2009 Boulder Summer School
Nonequilibrium Statistical Mechanics
July 6 – July 24, 2009

Week 1: July 6 – July 10, Location: Duane Physics, G125

Monday, July 6	
8:30 – 9:00 AM	Opening Remarks
9:00 – 10:15	Driven Diffusive Systems I (Zia)
10:45 – 12:00	Classical Models in Nonequilibrium Statistical Physics I (Redner)
2:30 – 3:45 PM	Driven Soft Matter I (Marchetti)
4:15 – 5:30	Driven Granular Systems and Jamming I (Teitel)
Tuesday, July 7	
9:00 – 10:15 AM	Classical Models in Nonequilibrium Statistical Physics II (Redner)
10:45 – 12:00	Driven Diffusive Systems II (Zia)
1:45 – 3:00 PM	Driven Granular Systems and Jamming II (Teitel)
3:30 – 4:45	Driven Soft Matter II (Marchetti)
5:30 – 8:00	Flagstaff Cookout (buses leave at 5:00 PM at Sewall Hall)
Wednesday, July 8	
9:00 – 10:15 AM	Nonequilibrium Work Relations I (Jarzynski)
10:45 – 12:00	Driven Granular Systems and Jamming III (Teitel)
2:15 – 3:30 PM	Driven Diffusive Systems III (Zia)
4:00 – 5:30	Contributed Research Seminars I
7:30 – 8:30	First Public Lecture: The Statistical Physics of Popularity (Redner)
Thursday, July 9	
9:00 – 10:15 AM	Driven Soft Matter III (Marchetti)
10:45 – 12:00	Nonequilibrium Work Relations II (Jarzynski)
2:30 – 3:45 PM	Classical Models in Nonequilibrium Statistical Physics III (Redner)
4:15 – 5:30	Driven Diffusive Systems IV (Zia)
7:00 – 10:00	Poster Session I (11^{th} Floor of Gamow Tower)
Friday, July 10	
9:00 – 10:15 AM	Nonequilibrium Work Relations III (Jarzynski)
10:45 – 12:00	Driven Soft Matter IV (Marchetti)
1:45 – 3:00 PM	Classical Models in Nonequilibrium Statistical Physics IV (Redner)
5:30 – 7:00	Sewall BBQ

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Nonequilibrium Statistical Mechanics
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Week 2: July 13 – July 17, Location: Duane Physics, G125

Monday, July 13	
9:00 – 10:15	Stochastic Thermodynamics I (Seifert)
10:45 – 12:00	Reaction-Diffusion Models in One Dimension I (ben-Avraham)
2:15 – 3:30 PM	Field Theory Approach to Diffusion-Limited Reactions I (Vollmayr-Lee)
4:00 – 5:45	Contributed Research Seminars II
Tuesday, July 14	
9:00 – 10:15 AM	Reaction-Diffusion Models in One Dimension II (ben-Avraham)
10:45 – 12:00	Nonequilibrium Relaxation in Coulomb Glasses I (Popovic)
2:30 – 3:45 PM	Stochastic Thermodynamics II (Seifert)
4:15 – 5:30	Field Theory Approach to Diffusion-Limited Reactions II (Vollmayr-Lee)
7:00 – 10:00	Poster Session II (11^{th} Floor of Gamow Tower)
Wednesday, July 15	
9:00 – 10:15 AM	Nonequilibrium Relaxation in Coulomb Glasses II (Popovic)
10:45 – 12:00	Stochastic Thermodynamics III (Seifert)
2:30 – 3:45 PM	Reaction-Diffusion Models in One Dimension III (ben-Avraham)
4:15 – 5:30	Nonperturbative RG Approach to Nonequilibrium Systems I (Wschebor)
7:30 – 8:30	Second Public Lecture: What is Physics? - A Personal Perspective (Zia)
Thursday, July 16	
9:00 – 10:15 AM	Aging Phenomena in Magnetic Systems I (Pleimling)
10:45 – 12:00	Field Theory Approach to Diffusion-Limited Reactions III (Vollmayr-Lee)
2:30 – 3:45 PM	Nonequilibrium Relaxation in Coulomb Glasses III (Popovic)
4:15 – 5:30	Reaction-Diffusion Models in One Dimension IV (ben-Avraham)
Friday, July 17	
9:00 – 10:15 AM	Field Theory Approach to Diffusion-Limited Reactions IV (Vollmayr-Lee)
10:45 – 12:00	Nonperturbative RG Approach to Nonequilibrium Systems II (Wschebor)
1:45 – 3:00 PM	Aging Phenomena in Magnetic Systems II (Pleimling)
5:30 – 7:00	Sewall BBQ

