
Laura Munoz, *Cornell University*

Trapping of Swimming Particles in Chaotic Fluid Flow,
Nicholas Ouellette, *Yale University*

Chaos Elimination of Fluctuations in Quantum Tunneling Rates,
Louis Pecora, *Naval Research Laboratory*

Measuring Information Flow in Anticipatory Systems,
Shawn Pethel, *U.S. Army RDECOM*

Crowd behavior: Synchronization of multistable chaotic systems by a common external force,
Alexander Pisarchik, *Centro de Investigaciones en Óptica*

Determining the onset of chaos in large Boolean networks,
Andrew Pomerance, *University of Maryland*

Time delays in the synchronization of chaotic coupled systems with feedback,
José Rios Leite, *Universidade Federal de Pernambuco*

Effects of Shape on Diffusion,
Rob Shaw, *Santa Fe Complex*

Flexibility Increases Energy Efficiency of Digging in Granular Substrates,
Dawn Wendell, *MIT*

Posters

Robustness of modular network and overlapping communities,
Yong-Yeol Ahn, *Northeastern University*

Chaotic Ionization of Bidirectionally Kicked Rydberg Atoms,
Korana Burke, *University of California Merced*

Homoclinic Snaking in Plane Couette Flow,
John Burke, *Boston University*

Jet-Induced Granular 2-D Crater Formation with Horizontal Symmetry Breaking,
Abe Clark, *Duke University*

Couette Shear for Elliptical Particles Near Jamming,
Somaiyeh Farhadi, *Duke University*

Measuring information flow in anticipatory systems,
Daniel Hahs, *US Army RDECOM*

Experimental and theoretical evidence for fluctuation driven activations in an excitable chemical system,
Harold Hastings, *Hofstra University*

Bifurcations of 2D Rayleigh-Taylor Unstable Flames,
Elizabeth Hicks, *University of Chicago*

Pattern formation in coating flows of suspensions,
Justin Kao, *Massachusetts Institute of Technology*

Spike-Time Reliability of Pulse-Coupled Oscillator Networks,
Kevin Lin, *University of Arizona*

Depinning of localized structures in a forced dissipative system,
Yi-Ping Ma, *University of California, Berkeley*

Clustering of particles in turbulence,
Julian Martinez Mercado, *University of Twente*

Invariant manifolds in chaotic advection-reaction-diffusion pattern formation,
Kevin Mitchell, *University of California, Merced*

Fluctuations in an agitated granular liquid,
Kiri Nichol, *Leiden University / North Carolina State University*

Stability and Bifurcations in a Dynamical System Associated with Membrane Kinetics Underlying Cardiac Arrhythmias,
Irina Popovici, *USNA*

Nonlinear Waves in Granular Crystals,
Mason Porter, *University of Oxford*

Density-dependent particle clustering on a Faraday wave,
Ceyda Sanli, *University of Twente*

The Buckley-Leverett Equation with Dynamic Capillary Pressure,
Michael Shearer, *North Carolina State University*

Spatiotemporal Dynamics of Calcium-Driven Alternans in Cardiac Tissue,
Per Sebastian Skardal, *University of Colorado at Boulder*

Fingering instability down the outside of a vertical cylinder,
Linda Smolka, *Bucknell University*

The Buckley-Leverett Equation with Dynamic Capillary Pressure,
Kimberly Spayd, *North Carolina State University*

Suspensions of Maps to Flows,
John Starrett, *New Mexico Institute of Mining and Technology*

The Effect of Network Structure on the Path to Synchronization in Large Systems of Coupled Oscillators,
John Stout, *North Carolina State University*

Brownian movement in complex asymmetric periodic potential under the influence of "green" noise,
Mikhail Sviridov, *Moscow Institute of Physics and Technology*

Synchronization in Finite-Memory Dynamical Systems,
Nicholas Travers, *University of California, Davis*

Reactive mixing of initially isolated scalars: estimation of mix-down time,
Yue-Kin Tsang, *The Chinese University of Hong Kong*

Stabilization of chaotic spiral waves during cardiac ventricular fibrillation using feedback control,
Ilija Uzelac, *Vanderbilt University*

Dynamic Structure Factor and Transport Coefficients of a Homogeneously Driven Granular Fluid in Steady State,
Katharina Vollmayr-Lee, *Bucknell University, USA*

Entrainment of a Thalamocortical Neuron to Periodic Sensorimotor Signals,
Dennis Guang Yang, *Drexel University*

A mathematical model of the decline of religion,
Haley Yaple, *Northwestern University*

Switching from steady-state to chaos via pulse trains in an optoelectronic oscillator,
Kristine Callan, *Duke University*

Brownian Motion By Switching Unstable Dissipative Systems,
Eric Campos Cantón, *Instituto Potosino de Investigación*

Phase space method for target ID,
Thomas Carroll, *Naval Research Lab*

Hamiltonian monodromy,
Chen Chen, *College of William and Mary*

Exploring the dynamics of CRISPR loci length: How much can a bacterium remember about viruses that infected it?,
Lauren Childs, *Georgia Institute of Technology*

The role of crossover recombination, inversion, and gene linkage in determining gene spacing in a chromosome.,
Brian Clark, *Illinois State University*

Bifurcations from sub-wavelength changes in a wave chaotic cavity with nonlinear feedback,
Seth Cohen, *Duke University*

Exact Folded-Band Oscillator,
Ned Corron, *US Army RDECOM*

Electroporation in a three-dimensional, time-dependent model of a skeletal muscle fiber,
Jonathan Cranford, *Duke University*

Force Network in a 2D Frictionless Emulsion Model System,
Kenneth Desmond, *Emory University*

Homogeneous linear shear of a two dimensional granular system,
Joshua Dijksman, *Duke University*

