**A. Alan Middleton**

**Curriculum Vitae, January 2025**

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# Professional Appointments

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| 2017 - 2023 | Associate Dean of Research and Scholarship, College of Arts & Sciences,  Syracuse University |
| 2013 - Dec. 2017 | Chair, Department of Physics, Syracuse University |
| 2009 - 2013 | Associate Chair, Department of Physics, Syracuse University |
| 2008 - | Professor in the Department of Physics, Syracuse University |
| 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  **Education** | Research Associate, Department of Physics, Syracuse University |
| Princeton University | Ph.D., Physics, October 1990 |
| Harvey Mudd College | B.S., Physics and Mathematics, with Distinction,  Honors in Physics and Mathematics, June 1984 |

# Honors and Awards

Fellow of the American Association for the Advancement of Science (2017)

Fellow of the American Physical Society (2010)

National Science Foundation CAREER grant (1997)

Alfred P. Sloan Foundation Fellowship (1995)

Graduate Computational Physics award from Princeton University (1990)

National Science Foundation Graduate Fellowship (1984)

Churchill Scholar at Cambridge University (1984-1985)

# Administrative positions

**Associate Dean for Research and Scholarship (July 2017 - August 2023)** In this role, I support research, discovery, and scholarship in the College of Arts and Sciences, in both the Math and Sciences Division and the Humanities Division. My efforts include research development, laboratory space planning, hiring strategy, and otherwise improving the environment for research and research success. I also serve as part of the Dean’s Cabinet where other strategic and operational matters are addressed. The College has 279 tenured or tenure-track faculty, 79 nontenure-track faculty, and 58 faculty members who are professors of practice, research faculty, or postdoctoral researchers. These faculty work in 17 academic units and recruit external research support in the range of $16 million to $20 million each year. I have made important contributions to the creation of research centers, have been active in faculty recruitment and retention, and in providing input to major campus projects such as the campus STEM renovation framework study. My most important collaborators in this position are the Dean and the full Dean’s cabinet; department chairs; the Vice President for Research; Campus Planning, Design and Construction; the Office of Academic Affairs; the Graduate School; the Office of Sponsored Research; and individual faculty members, including faculty leaders in other colleges and schools. Within the cabinet, I work with the Associate Dean on Diversity, Equity, and Inclusion to champion best hiring practices, while working the dean to implement hiring practices and recruiting to increase diversity. I support a research mission with goals, practices, and faculty recognition that is more inclusive and supportive of diversity. My efforts on research and scholarship include the following responsibilities for staff, including new positions that we have established in the College of Arts and Sciences:

* I established the College’s research development team, comprised of two staff members, and collaborated with and mentored the team through 2023. I advocated for the hiring of staff directors for proposal development, designed the position responsibilities, and led hiring, in collaboration with the Dean of the College, the Humanities Center, and the Office of Research. I supervised and mentored two directors, one for sciences/mathematics (2018-2023) and one for humanities (2019-2023). The latter position was jointly hired with the Office of Research, to advance scholarship in the humanities and creative arts across campus. In 2021, I had the positions renamed as Directors of Research Development, to indicate clearly a broader aim of building the research careers of faculty members. In 2023, the positions were moved to the Office of Research. The team and I work together
  + to identify and highlight funding opportunities.
  + to support proposal development, including establishing pre-submission external reviews of grant proposals of all sizes.
  + with departments to increase nominations for honorary recognitions.
  + to provide funding and organization for book manuscript workshops with external reviewers and to bring presentations by editors from major university presses to campus.
  + to develop mechanisms for research training, such as internal proposal writing workshops and research leadership training workshops provided by consultants.
  + to track better faculty achievements, from proposals in the sciences through fellowships in the humanities.
  + with chairs to identify overall research priorities and specific opportunities for the faculty in their unit.
  + to facilitate meetings with recently hired faculty, so that we can hear directly of their successes and challenges and to generate ideas to improve the research environment for newly hired faculty.
* I supervise the Director of the Computing Services Group for the College of Arts and Sciences. This unit has seven staff members and serves general and research computing needs for faculty and staff in the College. This includes identifying faculty IT needs, budgeting for computer purchases, managing policies for support, supporting accessibility in software, and supporting laboratory-specific needs in individual research groups.
* I have worked with our Director of Administration and Operations to design and implement the formation of a new college-wide science facilities coordinators team, with the team having a dotted reporting line to my position. The three staff members of this team now support our science facilities using a distributed model, replacing a model of department/building-based facilities staff. The individual departments or buildings no longer rely on a single science facilities manager. The purpose of this reorganization has been to provide a larger knowledge set shared between buildings and reliable backup for research facilities services (for illnesses, vacation, and turnover), along with efficiency of service, through mobility between buildings and the ability to have a larger team address surges in demand in a particular department.

