Erica W. Carlson
Curriculum Vitae

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Education

University of California, Los Angeles
Ph.D., Theoretical Condensed Matter Physics 2000
Dissertation advisor: Prof. Steven A. Kivelson
M.S., Physics 1995

California Institute of Technology, Pasadena, CA
B.S., Physics 1994

Positions

Purdue University, West Lafayette, IN
150th Anniversary Professor of Physics and Astronomy 2018-Present
Professor Dept. of Physics and Astronomy 2013-Present
Associate Professor Dept. of Physics 2009-2013
Assistant Professor Dept. of Physics 2003-2009

École Supérieure de Physique et Chimie Industrielles, Paris 2010, 2020, 2022, 2023
Visiting Scientist Laboratoire de Physique et d'Étude des Matériaux

Argonne National Laboratory
Visiting Scientist Materials Science Division 2003

Boston University, Boston, MA
Postdoctoral Researcher Dept. of Physics with Prof. David K. Campbell 2000-2003

University of California, Los Angeles
Postdoctoral Researcher Dept. of Physics with Prof. Steven A. Kivelson Summer 2000
Research Assistant Dept. of Physics with Prof. Steven A. Kivelson 1996-2000

California Institute of Technology, Pasadena, CA
Research Assistant Dept. of Physics with Prof. Jerome Pine Summer 1993
- Experiment: Live neural networks embedded in silicon

Research Assistant Dept. of Chemistry with Prof. Peter Dervan Spring 1991
- Experiment: Binding constants of triple helical DNA

Emory University, Atlanta, GA
Research Assistant Dept. of Chemistry with Prof. Carl S. Hagan Summer 1991
- Experiment: Created new organic cage molecules with inorganic centers

Awards and Honors

Seed for Success Acorn Award (Purdue)	2022
Fulbright Scholar	2020
Book of Great Teachers (Purdue)	2018
150th Anniversary Professor	2018
Fellow, Center for Instructional Excellence (Purdue)	2016-2018
Charles B. Murphy Outstanding Undergraduate Teaching Award, Purdue (The University's highest teaching award)	2017
Fellow, Purdue Teaching Academy	2017
Fellow of the American Physical Society	2015
For theoretical insights into the critical role of electron nematicity, disorder, and noise in novel phases of strongly correlated electron systems and predicting unique characteristics. (DCMP)	
APS-IUSSTF Professorship Award in Physics	2013
Spira Award for Excellence in Undergraduate Teaching, Purdue Physics	2010
Spira Award for Excellence in Graduate Teaching, Purdue Physics	2009
Cottrell Scholar Award, Research Corporation	2006
College of Science Award for Outstanding Contributions to Undergraduate Education by an Assistant Professor	2006
Spira Award for Excellence in Undergraduate Teaching, Purdue Physics	2005
Outstanding Graduate Student Award, UCLA Physics	2001
University Postdoctoral Fellowship, Ohio State University (declined)	2000
Harvey Fellowship, Mustard Seed Foundation	1998-2000
Richardson Travel Award, UCLA Physics	1999
RA/Mentorship Fellowship, UCLA	1997-1998
Departmental Teaching Associate Award, UCLA Physics	1997
Graduate Opportunity Fellowship, UCLA	1994-1995
Summer Undergraduate Research Fellowship, Caltech	1993
Doris S. Perpall Speaking Award, Caltech	1993

Outreach and Community Engagement

See Examples at http://www.physics.purdue.edu/~erica/outreach/index.html

Outreach to the General Public and Students:

"The New Universes Inside of Quantum Materials," Public Lecture at the Aspen Center for Physics, part of the Disorder and Quantum Phases of Matter conference, December 2023

Co-PI on Innovation in Quantum Pedagogy, Application and its Relation to Culture (IQ-PARC) https://www.iqparc.com/

Launched new YouTube channel on Quantum Materials December 2023:
www.youtube.com/@TheQuantumAge (**80,000+ Views / 660+ Subscribers**)
New videos already released:
Welcome to The Quantum Age

Superconductors and Their Quantum Tricks

New videos completed but not yet released:

