

A. Alan Middleton Curriculum Vitae

Department of Physics, Syracuse University, Syracuse, NY 13244
Phone: (315)443-2408, FAX: (315)443-9103, e-mail: aam@syr.edu

Education

Princeton University Ph.D., Physics, October 1990
Cambridge University Certificate of Advanced Study (Part III Maths,) June 1985
Harvey Mudd College B.S., Physics and Mathematics, with Distinction,
Honors in Physics and Mathematics, June 1984

Professional Employment

2008 - Professor in the Department of Physics, Syracuse University
(Associate Chairperson, 2009 - present)
2001 - 2008 Associate Professor in the Department of Physics, Syracuse University
1995 - 2001 Assistant Professor in the Department of Physics, Syracuse University
1992 - 1994 Visiting scientist at the NEC Research Institute, Princeton, NJ
1990 - 1992 Research associate in the Physics Department, Syracuse University
1989 - 1990 Graduate Research Assistant, Physics Department, Princeton University
Summer 1989 Theoretical Physics Department, AT&T Bell Labs, Murray Hill, NJ
1987-1989 Teaching Assistant, Department of Physics, Princeton University
Summer 1984 Research Assistant at IBM's San Jose Research Laboratory

Honors and Awards

Fellow of the American Physical Society
Alfred P. Sloan Foundation Fellowship (1995 - 1999)
Graduate Computational Physics award from Princeton University (1990)
National Science Foundation Graduate Fellowship (1984-1987)
Churchill Scholar (1984-1985)

Research Interests

Materials with disorder: ground states, barriers and metastable states in
random materials such as spin glasses and other random magnets
Connections between algorithm dynamics, computer science analyses,
including computational complexity, and physics
Transport in disordered materials, such as vortices in type-II superconductors,

interface motion, and colloidal assemblies.
Algorithms for efficient simulation of complex dynamics, including heuristic
coarse graining for glassy materials
Deriving visualizations and qualitative results from large simulations
Use of parallel computers for scientific simulation

Grants

- Principal Investigator (PI) “Complex Dynamics and Algorithms for Disordered Matter”,
National Science Foundation, Division of Materials Research,
\$300,000, 2010-2013
- PI “Statics and Dynamics of Materials with Quenched Disorder”,
National Science Foundation, Division of Materials Research,
\$279,000, 2006-2010
- PI “Phases and Dynamics of Disordered Condensed Matter Systems”,
National Science Foundation, Division of Materials Research,
\$225,000, 2001-2005
- Co-PI “Statistical Physics and Computational Complexity”,
NSF DMR, under Information and Technology Research,
with Profs. Bowick and Marchetti,
\$474,000, 2002-2007
- PI “Dynamics and Phase Space Structure of Condensed Matter
Systems with Mesoscopic Degrees of Freedom”,
NSF DMR, \$211,000, 1997-2001
- Co-PI “Information Science in the Service of Science Education”,
with Profs. Vidali, Catterall, Lipson,
NSF Division of Undergraduate Education,
\$200,000, 1996-2000

I have also received, with Eric Schiff, an internal grant for \$2,450 from the Syracuse University Faculty Instructional Grant Program (12/95) and have been awarded computer time from the National Partnership for Advanced Computational Infrastructure, from the Cornell Theory Center, and currently from Brookhaven National Laboratory.

Teaching and Service at Syracuse University

I have developed and taught a wide range of courses at Syracuse University, from large introductory science courses to graduate quantum mechanics and condensed matter physics. I have invested large amounts of time in each course developing new approaches to the content

and updating the material. Most recently, I have created an Honors Course, "Seeing Light", that involves dedicated students (who are primarily not science majors) in a historical, experimental, and philosophical discussion of vision and light, through color, images, quantum physics, and relativity.

I was the Director of Undergraduate Studies from the Spring Term of 2000 through the middle of 2007. During this time, the total number of majors rose from about 7 to 52. This was a challenging job, involving recruiting and giving tours to prospective students, extensive advising, making suggestions for courses, and helping with teaching assignments and course schedules. I continue to maintain contacts with the New Faculty Workshop network and am giving a talk in March 2009 on teaching at the APS March Meeting. I have also served on a number of search committees, curriculum committees, the qualifying examination committee, and faculty review committees, including promotion and tenure committees. I currently serve as Associate Chair of the Department of Physics, primarily as administrator for educational matters. I have served on the College Promotion and Tenure Committee and currently serve on the Core Faculty of Renee Crown University Honors Program.