2009 Boulder Summer School
Nonequilibrium Statistical Mechanics
July 6 – July 24, 2009

Week 3: July 20 – July 24, Location: Duane Physics, G125

Monday, July 20	
9:00 – 10:15	Nonperturbative RG Approach to Nonequilibrium Systems III (Wschebor)
10:45 – 12:00	Aging Phenomena in Magnetic Systems III (Pleimling)
1:14 – 2:15 PM	Nonperturbative Renormalization Group Approach to Nonequilibrium Systems IV (Wschebor)
2:30 – 3:45 PM	Dynamical Phenomena in Nanoscale Magnets I (Rikvold)
4:15 – 5:30	Spin Dynamics in Nanomagnets I (Kent)
Tuesday, July 21	
9:00 – 10:15 AM	Driven Colloids I (Reichhardt)
10:45 – 12:00	Dynamical Phenomena in Nanoscale Magnets II (Rikvold)
2:30 – 3:45 PM	Spin Dynamics in Nanomagnets II (Kent)
4:15 – 5:30	Single-Molecule Manipulation Experiments of Biological Molecules I (Kiang)
Wednesday, July 22	
9:00 – 10:15 AM	Dynamical Phenomena in Nanoscale Magnets III (Rikvold)
10:45 – 12:00	Spatial Models in Evolutionary Game Theory I (Frey)
2:15 – 3:30 PM	Driven Colloids II (Reichhardt)
4:00 – 5:30	Contributed Research Seminars III
Thursday, July 23	
9:00 – 10:15 AM	Single-Molecule Manipulation Experiments of Biological Molecules II (Kiang)
10:45 – 12:00	Spin Dynamics in Nanomagnets III (Kent)
1:15 – 2:15 PM	Macro-biophysics: Statistical physicists look at evolution and ecology (Rikvold)
2:30 – 3:45 PM	Spatial Models in Evolutionary Game Theory II (Frey)
4:15 – 5:30	Driven Colloids III (Reichhardt)
Friday, July 24	
9:00 – 10:15 AM	Spatial Models in Evolutionary Game Theory III (Frey)
10:45 – 12:00	Single-Molecule Manipulation Experiments of Biological Molecules III (Kiang)
1:45 – 2:30 PM	Closing Discussion and Feedback
5:30 – 7:00	Sewall BBQ

2009 Boulder Summer School
Nonequilibrium Statistical Mechanics:
Fundamental Problems and Applications

July 6 – July 24, 2009

Schedule

Detailed

Week 1: July 6 – July 10, Location: Duane Physics, G125

Monday, July 6

8:30 am Opening remarks – Leo Radzihovsky, scientific coordinators

9:00 am Lecture 1 – Royce Zia, Virginia Tech. Driven diffusive systems 1: Equilibrium vs non-equilibrium statistical mechanics

10:15 am Break

10:45 am Lecture 2 – Sid Redner, Boston University. Classic models in nonequilibrium statistical physics 1: Kinetics of aggregation

12:15 pm Lunch

2:30 pm Lecture 3 – Cristina Marchetti, Syracuse University. Active and driven soft matter 1: Introduction

3:45 pm Break

4:15 pm Lecture 4 – Steve Teitel, University of Rochester. Driven granular systems and jamming 1