Novel Superconductors and the National Quantum Initiative | Laura Greene

Quantum Education Research | Chandralekha Singh

How Magnets Harness the Power of Quantum

Quantum Spin Ice and Magnetic Monopoles

To support the launch of The Quantum Age YouTube channel, these were also launched:

www.thequantumage.com (submitted for an industry microsite award)

The Quantum Age on LinkedIn

The Quantum Age on Twitter/X

Advertising campaign to support the channel

Quantum Periodic Table Workshop for Middle School Teachers (IQ-PARC), co-Organizer. (Teachers received 3 days of training as well as lesson plans and materials.) June 2023

Radioactivity Workshop for Middle School Teachers (IQ-PARC), co-Organizer. (Teachers received 3 days of training as well as lesson plans and materials.) July 2022

Quantum Workforce Panel Discussion at the 2nd Annual Quantum Summer School of the Quantum Science Center, Purdue University May 2022

“Lunch with the experts,” outreach to students, APS March meeting March 2022

Guest on Superheroes Of Science, Purdue CoS,
https://www.youtube.com/watch?v=SrvmdIU3hds November 2020

YouTube channel, youtube.com/QuantumCoffeehouse (**23,000+ Views; 1.3K+ Subscribers)**
for the Purdue Quantum Science and Engineering Institute May 2020
See the outreach playlists: Quantum Connections and Quantum Coffee Break

"Fractal Views on Quantum Matter," Presidential Colloquium Series, Purdue April 2019

Popular Level Video Series "Understanding the Quantum World" Released April 2019
https://www.thegreatcourses.com/courses/understanding-the-quantum-world.html
Best opening weekend of any course in the 2 years prior
Top ROI of all of the Great Courses in 2019

"Teaching@Purdue 2018" featuring the 150th Anniversary Professors discussing the Provost's Teaching & Learning Initiative Oct. 2018

President's Colloquium Series, Purdue University "Reductionism, Emergence, and Freedom: Are we bound by the laws of physics?" Sept., 2017

Eclipse Outreach to Cumberland Elementary School, West Lafayette, IN August, 2017

Outreach on Superconductivity to Harrison H.S., West Lafayette, IN May, 2017
Lunch with the Experts, outreach to graduate students, APS March Meeting 2017
Panelist,The Veritas Forum, Oregon State University 2017
Panelist, The Veritas Forum, Washington University, St. Louis 2017
YouTube Channel for Electric and Magnetic Interactions 2016
www.youtube.com/profcarlson (**228,000+ views; 5.4K Subscribers**)
Outreach on Big Bang, Universidad Científica del Sur, Villa El Salvador, PERÚ 2016
Outreach on Big Bang, Universidad Ricardo Palma, Santiago de Surco, PERÚ 2016
Interview with Modesto Montoya, "Encuentro con la Ciencia," PERÚ 2016
Outreach on Superconductivity to Harrison H.S., West Lafayette, IN 2016
Sample Lecture Recording for The Great Courses, "Quantum Mechanics,"
The Learning Company, Washington, DC 2015
Public Lecture at West Lafayette Public Library, "Quantum Mechanics in Plain English,"
https://nanohub.org/resources/22400 2015
Outreach on Magnetism to Cumberland Elementary School, West Lafayette, IN 2014
Outreach on Magnetism to Montessori Preschool, West Lafayette, IN 2014
Outreach on Superconductivity to Harrison H.S., West Lafayette, IN 2013
TEDx talk: “Are you more than your atoms?"
http://www.youtube.com/watch?v=fbU9l46Lz7c (**15,000+ views**) 2013
Outreach to Purdue Child Development Lab (CDL)
Preschool (Purdue) on Magnetism, for 2-3 year-olds 2012
Outreach on Superconductivity to Harrison H.S., West Lafayette, IN 2012
Outreach to CDL Preschool (Purdue) on Magnetism, for 3-5 year-olds 2011
Outreach on Superconductivity to Harrison H.S., West Lafayette, IN 2011
5 Public Lectures in Paris, FRANCE (*in French)* 2010
Outreach on Superconductivity to Harrison H.S., West Lafayette, IN 2009
Lunch with the Experts, outreach to graduate students, APS March Meeting 2007
Organize lunches/dinners for graduate women in physics at Purdue 2003-present
Interview with youtube.com/ScienceTheater
https://www.youtube.com/watch?v=xa4e-1Nuohg (**1,600+ views)** 2006
Research outreach and demonstrations, Harrison H.S., West Lafayette, IN 2005
Einstein *vs.* the Bug, stage show at the Purdue Bug Bowl 2004, 2005
Consultant for sciencetheater.net 2005-present
Panelist, Graduate Women in Science Program at Purdue 2004
Physics demonstrations at Bigelow Middle School, Newton, MA 2002
Science fair judge at Runkle Middle School, Brookline, MA 2001
Pathways Conference, Boston University
For high school girls interested in science and technology careers
- Mentor and Demonstrator 2001, 2003