**Chair of the Department of Physics (July 2013 - December 2017)** As Chair, I served in a department with 30 faculty, 75 graduate students, 23 postdoctoral researchers, and 15 staff members. The department had $7.9 million in sponsored research expenditures in FY’17. We provided 11,000 student credit hours of instruction and graduated about 17 majors in physics each year. As Chair, I supported faculty hiring for strength in expanding areas, faculty career development, the physical and administrative research infrastructure, attention to diversity, staff development, and promoted the visibility of the department and individual faculty efforts. I reinstituted a planning committee to guide our strategic processes for hiring and research support. I increased the number of teaching recognitions for our faculty. I restructured our staff to handle an increasing volume of research administration; focused on facilitating teaching training for faculty and thorough assessment of our educational programs; initiated and oversaw renovations of laboratories, common spaces, and our instructional clinic; collaborated with others on the conversion of historic Holden Observatory to a teaching space for astronomy; formalized many of our procedures and documented these procedures on a new platform; and advocated for publicity for our accomplishments. In my time as chair, I instituted the first faculty-retreat workshop on diversity. I also initiated the organization of our department hosting a regional Conference for Undergraduate Women in Physics. In my work as Chair, I collaborated closely with the physics faculty, our students, the Dean’s office, the Vice President for Research, Campus Planning, Design and Construction, the Provost’s office, the Chancellor’s office, SU ADVANCE (the National Science Foundation program to improve participation by women in the sciences and engineering), WISE (the faculty-organized Women In Science and Engineering program), the Syracuse Biomaterials Institute at Syracuse University, the College of Engineering and Computer Science faculty and administrators, tutoring centers, and other science departments.

**Associate Chair of the Department of Physics (2009-2013)** I served as primary administrator for educational matters and collaborated with the chair on faculty matters and strategic planning. In this role, I was responsible for overseeing curricular matters (which included course scheduling and teaching assignments), helping to organize departmental reports, addressing student concerns, managing office space for faculty and graduate students, and consulted with the chair on strategy, administrative tasks, and departmental priorities.

**Director of Undergraduate Studies (2000-2007)** My efforts involved guiding curriculum development for our program, recruiting and giving tours to prospective students, initially advising all majors, advocating for the dedication of space for an undergraduate lounge, implementing new assessments of our undergraduate program (including extended exit interviews), attending conferences on teaching and program development, and assisting the chair with teaching assignments and course schedules. During the time I held the position, the number of enrolled majors rose from about 7 to 52, reflecting new efforts implemented in collaboration with other faculty to support individual students and cohorts. I maintained contacts with the leaders of the Physics New Faculty Workshop network, including recruiting new participants and presenting an invited talk on our efforts on teaching in Syracuse physics at the 2009 March Meeting of the American Physical Society.