6:00 pm Dinner

Tuesday, July 7

9:00 am Lecture 5 – Sid Redner, Boston University. Classic models in nonequilibrium statistical physics 2: Kinetics of adsorption

10:15 am Break

10:45 am Lecture 6 – Royce Zia, Virginia Tech. Driven diffusive systems 2: An Ising-like model in DDS – Physics beyond expectations

12:15 pm Lunch

1:45 pm Lecture 7 – Steve Teitel, University of Rochester. Driven granular systems and jamming 2

3:00 pm Break

3:30 pm Lecture 8 – Cristina Marchetti, Syracuse University. Active and driven soft matter 2:

Hydrodynamics of “living liquid crystals”

5:00 pm Buses leave Sewall Hall for Flagstaff Cookout on Flagstaff Mountain

Wednesday, July 8

9:00 am Lecture 9 – Chris Jarzynski, University of Maryland. Nonequilibrium work relations 1: Macroscopic thermodynamics and the second law

10:15 am Break

10:45 am Lecture 10 – Steve Teitel, University of Rochester. Driven granular systems and jamming 3

12:15 pm Lunch

2:15 pm Lecture 11 – Royce Zia, Virginia Tech. Driven diffusive systems 3: DDS in one dimension (TASEP etc.)

3:30 pm Break

Contributed research seminars (12 + 3 min each):

4:00 pm Leah Shaw, College of William and Mary. Vaccination and social adaptation for epidemic control in networks

4:15 pm Thierry Platini, Virginia Tech. Non-equilibrium dynamics of epidemic models on adaptive networks

4:30 pm Alexandra Landsman, James Madison University. Epidemic extinction via a far from equilibrium stochastic fluctuation

4:45 pm Kirill Korolev, Harvard University. Genetic demixing and Fisher waves in the one-dimensional stepping stone model

5:00 pm Kipton Barros, Boston University. The quenched Ising ferromagnet: freezing into a metastable state of striped domains

5:15 pm Gcina Mavimbela, Ohio University. Fokker-Planck dynamics in the energy domain

6:00 pm Dinner

7:30 pm First public Lecture – Sidney Redner, Boston University. The Statistical Physics of Popularity

Thursday, July 9

9:00 am Lecture 12 – Cristina Marchetti, Syracuse University. Active and driven soft matter 3: Self-propelled rods on a substrate

10:15 am Break

10:45 am Lecture 13 – Chris Jarzynski, University of Maryland. Nonequilibrium work relations 2:

Microscopic systems driven away from equilibrium

12:15 pm Lunch

2:30 pm Lecture 14 – Sid Redner, Boston University. Classic models in nonequilibrium statistical physics 3: First-passage processes

3:45 pm Break

4:15 pm Lecture 15 – Royce Zia, Virginia Tech. Driven diffusive systems 4: Surprises with two species of particles

6:00 pm Dinner

7:00 pm Poster session 1 – 11th Floor of Gamow Tower

1. Elena Agliari, University of Parma. Random walks on deterministic scale-free networks: exact results
2. Jonas Cremer, Ludwig-Maximilians University Munich. Estimating the role of fluctuations in evolutionary game theory
3. JiaJia Dong, Hamline University. Novel characteristics in the totally asymmetric simple exclusion process (TASEP) with extended particles
4. Nancy Carolina Forero-Martinez, Queen's University Belfast. Molecular to ionic transition in protic ionic liquids (PILs)
5. Chiu Fan Lee, Oxford University. Thermal breakage of a discrete one-dimensional string
6. Xiong-Jun Liu, Texas A&M University. Effect of optically induced spin-orbit coupling in a cold atomic gas
7. Majid Mosayebi, ETH Zurich. Correlated domains in non-affine displacement of inherent structure in supercooled liquids
8. Matthias Nyfeler, University of Bern. Nested cluster algorithm for frustrated quantum antiferromagnets
9. Carl Schreck, Yale University. A new jamming critical point controls the glassy dynamics of anisotropic particles
10. Maurizio Trujillo Martinez, University Bonn. Nonequilibrium Josephson oscillations in Bose-Einstein condensates without dissipation
11. Martijn van den Broek, Lawrence Berkeley National Laboratory. Intrinsic ratchets
12. Jonathan Whitmer, University of Illinois at Urbana-Champaign. Dynamics of Janus particles