Mentored graduate student women in physics, UCLA
- Organized highly attended lunch gatherings 1995-2000

Bountiful Harvest, Duarte, CA and Afikpo, Nigeria (nonprofit organization)
Agricultural and economic development in rural Nigeria
- Board of Directors 1998-present
- Creator and webmaster www.bountifulharvest.org 1998-present
- Spearheaded e-commerce collaboration with PCWorld magazine 1998

Harvey Fellows, Arlington, VA (nonprofit organization)
- Chair, Advisory Board 2002-2003
- Advisory Board Member 2001-2003

- Created and maintained alumni electronic listserv 1998-2003

Mentored middle school girls in a local youth club, Los Angeles, CA 1995-1998

Outreach talk: "The Secret Life of Electrons in Cuprate Oxides"

Purdue University, Undergraduate Honors Seminar 2004, 2005

Purdue University, REU Seminar (every summer) 2004-present

Purdue University, Graduate Research Seminar February 2004

Science Outreach to Religious Communities:

Invited Plenary Lecture, Palm Beach Atlantic University October 2023

Presentation to Grad Resources, Paris, FRANCE June 2023

Presentation *in French* to Groupes Bibliques Universitaires, Paris, FRANCE June 2023

Zoom interview for a Jesuit high school in Kaunas, Lithuania. February 2023

Invited Plenary Lecture at Annual Meeting of the American Scientific Affiliation July 2022

Interview *in French* (online) with Le Forum Veritas, Paris, FRANCE June 2022
https://www.youtube.com/watch?v=MIXzShs0QMg&t=20s

Interviewed on Science+God with Dr. G January 2022
https://www.accessmore.com/episode/Journey-88---Theres-More-to-You-Than-You-Can-Possibly-Imagine

Invited Respondent at the Annual Meeting of the American Scientific Affiliation July 2021
https://asa2021.us2.pathable.com/meetings/virtual/pjLACpRDNbN7dMNdw

Invited Participant at the Dabar Conference hosted by the Henry Center at Trinity Evangelical Divinity School (Deerfield, Illinois), “God saw that it was good: Uniting the Natural and Moral Order,” Participated in discussions *in French* with attendees from Institut Biblique de Nogent. June 2021

Interviewed on Christ and Culture Podcast (as part of the Science for Seminaries program of the American Association for the Advancement of Science, AAAS) January 2021
https://intersectproject.org/faith-and-science/erica-carlson-science-in-the-sanctuary/

Interviewed by Adam Hamilton, (reach of ~ 30,000) January 2021

Keynote Speaker, Southeastern Baptist Theological Seminary, Wake Forest, NC, as part of the Science for Seminaries program of the American Association for the Advancement of Science (AAAS) September 2020

"Quantum Physics and Emergence for Non-Experts." One of 7 invited presenters at the Dabar conference on Divine Action, Trinity Evangelical Divinity School, IL June 2019

"Quantum Mechanics for Everyone," 6th Annual Meeting of the Christian Scientific Society, Pittsburgh, PA
2018

Keynote Speaker, Concordia Seminary, St. Louis, MO, as part of the Science for Seminaries program of the American Association for the Advancement of Science (AAAS) April 2018

Teaching

Prof. Carlson has implemented course transformations in Phys 272 Electric and Magnetic Interactions in conjunction with Purdue's IMPACT Program, and was chosen to be part of Purdue's First in the World Grant.