Undergraduate courses

"Science for the 21st Century", a lecture and lab course, focused on light, matter (including nuclear weapons), liquid crystal displays, and pseudoscience

"Science and Computers", an upper division computer-lab oriented course emphasizing visualization and simulations.

"Journal Workshop in Physics", an course for new majors to provide a survey of physics

"Problem Solving in Contemporary Physics", a course for seniors including problem solving skills and career & graduate school opportunities

"Seeing Light", an honors course for a variety of majors that reviews the history of theories of light and vision and modern applications

"First-year forum", a short seminar course for incoming students

"Thermodynamics and Statistical Physics", a course for juniors and seniors

Graduate Courses

"Science and Computers", a graduate version of the above

"Quantum Mechanics II", including my addition of MRI and quantum communication

"Condensed Matter Physics", both a seminar and a course based on Chaikin & Lubensky

Community Outreach and Service

Public science lectures on campus

Visits to local schools, for physics demonstrations (> twice/year)

Guest on local PBS show to discuss chaos

Talk on "The Spectacular Science of Six-Sided Snow" at the Museum of Science and Technology

Co-organizer for the 2001 Boulder School in Condensed Matter Physics

Article on and AAPT prize for demonstration on color mixing

Graduate students: David McNamara, Shantenu Jha, Berta-Elizabeth Rodriguez-Milla, Creighton Thomas.

Post-doctoral associates: Chen Zeng, Thomas Prellberg, Karl Saunders, Jennifer Schwarz, Jan Meinke.

I have also worked on research projects with undergraduate students, about one or two per year over recent years.

Recent Invited Talks

2000: University of Washington, International Centre for Theoretical Physics (Trieste, Italy), Université Paris-Sud (Orsay, France), Brown University; 2001: Colgate University, American Physical Society March Meeting (Seattle, WA), University of Rochester, Schloss Dagstuhl (Wadern, Germany), University of Illinois Urbana-Champaign; 2002: Disordered Systems Workshop (Helsinki, Finland); 2003: Rochester Polytechnic Institute, Schloss Dagstuhl (Wadern, Germany), Kavli Institute of Theoretical Physics (Santa Barbara, CA), Harvey Mudd College (Claremont, CA); 2004: University of California Davis, University of California Santa Cruz, University of Chicago, 12th International Conference on Recent Progress in Many-Body Physics (Santa Fe, NM), University of Massachusetts Amherst. 2005: Rutgers Statistical Physics Meeting, Emory University Colloquium. 2006: Joint LPTENS/Jussieu seminar in Paris, France, Invited participant and talk at the International Centre for Theoretical Physics, Trieste, Italy, Invited participant and talk at Max Planck Institute for Complex Systems, Dresden, Germany, Invited participant and talk at Kavli Institute for Theoretical Physics (Oct-Dec.), George Washington University. 2007: Institute for Pure and Applied Mathematics at UCLA, Los Alamos National Laboratory, Central New York Workshop on Complex Matter [Also invited participant at Aspen Center for Physics, July 2005 & July 2007, invited participant at American Institute of Mathematics Workshop, August, 2006], Syracuse University. 2008: Louisiana State University Center for Computation and Technology, Kavli Institute of Theoretical Physics in China, Los Alamos National Laboratory, University of Massachusetts Amherst. 2009: 101st Statistical Mechanics Meeting at Rutgers (May), Physics of Algorithms Workshop in Santa Fe, NM (Sept.). 2010: American Physical Society March Meeting (Portland, OR); 104th Statistical Mechanics Meeting at Rutgers (December). 2011: Washington University in St. Louis, Kavli Institute for Theoretical Physics China (Beijing), University of Science and Technology of China (Hefei).

SERVICE TO THE RESEARCH COMMUNITY: Regular reviewer for Physical Review Letters, Physical Review E, Physical Review B, JSTAT, Europhysics Letters, and other journals. Grant reviewer and panel participant for the National Science Foundation and Department of Energy. Served on the High Performance Computing review panel for the NSF Mathematical and Physical Sciences Division (2005). Organizer of the 2001 Boulder School and co-organizer of the 2008 Aspen Center for Physics Workshop “Complexity, Disorder, and Algorithms”. Chair of an abstract sorters group for the 2010 APS March Meeting.