Friday, July 10

9:00 am Lecture 16 – Chris Jarzynski, University of Maryland. Nonequilibrium work relations 3: Dissipation and the arrow of time

10:15 am Break

10:45 am Lecture 17 – Cristina Marchetti, Syracuse University. Active and driven soft matter 4: Hydrodynamics of bacterial suspensions

12:15 pm Lunch

1:45 pm Lecture 18 – Sid Redner, Boston University. Classic models in nonequilibrium statistical physics 4: Growth of complex networks

5:30 pm Sewall BBQ

Week 2: July 13 – July 17, Location: Duane Physics, G125

Monday, July 13

9:00 am Lecture 19 – Udo Seifert, University of Stuttgart. Stochastic thermodynamics 1: Principles and paradigmatic examples

10:15 am Break

10:45 am Lecture 20 – Dani ben-Avraham, Clarkson University. Reaction-diffusion models in one dimension 1: Overview of problems and techniques

12:15 pm Lunch

2:15 pm Lecture 21 – Ben Vollmayr-Lee, Bucknell University. Field theory approach to diffusion-limited reactions 1: Models and mappings

3:30 pm Break

Contributed research seminars (12 + 3 min each):

4:00 pm Ignacio Franco, Northwestern University. Single-molecule studies of the folding and unfolding of oligorotaxanes: phenomenology and interpretation

4:15 pm Jordan Horowitz, University of Maryland. Directed flow in nonadiabatic discrete stochastic pumps

4:30 pm David Minh, National Institutes of Health. Optimized free energies from bidirectional single-molecule force spectroscopy

4:45 pm Sven Dorosz, Virginia Tech. Fluctuation ratios in the absence of microscopic time reversibility

5:00 pm Oleg Kogan, Michigan State University. The onset of singularities in the pattern of flucuational paths of a nonequilibrium system

5:15 pm Suriyanarayanan Vaikuntanathan, University of Maryland. A connection between Hamiltonian lag and dissipation

5:30 pm Jeffrey Weiss, University of Colorado Boulder. Climate variability and nonequilibrium statistical Mechanics

6:00 pm Dinner

Tuesday, July 14

9:00 am Lecture 22 – Dani ben-Avraham, Clarkson University. Reaction-diffusion models in one dimension 2: “A gift from the Gods” – One-species, diffusion-limited coalescence and the method of empty intervals

10:15 am Break

10:45 am Lecture 23 – Dragana Popovic, National High Magnetic Field Lab. Nonequilibrium relaxation in Coulomb glasses and near the metal-insulator transition 1

12:15 pm Lunch

2:30 pm Lecture 24 – Udo Seifert, University of Stuttgart. Stochastic thermodynamics 2: Non-equilibrium steady states

3:45 pm Break

4:15 pm Lecture 25 – Ben Vollmayr-Lee, Bucknell University. Field theory approach to diffusion-limited reactions 2: Single-species annihilation