In Fall 2014, I video recorded lectures of Phys 272, for future use as a resource for the Department. View the edited videos on the YouTube Channel here (editing completed 2016-2017): www.youtube.com/profcarlson

Purdue University, West Lafayette, IN

Instructor, Physics 344, Introduction to Quantum Science (sophomore phys majors) Fall 2023
Instructor, Physics 630 Adv. Theory of Electricity and Magnetism (graduate) Fall 2021, 2022
Instructor, Physics 645, Electron Theory of Solids I (graduate) Fall 2018; Fall 2019; Fall 2020
Instructor, Physics 646, Electron Theory of Solids II (graduate) Spring 2019, Spring 2021
Guest Speaker, HONR 399 "Purdue at 150" Spring 2019
Instructor and Coordinator, Physics 272 Electric and Magnetic Interactions (undergraduate) Fall 2012-2017
Instructor, Physics 630 Adv. Theory of Electricity and Magnetism (graduate) Spring 2011-2013
Instructor, Physics 172H Modern Mechanics Honors (undergraduate) Fall 2009, 2011
Instructor, Physics 545 Solid State Physics (undergraduate/ graduate) Spring 2004-2009
Instructor, Physics 416 Statistical Mechanics (honors physics majors) Fall 2004-2008

University of California, Los Angeles

Teaching Assistant Coordinator Office of Instructional Development 1996-2000
Trained and mentored incoming physics teaching assistants
New TA Orientation Seminar Leader Office of Instructional Development 1997, 1999
Teaching Associate Dept. of Physics and Astronomy 1996-1997
Teaching Associate Depts. of Art and Women's Studies 1999
Teaching Assistant Dept. of Physics and Astronomy 1994-1995

California Institute of Technology, Pasadena, CA

Dean's Tutor Office of the Undergraduate Dean 1994
Workshop Facilitator Summer Undergraduate Research Fellowship Office 1993
Peer Coach Summer Undergraduate Research Fellowship Office 1993
Private Tutor Pasadena, CA 1990-1994

Teaching Innovations

- YouTube Channel "Electric and Magnetic Interactions" online supplement for Phys 272 http://www.youtube.com/profcarlson (**228,000+ views; 5.4K Subscribers**).
- First college science course to be **podcast** on the iTunes music service: Physics 416 Thermal and Statistical Physics, Fall 2005.

- Lecture **blogs** provide summaries of class material and important student questions, including links to videos, simulations, and applets used in class. (See http://physics416.blogspot.com, http://physics545.blogspot.com).
- Set up a course **wiki**, an online document students create collaboratively, as a dynamic supplement to the course textbook.

Media Coverage of Research and Teaching Innovations / Media Appearances

1. Interviewed by Superheroes of Science (February 2024)
2. Interviewed for Purdue Experts series. (January 2024) These videos are available to journalists to quote in video, radio, or print.
3. "Boilermakers granted rare opportunity for hands-on experience with a quantum computer" by Cheryl Pierce, Interactions (Dept. of Physics and Astronomy, April 2024)
4. Carlson is quoted in "At a WSU Vancouver lab, researchers test a sweet solution to faster, cleaner computers," Oregon Public Broadcasting, December 2023.
5. "Neuromorphic computing will be great… if hardware can handle the workload," Purdue News, October 2023. Also picked up by EurekAlert! (AAAS), Tech Xplore, and Nanowerk
6. "Researchers at Purdue discover superconductive images are actually 3D and disorder-driven fractals," Purdue News, May 2023. Also picked up by EurekAlert (AAAS) and Phys.org
7. "Quantum Summer School is Just Around the Corner," Campus Technology, April 2022 mentions youtube.com/quantumcoffeehouse
8. "US Department of Defense Awards $2.8M to Purdue University Scientists for Quantum Education Program," Inside Quantum Technology News, October 2021
9. "U.S. Department of Defense awards $2.8M to Purdue University scientists for quantum education program," by Cheryl Pierce, Purdue News, October 2021
10. "Quantum Coffeehouse and other physics videos," nanoscale.blogspot.com by Doug Natelson, July 13, 2020
11. "Twelve Christian Women in Science You Should Know," Rebecca Randall, Christianity Today, Feb. 17, 2020
12. "Purdue breaks its record with faculty Fulbright Scholars," Purdue Today, May 3, 2019
13. "Scientists discover fractal patterns in a quantum material," MIT News, October 16, 2019
14. "Erica Carlson named 150th Anniversary Professor," Purdue Today, Feb.7, 2018
15. "Murphy Award: Erica Carlson," Purdue Today, Apr. 21, 2017 https://www.purdue.edu/newsroom/purduetoday/releases/2017/Q2/murphy-award-erica-carlson.html
16. "Science professors earn top Purdue teaching awards," College of Science News
17. Guest on Mysteries at the Museum, Season 11, Episode #5 "Black Knight UFO" about Purdue Alumnus and Astronaut Jerry Ross. First aired 7/29/16
18. Interview with Modesto Montoya, "Encuentro con la Ciencia," PERU, https://www.youtube.com/watch?v=o--Trq3HH2E , June 17, 2016
19. Quantum Mechanics public lecture is front page of Purdue's student newspaper, the Exponent, April 16, 2015. tinyurl.com/carlson-quantum
20. www.purdue.edu home page highlights Carlson Group Research, Sept. 21-27, 2012
21. "Purdue U Finds Evidence Imperfections Boost T_c in Cuprates," by Klaus Neumann, Superconductor Week, October 2012
22. "Fractal calculus may help explain superconductivity," Waves and Packets, August 25, 2012