# Service

* Chair of the Proto Faculty Council for the College of Arts and Sciences; oversaw development of first set of bylaws for the College.
* Member of the University Senate Committee on Budget and Fiscal Affairs, 2018 to 2023; co-chair, 2021 to 2022.
* Member of the University Senate Ad Hoc Committee on Gender Pay Equity from March, 2019 through May, 2021. Member on the re-instantiation of this committee, Feb. 2022 through December 2022..
* Member of the University Senate Committee on Women’s Concerns from 2017 through 2020.
* Member of the Syracuse University Travel Safety Policy Task Force Committee (20172018).
* Member (Fall 2016 - Winter 2017) of the Faculty Salary Review Committee. This group gathered and reviewed internal and external comparisons on salary, to review the salaries of full-time faculty for fairness, competitiveness, and equity, with special attention to gender, race, and ethnicity. The committee submitted its report to the Provost and Vice-Chancellor in December, 2017.
* As Associate Dean of Research and Scholarship, member *ex officio* on committees in the College of Arts and Sciences, including the Science and Mathematics Council (Chair), the Arts and Sciences Faculty Council, and the Humanities Council.
* Faculty member representative to the Syracuse University Senate, elected in the College of Arts and Sciences (2016-2020, 2021-2023).
* Faculty Sponsor for the Syracuse University Travel Team (2015-2016) which reviewed and made substantial revisions to the University’s Travel Policy. The goal of this work was to determine which parts of the proposed travel policy achieved savings. It was formed in response to community concern in response to the proposed policy. I coordinated the work of the committee along with the committee co-chairs (the Director of Purchasing and the Comptroller), along with the Administrative Sponsor (the Chief Financial Officer for Syracuse University).
* Faculty representative on the College of Arts and Sciences Faculty Council (2014-2016) and Council Chair (2015-2016). This committee met to set the agenda for faculty meetings and to otherwise handle matters on behalf of the faculty outside of major college faculty meetings, including making committee assignments, developing revisions to bylaws and procedures, and discussing general business of importance to the faculty.
* Member of departmental and college committees, including search committees, curriculum committees, scholarship committees, the qualifying examination committee, and faculty review committees, including promotion and tenure committees.
* I have served on the Coronat Scholar Selection Committee several times, most recently three consecutive years through 2017. The Committee reviews applications and then interviews and recruits students for the College of Arts and Science’s largest merit award.
* Core faculty member of the Renee Crown University Honors Program (2009-15); served on and chaired the capstone prize committee (2012, 2013).
* I served as a member of the search committee for the Dean of the College of Engineering and Computer Science (Oct. 2014 - Apr. 2015).
* Member of the Arts and Sciences College Promotion and Tenure Committee (2008-09).

# Research Interests

Materials with disorder: ground states, barriers and metastable states in random materials such as spin glasses and other random magnets; history dependence and complex memory effects in bulk materials

Connections between applications of optimization techniques, algorithm dynamics, computational complexity, and physical dynamics; applications of these connections to efficient simulation of complex dynamics, including heuristic coarse graining for glassy materials

Transport in disordered materials, such as vortices in type-II superconductors,

interface motion, and colloidal assemblies

Deriving strong qualitative results from large scale simulations to rigorously support theoretical arguements

# Service to the research community

* Co-organizer:
  + 2001 Boulder Summer School “Nonequilibrium Statistical Physics”
  + 2008 Aspen Center for Physics Workshop “Complexity, Disorder, and Algorithms”
  + 2012 Aspen Workshop “Disorder, Algorithms, and Complexity”
  + 2018 Kavli Institute for Theoretical Physics Workshop “Memory Formation in Matter”
* Regular reviewer for Physical Review Letters, Physical Review X, Physical Review E, Physical Review B, JSTAT, Europhysics Letters, and other journals. Chair of an abstract sorters group for the 2010 APS March Meeting.
* 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).

# Grants

Principal Investigator “Algorithms, States, and Dynamics in Models of Disordered Matter”,

(PI) National Science Foundation, Division of Materials Research,

$330,000, 2014-2018

PI “Complex Dynamics and Algorithms for Disordered Matter”,

National Science Foundation, Division of Materials Research (DMR), $300,000, 2010-2014

Co-PI “IGERT: Soft Interfaces - Bridging the Divide in Graduate Education”, with M. C. Marchetti (PI), P. Mather, D. Ren, K. Ruhlandt,

National Science Foundation, IGERT,

$1,166,039, 2011-2016

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 M. J. Bowick (PI) and M. C. Marchetti,

$474,000, 2002-2007

PI “Dynamics and Phase Space Structure of Condensed Matter

Systems with Mesoscopic Degrees of Freedom”,

NSF DMR CAREER grant, $211,000, 1997-2001

Co-PI “Information Science in the Service of Science Education”, with G. Vidali (PI), S. M. Catterall, G. Fox, E. Lipson,

NSF Division of Undergraduate Education,

$200,000, 1996-2000

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

Graduate students, PhD completion: David McNamara, Shantenu Jha, Berta-Elizabeth RodriguezMilla, Creighton Thomas, Sean Sweeney, Jie Yang.