6:00 pm Dinner

7:00 pm Poster Session 2 – 11th floor of Gamow Tower

1. Shiladitya Banerjee, Syracuse University. Acitivity-induced deformation of Cross-linked actin networks
2. George Daquila, Virginia Tech. Unusual finite-size crossover features in driven lattice gases
3. Niloufar Faghihi, University of Western Ontario. Field theoretical approach to solidification of magnetic materials
4. Morteza Haeri, Syracuse University. Voltage dependent electrochemical impedence spectroscopy of CoCrMo biomedical alloy
5. Xuefei Li, Hong Kong Baptist University. Bacterial chemotaxis and pattern formation
6. Anna Melbinger, Ludwig-Maximilians University Munich. Driven transport on parallel lanes with particle exclusion and obstruction
7. David Minh, National Institutes of Health. Density-dependent analysis of nonequilibrium paths improves free energy estimates
8. Jayson Paulose, Harvard University. Cooperative sequential adsorption: an application to nanoscale self-organization
9. Anton Souslov, University of Pennsylvania. Periodic lattices from isostaticity
10. Salomon Turgman, North Carolina State University. Computer simulation study of solvent quality and reaction geometry on controlled radical polymerization
11. Daniel Volovik, Boston University. Hot and cold streaks in Europe
12. Kai Zhang, Duke University. Monte Carlo study of modulated phases with shear

Wednesday, July 15

9:00 am Lecture 26 – Dragana Popovic, National High Magnetic Field Lab. Nonequilibrium relaxation in Coulomb glasses and near the metal-insulator transition 2

10:15 am Break

10:45 am Lecture 27 – Udo Seifert, University of Stuttgart. Stochastic thermodynamics 3: Stochastic dynamics on (biochemical) networks

12:15 pm Lunch

2:30 pm Lecture 28 – Dani ben-Avraham, Clarkson University. Reaction-diffusion models in one dimension 3: Annihilation and advanced applications of the method of empty intervals

3:45 pm Break

4:15 pm Lecture 29 – Nicholas Wschebor, University of the Republic. Nonperturbative renormalization group approach to nonequilibrium systems 1: Introduction to the non-perturbative renormalization group

6:00 pm Dinner

7:30 pm Second public Lecture – Royce K.P. Zia, Virginia Tech. What is Physics? – A personal perspective

Thursday, July 16

9:00 am Lecture 30 – Michel Pleimling, Virginia Tech. Aging phenomena in magnetic systems 1: Introduction to aging phenomena

10:15 am Break

10:45 am Lecture 31 – Ben Vollmayr-Lee, Bucknell University. Field theory approach to diffusion-limited reactions 3: Applications

12:15 pm Lunch

2:30 pm Lecture 32 – Dragana Popovic, National High Magnetic Field Laboratory. Nonequilibrium relaxation in Coulomb glasses and near the metal-insulator transition 3

3:45 pm Break

4:15 pm Lecture 33 – Dani ben-Avraham, Clarkson University. Reaction-diffusion models in one dimension 4: Some good open problems (and how one might go about solving them)

6:00 pm Dinner

Friday, July 17

9:00 am Lecture 34 – Ben Vollmayr-Lee, Bucknell University. Field theory approach to diffusion-limited reactions 4: Active to absorbing state transitions

10:15 am Break

10:45 am Lecture 35 – Nicholas Wschebor, University of Montevideo. Nonperturbative renormalization group approach to nonequilibrium systems 2: A simple NPRG application at equilibrium

12:15 pm Lunch

1:45 pm Lecture 36 – Michel Pleimling, Virginia Tech. Aging phenomena in magnetic systems 2: Phenomenology of aging

5:30 pm Sewall BBQ

Week 3: July 20 – July 24, Location: Duane Physics, G125

Monday, July 20

9:00 am Lecture 37 – Nicholas Wschebor, University of Montevideo. Nonperturbative renormalization group approach to nonequilibrium systems 3: Simple NPRG applications in reaction-diffusion systems

10:15 am Break

10:45 am Lecture 38 – Michel Pleimling, Virginia Tech. Aging phenomena in magnetic systems 3: Aging in coarsening systems

12:15 pm Lunch

1:15 pm Optional Lecture – Nicholas Wschebor, University of Montevideo. Nonperturbative renormalization group approach to nonequilibrium systems 4

2:30 pm Lecture 39 – Per Rikvold, Florida State University. Dynamical phenomena in nanoscale magnets 1: Dynamical phenomena and finite-size effects in magnetization switching