23. “Superconductor ‘flaws’ could be key to its abilities,” by Elizabeth Gardner, R&D Magazine August 2012
24. “Superconductivity associated with fractal structure of nanoscale electron lines,” by Siv Schwink, University of Illinois at Urbana-Champaign, June 2012
25. Interviewed *(in French)* by Radio France Internationale, June 2012
26. “Where there’s a wiki, there’s a way,” by Amira Zamin, Insights Magazine, Purdue College of Science, Fall/Winter 2007
27. "Professor honored for teaching, soft matter research,” by Tanya Brown, Journal and Courier, June 12, 2006
28. “Missed Class? Try a Podcast,” by Jodi S.Cohen, Chicago Tribune, Front page, Oct. 20, 2005
29. “Listen While You Learn,” by Abe Aamidor, Indianapolis Star, December 18, 2005

Public Service

Visit with the local office of US Congressional Rep. Jim Baird — Fall 2019
Scientific advice on pandemic management sent to their office — Spring 2020

Capitol Hill visits with the American Physical Society, Washington, DC — March 9, 2006
(the only participant from Indiana)
Meetings with the offices of Sen. Evan Bayh, Sen. Richard Lugar, Rep. Steve Buyer, Rep. Julia Carson, Rep. Mike Pence

I occasionally correct physics articles at wikipedia.org

Areas of Research

- Multiscale Theory of Scanning Probe Experiments
- Pattern Formation in Strongly Correlated Electronic Systems
- Condensed matter theory of quantum materials
- Liquid crystalline vortex matter in type II superconductors
- Theory and phenomenology of high temperature superconductivity
- Stripe phases in doped antiferromagnets
- Noise and nonequilibrium behavior of stripe phases
- Granular superconductors
- Analytic work and Monte Carlo simulations of the XY and Ising models
- Field Theory and Bosonization of one dimensional electronic systems
- Dimensional crossover
- Spin Waves in Stripe Ordered Phases

Professional Activities

Session Chair, Quantum in Complex Matter, Ischia, ITALY — June 2024
Organized March Meeting Symposium, — 2024
“Quantum Materials for Neuromorphic Computing”
Member, American Physical Society, Division of Condensed Matter Physics — 1997-present
Member, American Association for the Advancement of Science — 2022-present
Presentation Coaching by Melissa Harris — Spring 2023
Presentation Training by Duarte.com — July 2019