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

# Invited Talks

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 Institiute 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 Massachussetts 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). 2012: "Quantum Information Meets Statistical Physics" conference, Innsbruck, Austria. August, 2013: Invited speaker at Santa Fe Institue (“Deep Computation in Statistical Physics”) and at a symposium in honor of Dan Stein at New York University. 2014: Kavli Institute of Theoretical Physics, invited speaker at workshop on “Complexity and Mechanics”; Invited workshop speaker, "Classical and Quantum Optimization", Zurich; Invited session speaker, March Amercian Physical Society Meeting. 2016: “Workshop on Physics Informed Machine Learning”, Santa Fe, NM; 116th Statistical Mechanics Conference, Rutgers University.

# Publications

[Also see aamiddle.expressions.syr.edu for current list, source code, unpublished items, and gallery]

1. “Simple random matrix model for the vibrational spectrum of structural glasses”,

Physical Review E **98**, 042908 (2018)

E. Stanifer, P. K. Morse, A. A. Middleton, M. L. Manning.

1. “Minimal spanning trees at the percolation threshold: A numerical calculation”,

Physical Review E **88**, 032129 (2013) Sean M. Sweeney, A. Alan Middleton.

1. “Extracting thermodynamic behavior of spin glasses from the overlap function”,Physical Review B **87**, 220201 (2013) A. Alan Middleton.
2. “Numerically exact correlations and sampling in the two-dimensional Ising spin glass”,Physical Review E **87**, 043303 (2013), Creighton K. Thomas, A. Alan Middleton.
3. “Zero and low temperature behavior of the two-dimensional ±*J* Ising spin glass”, Physical Review Letters **107**, 047203 (2011),

Creighton K. Thomas, David A. Huse, A. Alan Middleton.

1. “Chaos and universality in two-dimensional Ising spin glasses”,preprint archived as cond-mat/1012.3444,

Creighton K. Thomas, David A. Huse, A. Alan Middleton.

1. “Exact Algorithm for Sampling the 2D Ising Spin Glass”,

Physical Review E **80**, 046708 (2009), Creighton K. Thomas, A. Alan Middleton.

1. “Statistics of static avalanches in a random pinning landscape”,

Physical Review B **79**, 050101 (2009),

Pierre Le Doussal, A. Alan Middleton, Kay Joerg Wiese.

1. “Persistence and Memory in Patchwork Dynamics for Glassy Models”,

Physical Review B **77**, 092415 (2008),

Creighton K. Thomas, Olivia L. White, A. Alan Middleton.

1. “Matching Kasteleyn Cities for Spin Glass Ground States”,

Physical Review B **76**, 220406(R) (2007),

Creighton K. Thomas, A. Alan Middleton.

1. “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.

1. “Irrational mode locking in quasiperiodic systems”,Physical Review Letters **98**, 148001 (2007), Creighton K. Thomas, A. Alan Middleton.
2. “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,

1. “Effects of Disorder on Electron Transport in Arrays of Quantum Dots”,preprint with S. Jha, http://arxiv.org/abs/cond-mat/0511094.
2. “Linking Physics and Algorithms in the random-field Ising model”,preprint with Meinke, http://arxiv.org/abs/cond-mat/0502471.
3. “Exploring optimization for the random-field Ising model”,preprint archived as cond-mat/0501269,

D. Clay Hambrick, Jan H. Meinke, A. Alan Middleton.

1. “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.

1. “Improved extremal optimization for the Ising spin glass”,Physical Review E **69**, 055701 (2004), A. Alan Middleton.
2. “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.

1. “Percolation of unsatisfiability in finite dimensions",Physical Review E **70**, 035103(R) (4pp., 2004), J. M. Schwarz and A. Alan Middleton.
2. “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.