PUBLICATIONS

[Also see <http://physics.syr.edu/~aam/papers/>]

1. “The Deconfining Transition for Finite-temperature $U(1)$ Lattice Gauge Theory in $(2 + 1)$ Dimensions,”
Physics Letters **B175**, 64 (1986).
P. Coddington, A. Hey, A. A. Middleton, and J. Townsend.
2. “ $^{11}B(\alpha, p)^{14}C^*$ ($E_x = 23.288$ MeV) reaction and (p, π^+) production mechanisms,”
Physical Review C **38**, 1958 (1988).
L. K. Herold, K. E. Luther, A. A. Middleton, M. L. Pitt, and J. D. Brown.
3. “Discrete Scatterers and Autocorrelations of Multiply Scattered Light,”
Physical Review B **43**, 5934 (1991).
A. Alan Middleton and Daniel S. Fisher.
4. “Critical Behavior of Pinned Charge-Density Waves below the Threshold for Sliding,”
Physical Review Letters **66**, 92 (1991).
A. Alan Middleton and Daniel S. Fisher.
5. Reply to comment on “Critical Behavior of Pinned Charge-Density Waves below the Threshold for Sliding,”
Physical Review Letters **67**, 3873(1991).
A. Alan Middleton, Daniel S. Fisher, and Peter B. Littlewood.
6. “Asymptotic Uniqueness of the Sliding State for Charge Density Waves,”
Physical Review Letters **68**, 670 (1992).
A. Alan Middleton.
7. “Complete Mode-locking in Models of Charge-density Waves,”
Physical Review Letters **68**, 1586 (1992).
A. Alan Middleton, Ofer Biham, Peter B. Littlewood, and Paolo Sibani.
8. “Thermal Rounding of the Charge Density Wave Depinning Transition,”
Physical Review B **45**, 9465 (1992).
A. Alan Middleton.
9. “Dynamics of Directed Polymers with Cutting Interactions,”
Physical Review A **45**, 7288 (1992).
Sergei E. Esipov and A. Alan Middleton.
10. “Elastic String in a Random Potential,”
Physical Review Letters **70**, 662 (1993).
M. Dong, A. Alan Middleton, M. Cristina Marchetti, and Valerii Vinokur.

11. "Self-Organization and a Dynamical Transition in Traffic-flow Models,"
Physical Review A **46**, R6124 (1993).
Ofar Biham, A. Alan Middleton, and Dov Levine.
12. "Critical Behavior of Charge Density Waves Below Threshold: Numerical and Scaling Analysis",
Physical Review B **47**, 3530 (1993).
A. Alan Middleton and D. S. Fisher.
13. "Scaling Near Mode Locking in a Charge Density Wave Conductor",
Physical Review Letters **70**, 3784 (1993).
Mark J. Higgins, A. Alan Middleton, and S. Bhattacharya.
14. "Collective Transport in Arrays of Small Metallic Dots",
Physical Review Letters **71**, 3198 (1993).
A. Alan Middleton and Ned S. Wingreen.
15. "Avalanches and the renormalization group for pinned charge-density waves",
Physical Review B **49**, 244 (1994).
Onuttom Narayan and A. Alan Middleton.
16. "Self-Organized criticality in non-conserved systems",
Physical Review Letters **74**, 742 (1995).
A. Alan Middleton and Chao Tang.
17. "Numerical Results for the Ground-State Interface in a Random Medium",
Physical Review **E52**, R3337 (1995).
A. Alan Middleton.
18. "Vortex Dynamics and Defects in Simulated Flux Flow",,
Physical Review B **54**, 12427-12436 (1996),
Michael C. Faleski, M. Cristina Marchetti, and A. Alan Middleton.
19. "Ground-State Roughness of the Disordered Substrate and Flux Line in $d=2$ ",
Physical Review Letters **77**, 3204-3207 (1996),
Chen Zeng, A. Alan Middleton, Y. Shapir.
20. "Statistical Topography of Glassy Interfaces",
Physical Review Letters **80**, 109-112 (1998),
Chen Zeng, Jané Kondev, David McNamara, and A. Alan Middleton.
21. "Computational Complexity of Determining the Barriers to Interface Motion in Random Systems",
Physical Review E **59**, 2571-2577 (1999),
A. Alan Middleton.