Editorial Board, Nature Partner Journal Quantum Materials,	2017-Present
Elected Member-At-Large, DCMP Executive Committee of the APS	2016-2019
Media Training through PulsePoint and Purdue	July 2018
Session Chair, Gordon Research Conference on Correlated Electron Systems	June 2016
Communication Skills for Women	August 2015
Participant, Purdue Quantum Center Kickoff Workshop	October 2015
Session Chair, International Conference on Superstripes, Ischia, Italy	July 2015
Session Chair, International Conference on Superstripes, Erice, Italy	July 2014
Session Chair, Overarching issues in the Theory of Highly Correlated Electronic Fluids	June 2014
Assistant Editor for Materials & Mechanisms of Superconductivity	2012
Session Chair, 55th International School of Solid State Physics, Erice, Italy	July 2012
Review Panel for CMP, National Science Foundation	February 2012
Session Chair, Quantum Phenomena in Complex Matter, Rome, Italy	July 2011
Session Chair, Quantum Phenomena in Complex Matter, Erice, Italy	July 2010
Review Panel for PREM, National Science Foundation	May 2009
Session Chair, FeAs High T_c Superconducting Multilayers	December 2008
Session Chair, Quantum Phenomena in Complex Matter, Erice, Italy	July 2008
Session Chair, APS March Meeting	March 2008
Review Panel for I2CAM, National Science Foundation	January 2008
Session Chair, APS March Meeting	March 2007
Co-Organizer, Workshop on Pseudogaps in Strongly Correlated Metals, Aspen Center for Physics	Summer 2004
Visiting Scientist, Materials Science Division, Argonne National Laboratory	July 2003
Session Chair, Workshop on Complex Quantum Order, Aspen Center for Physics	February 2003
Visitor, Aspen Center for Physics	August 2002
Session Chair, APS March Meeting	March 2002

Selected Academic Service

Promotions Subcommittee	2023-2024
Advanced Materials Faculty Search Committee	2024
Chair, Condensed Matter Theory Faculty Search	2021-2022
CoS Area Committee	2020-2022
Presented nomination to University Bement Award Committee	May 2021
Physics and Astronomy Head Search Advisory Committee	2020-2021
University Faculty Advancement Committee	2018-2019
IPC Member (2 junior faculty), presented case 2018	2016-present
IPC Chair (2 junior faculty), presented cases 2017, 2019	2016-2018; 2019-present
Promotions Subcommittee	2017-2019
Mentor (2 junior faculty)	2015-present
Presentation at New TA Orientation Days, Purdue University	August 2017
Ombudsman, Physics and Astronomy Department	2014-2023
Facilitator, Search Committee Training Workshops for the University	2015-2018
Hubert M. James Lecture Series Member	2014-2019
Hubert M. James Lecture - Hosted Andrea Ghez	2016
Physics Advisory Committee, Purdue	2004-2006; 2014-2016

Chair, Physics Advisory Committee, Purdue	2015-2016
Diversity Committee	2013-2018
Graduate-Faculty Committee, Purdue	2004-2017
Referee for NSF, Phys. Rev. Lett., Phys. Rev. B, JPCS	1998-present
Area Committee Alternate	2015-2018
Family Day, College of Science, Purdue	2015
Chair, Physics and Astronomy Head Search Advisory Committee, College of Science	2014-2015
College of Science Elections Committee	2009-2011
Selection Committee, CoS Award for Outstanding Contributions to Undergraduate Education by an Assistant Professor	2010
Institutional Communication Strategy (university)	Fall 2009
University Electronic Communications Committee	Fall 2008
Various Faculty Search Committee(s), Purdue	2003-2015; 2017-2019
Qualifying Exam Committee, Purdue	Fall 2003, Spring and Fall 2004
Graduate Core Review Committee, Purdue	Fall 2003
Graduate Examinations Review Committee, UCLA	1999
Graduate Representative to Academic Affairs Committee, UCLA	1999
Graduate Representative to Department Review, UCLA	1999

Research Publications

Superscripts denote Carlson group members: (U) undergraduate student; (G) graduate student; (P) postdoc.

Google Scholar profile https://tinyurl.com/ewcarlson-googlescholar

ORCID https://orcid.org/0000-0003-2162-5301

49) S. Anand[G], R. Ramachandran, J. Levy, E. W. Carlson, "Modeling Field-Induced Transverse Conduction in Coupled Quantum Wires," *manuscript in preparation, to be submitted to Phys. Rev. B.*

48) J. J. Sickle, E. W. Carlson, A. Zimmers, W. Wright, A. Ilgen, K. A. Dahmen, "Are mega-basins causing mega-earthquakes?" *manuscript in preparation*.