3:45 pm Break

4:15 pm Lecture 40 – Andy Kent, New York University. Spin dynamics in nanomagnets – single molecule magnets and metal ferromagnets 1: Spin dynamics in ferromagnetic systems: quantum and classical magnetization dynamics, overview of experiments

6:00 pm Dinner

Tuesday, July 21

9:00 am Lecture 41 – Cynthia Reichhardt, Los Alamos National Laboratory. Driven colloids 1: Ratchets

10:15 am Break

10:45 am Lecture 42 – Per Rikvold, Florida State University. Dynamical phenomena in nanoscale magnets 2: Simulation of magnetization switching in iron nanopillars

12:15 pm Lunch

2:30 pm Lecture 43 – Andy Kent, New York University. Spin dynamics in nanomagnets – single molecule magnets and metal ferromagnets 2: Spin-current induced magnetization dynamics in conducting ferromagnets

3:45 pm Break

4:15 pm Lecture 44 – Ching-Hwa Kiang, Rice University. Single-molecule manipulation experiments of biological molecules 1: Introduction and techniques

6:00 pm Dinner

Wednesday, July 22

9:00 am Lecture 45 – Per Rikvold, Florida State University. Dynamical phenomena in nanoscale

magnets 3: Dynamic phase transition in two-dimensional Ising-like systems driven by an oscillating field

10:15 am Break

10:45 am Lecture 46 – Erwin Frey, Ludwig Maximilians University Munich. Spatial models in evolutionary game theory 1: An introduction to game theory

12:15 pm Lunch

2:15 pm Lecture 47 – Cynthia Reichhardt, Los Alamos National Laboratory. Driven colloids 2: Absorbing phase transitions

3:30 pm Break

Contributed research seminars (12 + 3 min each):

4:00 pm Mya Warren, University of British Columbia. Heterogeneous diffusion in amorphous solids

4:15 pm Mark Jhon, University of California at Berkeley. Kinetic Monte Carlo model of the dynamic mechanical response of nacre

4:30 pm Ting Ge, Johns Hopkins University. Evolution of entanglements during craze formation

4:45 pm Erik Woldhuis, Leiden University. Foam rheology near the jamming transition

5:00 pm Christopher Calderon, Rice University. Extracting multiscale information from time series characterizing proteins under the influence of time dependent external forces

5:15 pm Vijay Kumar Krishnamurthy, Indian Institute of Science Bangalore. Brownian inchworm model of a self-propelled particle

5:30 pm TBA

6:00 pm Dinner

Thursday, July 23

9:00 am Lecture 48 – Ching-Hwa Kiang, Rice University. Single-molecule manipulation experiments of biological molecules 2: Principles involved in interpreting force measurements

10:15 am Break

10:45 am Lecture 49 – Andy Kent, New York University. Spin dynamics in nanomagnets – single molecule magnets and metal ferromagnets 3: Quantum spin dynamics in molecular magnets

12:15 pm Lunch

1:15 pm Optional Lecture – Per Rikvold, Florida State University. Macro-biophysics: Statistical physicists look at evolution and ecology

2:30 pm Lecture 50 – Erwin Frey, Ludwig Maximilians University Munich. Spatial models in evolutionary game theory 2: Stochastic description of well-mixed systems

3:45 pm Break

4:15 pm Lecture 51 – Cynthia Reichhardt, Los Alamos National Laboratory. Driven colloids 3: Jamming

6:00 pm Dinner

Friday, July 24

9:00 am Lecture 52 – Erwin Frey, Ludwig Maximilians University Munich. Spatial models in evolutionary game theory 3: Spatial dynamics and pattern formation

10:15 am Break

10:45 am Lecture 53 – Ching-Hwa Kiang, Rice University. Single-molecule manipulation experiments of biological molecules 3: Applications to biological systems

12:15 pm Lunch

1:45 pm Closing discussion and feedback

5:30 pm Sewall BBQ