1. “The three-dimensional random field Ising magnet: interfaces, scaling,and the nature ofstates”,

Physical Review B **65**, 134411 (31 pp., 2002), A. Alan Middleton and Daniel S. Fisher.

1. “Critical slowing down in polynomial time algorithms”,Physical Review Letters **88**, 017202 (4 pp., 2002), A. Alan Middleton.
2. “Scaling, domains, and states in the four-dimensional random field Ising magnet”,preprint archived as cond-mat/0208182, A. Alan Middleton.
3. “Energetics and geometry of excitations in random systems”,Phys. Rev. B **63**, 060202(R) (4 pp., 2001), A. Alan Middleton.
4. “Viscoelastic Depinning of Driven Systems: Mean-Field Plastic Scallops”,

Physical Review Letters **85**, 1104-1107 (2000),

M. Cristina Marchetti, A. Alan Middleton, Thomas Prellberg.

1. “Disorder-Induced Topological Defects in a d=2 Elastic Medium atZero Temperature”,Physical Review B **61**, 14787-14790 (2000), A. Alan Middleton.
2. “Numerical investigation of the thermodynamic limit for ground states in models withquenched disorder”,

Physical Review Letters **83**, 1672-1675 (1999), A. Alan Middleton.

1. “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.

1. “Computational Complexity of Determining the Barriers to Interface Motion in Random

Systems”,

Physical Review E **59**, 2571-2577 (1999), A. Alan Middleton.

1. “Statistical Topography of Glassy Interfaces”,

Physical Review Letters **80**, 109-112 (1998),

Chen Zeng, Jané Kondev, David McNamara, and A. Alan Middleton.

1. “Ground-State Roughness of the Disordered Substrate and Flux Lines in d=2”,Physical Review Letters **77**, 3204-3207 (1996), Chen Zeng, A. Alan Middleton, Y. Shapir.
2. “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.

1. “Numerical Results for the Ground-State Interface in a Random Medium”,Physical Review **E52**, R3337 (1995). A. Alan Middleton.
2. “Self-Organized criticality in non-conserved systems”,Physical Review Letters **74**, 742 (1995). A. Alan Middleton and Chao Tang.
3. “Avalanches and the renormalization group for pinned charge-density waves”,Physical Review B **49**, 244 (1994).

Onuttom Narayan and A. Alan Middleton.

1. “Collective Transport in Arrays of Small Metallic Dots”,Physical Review Letters **71**, 3198 (1993). A. Alan Middleton and Ned S. Wingreen.
2. “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.

1. “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.

1. “Self-Organization and a Dynamical Transition in Traffic-flow Models,”Physical Review A **46**, R6124 (1993).

Ofer Biham, A. Alan Middleton, and Dov Levine.

1. “Elastic String in a Random Potential,”

Physical Review Letters **70**, 662 (1993).

M. Dong, A. Alan Middleton, M. Cristina Marchetti, and Valerii Vinokur.

1. “Dynamics of Directed Polymers with Cutting Interactions,”Physical Review A **45**, 7288 (1992).

Sergei E. Esipov and A. Alan Middleton.

1. “Thermal Rounding of the Charge Density Wave Depinning Transition,”Physical Review B **45**, 9465 (1992). A. Alan Middleton.
2. “Complete Mode-locking in Models of Charge-density Waves,”Physical Review Letters **68**, 1586 (1992).
   1. Alan Middleton, Ofer Biham, Peter B. Littlewood, and Paolo Sibani.
3. “Asymptotic Uniqueness of the Sliding State for Charge DensityWaves,”Physical Review Letters **68**, 670 (1992). A. Alan Middleton.
4. Reply to comment on “Critical Behavior of Pinned Charge-Density Waves below the Threshold for Sliding,”

Physical Review Letters **67**, 3873(1991).

* 1. Alan Middleton, Daniel S. Fisher, and Peter B. Littlewood.

1. “Critical Behavior of Pinned Charge-Density Waves below the Threshold for Sliding,”Physical Review Letters **66**, 92 (1991).
   1. Alan Middleton and Daniel S. Fisher.
2. “Discrete Scatterers and Autocorrelations of Multiply Scattered Light,”Physical Review B **43**, 5934 (1991).
   1. Alan Middleton and Daniel S. Fisher.
3. “11*B*(*α,p*)14*C*∗ (*Ex* = 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.