An Information-Theoretic Analysis of Competing Models of Stochastic Computation,
Christopher Ellison, *UC Davis*

Universal Shapes Formed by Two Interacting Cracks,
Melissa Fender, *NCSU*

Applying the Loschmidt Echo and Fidelity Decay to Classical Waves in a Wave Chaotic System with a Nonlinear Dynamic Response,
Matthew Frazier, *University of Maryland, College Park*

Evolutionary stability of an optimal strategy for habitat selection,
Theodore Galanthay, *University of Colorado - Boulder*

Quantifying the Complexity of Kauffman Networks,
Xinwei Gong, *Duke University*

Subrcritical Fracture of Porous Media,
Alessio Guarino, *Université de la Polynésie Française*

Dynamic Modeling and Simulation of a Real World Billiard,
Alex Hartl, *North Carolina State University*

Chaos in semiconductor at hellical instability,
Khadjimurat Ibragimov, *Institute of Physics Daghestan Sc. Centre of Russian A. S.*

Isochronous chaos synchronization of delay-coupled optoelectronic oscillators,
Lucas Illing, *Reed College*

Quantum and classical pumping using ultracold atoms,
Megan Ivory, *College of William and Mary*

Application of periodic orbit theory to chaos computing,
Behnam Kia, *Arizona State University*

Pattern formation of grains in oscillatory frluid flows,
Daphne Klotsa, *University of Bath*

Understanding the Dynamics of Flames using Time Series Analysis,
Christopher Kulp, *Lycoming College*

A new algorithm for detection of apnea in infants in neonatal intensive care units,
Hoshik Lee, *College of William and Mary*

Symmetry and Stability in Network Dynamical Systems,
Anika Lindemann, *Colby College*

Probabilistic Maxima in Basins of Attraction of Coexisting States in a Noisy MultistableSystem,
Brenda Martinez, *Universidad de Guadalajara*

Pinned and Twisted Scroll Rings in an Excitable Chemical System,
Bradley Martsberger, *Duke*

Localization phenomena arising from spatially periodic forcing,
Jonathan McCoy, *Colby College*

Instability in a Sheet of Birds,
Nicholas Mecholsky, *University of Maryland*

Control of chaos by a weak perturbation in an impact oscillator.,
Everton Medeiros, *Universidade de São Paulo*

Estimating the time scales for the evolution of robustness under almost-neutral drift,
Garrett Mitchener, *College of Charleston*

Application of Nonlinear Data Analysis to Locating Disease Clusters,
Linda Moniz, *Johns Hopkins University*

Robustness of multi-layer networks composed of mixed oscillators,
Kai Morino, *The University of Tokyo*

Noise-induced Phenomena in Two Strongly Pulse-coupled Resonate-and-Fire Neuron Models,
Kazuki Nakada, *Kyushu Institute of Technology*

Intermittent Jamming in Quasi-2D Microfunnels
Carlos Ortiz, *North Carolina State University*

The effect of force chains on near-field sound propagation,
Eli Owens, *North Carolina State University*

Phase Synchronization of Directly Coupled Boolean Chaos Oscillators,
Myung Park, *University of Maryland / IREAP*

Algortithm for Planar 4-Body Problem Central Configurations with Given Masses,
Eduardo Piña, *Universidad Autonoma Metropolitana*

Mixing properties of a granular monolayer,
James Puckett, *North Carolina State University*

Cyclic simple shear in a two-dimensional granular system,
Jie Ren, *Duke University*

Nonlinear synchronization of the Polar Regions? climatic oscillations over the last ice age: A working hypothesis,
José Rial, *UNC-Chapel Hill*

Effect of strength-interval relationship on cardiac rhythm dynamics in a one-dimensional mapping model,
Caroline Ring, *Duke University*

Frequency-comb generation with an opto-electronic oscillator,
David Rosin, *Technische Universität Berlin, Duke University*

Deformable self-propelled domain in a three-dimensional excitable reaction-diffusion system,
Kyohei Shitara, *Kyoto University*

Excitable Nodes on Random Networks: Structure and Dynamics,
Thounaojam Umeshkanta Singh, *Jawaharlal Nehru University, New Delhi*

Identification of delays and discontinuity points of unknown systems by using synchronization of chaos,
Francesco Sorrentino, *University of Maryland at College Park and Universitá degli Studi di Napoli Parthenope*

Relation between Autonomous Boolean and ODE Models of a Gene Regulatory Network,
Mengyang Sun, *Duke University*

Theory and experiment of fast non-deterministic random bit generation with on-chip chaos lasers,
Satoshi Sunada, *NTT Communication Science Laboratories*

Blowout bifurcation and spatial mode excitation in the bubbling transition to turbulence,
José Danilo Szezech, *Universidade de São Paulo*

Jamming of Granular Flow in a Two-Dimensional Hopper,
Junyao Tang, *Duke University*

Avalanching and shear of vibrated granular/granular-fluid mixtures,
Brian Utter, *James Madison University*

Velocity Vector Field Pattern in a 2x2 game of Human Subject Experimental Economics Experiment,
Zhijian Wang, *Zhejiang University*

The Effect of Network Structure on the Path to Synchronization in Large Systems of Coupled Oscillators,
Matt Whiteway, *University of Oklahoma*

Voltage interval mappings for activity transitions in neuron models for elliptic bursters,
Jeremy Wojcik, *Georgia State University and Neuroscience Institute*

A free energy simulation approach to the study of equilibrium modulated phases,
Kai Zhang, *Duke University*

Bistability and Oscillations in Fluid Networks,
John Geddes, *Franklin W. Olin College of Engineering*

Nonlinear Dynamics and Methods of Investigation of Chaotic Time Series in the Brain,
Nayoung Koh, *University of Califoria, Irvine*

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