22. "Disorder-Induced Topological Defects in a $d=2$ Elastic Medium at Zero Temperature",
Physical Review B **61**, 14787-14790 (2000),
A. Alan Middleton.
23. "Numerical investigation of the thermodynamic limit for ground states in models with quenched disorder",
Physical Review Letters **83**, 1672-1675 (1999),
A. Alan Middleton.
24. "Simulation of the Zero Temperature Behavior of a 3-Dimensional Elastic Medium",
Phys. Rev. B **60**, 10062-10069 (1999),
David McNamara, A. Alan Middleton, Chen Zeng.
25. "Viscoelastic Depinning of Driven Systems: Mean-Field Plastic Scallop",
Physical Review Letters **85**, 1104-1107 (2000),
M. Cristina Marchetti, A. Alan Middleton, Thomas Prellberg.
26. "Energetics and geometry of excitations in random systems",
Phys. Rev. B **63**, 060202(R) (4 pp., 2001),
A. Alan Middleton.
27. "Critical slowing down in polynomial time algorithms",
Physical Review Letters **88**, 017202 (4 pp., 2002),
A. Alan Middleton.
28. "The three-dimensional random field Ising magnet: interfaces, scaling, and the nature of states",
Physical Review B **65**, 134411 (31 pp., 2002),
A. Alan Middleton and Daniel S. Fisher.
29. "Scaling, domains, and states in the four-dimensional random field Ising magnet",
preprint archived as cond-mat/0208182,
A. Alan Middleton.
30. "Driven depinning of strongly disordered media and anisotropic mean-field limits",
Physical Review Letters **91**, 107002 (4 pp., 2003),
M. Cristina Marchetti, A. Alan Middleton, Karl Saunders, J. M. Schwarz.
31. "Percolation of unsatisfiability in finite dimensions",
Physical Review E **70**, 035103(R) (4pp., 2004),
J. M. Schwarz and A. Alan Middleton.
32. "Mean Field Theory of Collective Transport with Phase Slips",
Physical Review B **70**, 024205 (29 pp., 2004),
Karl Saunders, J. M. Schwarz, M. Cristina Marchetti, A. Alan Middleton.

33. “Improved extremal optimization for the Ising spin glass”,
Physical Review E **69**, 055701 (2004),
A. Alan Middleton.
34. “Counting States and Counting Operations”,
Chapter 5 (pp. 71-100) in *New Optimization Algorithms in Physics*,
Eds. Hartmann and Rieger, Wiley-VCH (2004),
A. Alan Middleton.
35. “Exploring optimization for the random-field Ising model”,
preprint archived as cond-mat/0501269,
D. Clay Hambrick, Jan H. Meinke, A. Alan Middleton.
36. “Linking Physics and Algorithms in the random-field Ising model”,
preprint with Meinke, <http://arxiv.org/abs/cond-mat/0502471>.
37. “Effects of Disorder on Electron Transport in Arrays of Quantum Dots”,
preprint with S. Jha, <http://arxiv.org/abs/cond-mat/0511094>.
38. “Measuring functional renormalization group fixed-point functions for pinned manifolds”,
Physical Review Letters **98**, 155701 (2007),
A. Alan Middleton, P. Le Doussal, and K. J. Wiese,
39. “Irrational mode locking in quasiperiodic systems”,
Physical Review Letters **98**, 148001 (2007),
Creighton K. Thomas, A. Alan Middleton.
40. “Are Domain Walls in Spin Glasses Described by Stochastic Loewner Evolution?”,
Physical Review B **76**, 020403(R) (2007),
D. Bernard, P. Le Doussal, A. Alan Middleton.
41. “Matching Kasteleyn Cities for Spin Glass Ground States”,
Physical Review B **76**, 220406(R) (2007),
Creighton K. Thomas, A. Alan Middleton.
42. “Persistence and Memory in Patchwork Dynamics for Glassy Models”,
Physical Review B **77**, 092415 (2008),
Creighton K. Thomas, Olivia L. White, A. Alan Middleton.
43. “Statistics of static avalanches in a random pinning landscape”,
Physical Review B **79**, 050101 (2009),
Pierre Le Doussal, A. Alan Middleton, Kay Joerg Wiese.
44. “Exact Algorithm for Sampling the 2D Ising Spin Glass”,
Physical Review E **80**, 046708 (2009),
Creighton K. Thomas, A. Alan Middleton.