1. “The Deconfining Transition for Finite-temperature *U*(1) LatticeGauge Theory in (2+1)

Dimensions,”

Physics Letters **B175**, 64 (1986).

P. Coddington, A. Hey, A. A. Middleton, and J. Townsend.

# Teaching and Outreach

I have developed and taught courses ranging from large (300 student) introductory science courses through a course on graduate quantum mechanics. In my teaching, I have been dedicated in developing approaches that promote full student engagement and building facility with methods and fluency in the language of the course subject. My methods include deemphasizing long presentations in favor of student discussion, iwhite board work in small groups, small lab exercises (sometimes at the student’s desk), and demonstrations for engagement and demonstration of physical principles. My goal is to have reflective discussion and hands-on activities even in the most theoretical courses. I have moved to emphasizing frequent lower-stakes assessments. Assessments are all designed to include qualitative explanations, even for more mathematical derivations. My goals are for students to become more fluent in thinking in and speaking the language of science, to show facility in explaining everyday phenomena and technologies. This is of importance both for those becoming career scientists and those who will have only a couple of science courses in their university education.

I have created an Honors Course, “Seeing Light”, that involves students from all colleges and schools at Syracuse University in a historical, experimental, and philosophical exploration of vision and light. We start with a review of ancient Greek, Arabic, and Chinese observations and attendant models, frequently using (translated) primary source materials. The structure of the concepts is examined, along with their evolution over time. We see how the superseded models have remaining explanatory power and that different models of light and vision each have their realms of applicability. Students use experiments to test various crucial developments in theories of light and vision, ranging from earlier models to modern explanations of color, images, and quantum physics. Students using the diagrams in historical works as lab guides for their own experiments. I have also taught a seminar course for new majors. This course introduces the students to the active areas and benchmark papers in several modern areas of physics, introduces them to terminology and frameworks that physicists use in contemporary research, and encourages them to find research opportunities with faculty. The computational courses that I have taught focus on developing physical understanding and scientific conclusions through the use existing tool boxes and object-oriented programming, rather than the details of established numerical methods. I received the “Lunch on the Department” award for upper division undergraduate teaching in 2012 for my teaching in statistical physics.

Undergraduate courses

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

“Science for the 21st Century”, a lecture and lab course, with sections on light and matter including applications to nuclear energy and liquid crystal displays

“Science and Computers”, an upper division computer-lab oriented course emphasizing visualization and simulations for numerical solution and deeper understanding of physics.

“Statistical Mechanics and Thermodynamics”, a course for juniors and seniors which develops the deep connections between counting states, entropy, and quantum gases

“Journal Workshop in Physics”, a course for new majors that introduces them to landmark papers, current research questions, and careers in physics

“Problem Solving in Contemporary Physics”, a course for seniors that focuses on problem solving skills and alllows for exploration of career and graduate school opportunities

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

“Major Concepts of Physics II”’, a core course for non-majors, co-taught

Graduate Courses

“Science and Computers”, develops advanced skills in programming tools to solve scientific problems

“Quantum Mechanics II”, a second course in graduate quantum mechanics, where

I included applications to magnetic resonance imaging and quantum communication

“Condensed Matter Physics”, this course was based on the important text by Chaikin and Lubensky, and introduced students to the physical consequences of a variety of symmetries

“Solid State Physics”, a traditional crystals, band structure, and superconductivity course based on the text by Ashcroft and Mermin

Community Outreach

Visits to local schools, for physics demonstrations

Guest appearance on a local PBS show to discuss the science of chaos

Interview on local morning radio program to explain sightings of double rainbows

Presented “The Spectacular Science of Six-Sided Snow” at the Museum of Science and Technology

Coordinated visits by local high school students to shadow faculty and staff researchers

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

“Color Mixing via Polarization” awarded American Association Physics Teacher meeting prize.

I have mentored undergraduate students in multiple independent study courses and research projects.