47) A. Rajapurohita[U], P.-Y. Chen[U], F. Simmons[G], S. Basak[G], M. Alzate Banguero, P. Salev, I. K. Schuller, L. Aigouy, A. Zimmers, and E. W. Carlson, "Resistor Network for VO2" *manuscript in preparation, to be submitted to Phys Rev. B.*

47) Zhuoqun Fang, Melissa Alzate-Banguero, Amit R. Rajapurohita[U], Forrest Simmons[G], Erica W. Carlson, Zhuoying Chen, Lionel Aigouy, Alexandre Zimmers, "Tuning the Resistance of a VO2 Junction with a Focused Laser Beam and Atomic Force Microscopy," *submitted to Advanced Electronic Materials* (2024)

46) M. Alzate Banguero, S. Basak[G], N. Raymond, F. Simmons[G], P. Salev, I. K. Schuller, L. Aigouy, E. W. Carlson, A. Zimmers, "Correlative mapping of local hysteresis properties in VO_2," https://arxiv.org/abs/2301.04220

45) S. Basak[G], Y. Sun[G], M. Alzate Banguero, P. Salev, I. K. Schuller, L. Aigouy, E. W. Carlson, A. Zimmers, "Spatially Distributed Ramp Reversal Memory in VO_2," *Advanced*

Electronic Materials aelm.202300085 (2023). *Chosen for the Back Cover of the Journal.* Media Coverage: **EurekAlert! (AAAS), Tech Xplore, Nanowerk, Purdue News**, and **Purdue Today**

44) C.-L. Song, E. J. Main, F. Simmons[G], S. Liu[G], B. Phillabaum[G], K. A. Dahmen, E. W. Hudson, J. E. Hoffman, and E. W. Carlson, "Critical Nematic Correlations Throughout the Superconducting Doping Range in BSCO," *Nature Communications* **14,** 2622 (2023). Media Coverage: **EurekAlert! (AAAS)**, **Phys.org**, and **Purdue News**

43) S. Basak[G], M. Alzate Banguero, L. Burzawa[U], F. Simmons[G], P. Salev, I. K. Schuller, M.M. Qazilbash, D. N. Basov, L. Aigouy, A. Zimmers, and E. W. Carlson, "Deep Learning Hamiltonians from Disordered Image Data in Quantum Materials," *Physical Review B* **107**, 205121 (2023).

42) S.Liu[G], E. W. Carlson, and K. A. Dahmen, " Connecting complex electronic pattern formation to critical exponents," *Condensed Matter* 6, 39 (2021).

41) S. Basak[G], K. A. Dahmen, E. W. Carlson, "Period Multiplication Cascade at the Order by Disorder Transition in the Uniaxial Random Field XY Magnet," *Nature Communications* 11, 4665 (2020).

40) J. Li, J. Pelliciari, C. Mazzoli, S. Catalano, F. Simmons[G], M. Gibert, E. W. Carlson, J.-M. Triscone, S. Wilkins, R. Comin, "Scale-invariant magnetic textures in a strongly correlated oxide," *Nature Communications, 10, 4568 (2019).* (Top 50 articles in Nature Communications 2019)

39) L. Burzawa[U], S. Liu[G], and E. W. Carlson, "Classifying pattern formation in strongly correlated electronic systems via machine learning," *Physical Review Materials, 3, 033805 (2019).*

38) K.W. Post, A. S. McLeod, M. Hepting, M. Bluschke, Y. Wang[G], G. Cristiani, G. Logvenov, A. Charnukha, A. Pasupathy, A. V. Boris, E. Benckiser, K. A. Dahmen, E. W. Carlson, B. Keimer, D. Basov, "Coexisting first- and second-order electronic phase transitions in a correlated oxide," *Nature Physics 14, 1056* (2018).

37) S. Basak[G] and E. W. Carlson, " Distinguishing XY from Ising Electron Nematics," *Physical Review B* 96, 081303(R) (2017).

36) S. Liu[G], B. Phillabaum[G], E. W. Carlson, K. A. Dahmen, N. S. Vidhyadhiraja, M. M. Qazilbash, and D. N. Basov, "Random Field Driven Spatial Complexity at the Mott Transition in VO2," *Physical Review Letters*, 116, 036401 (2016).

35) E. W. Carlson, "Charge Topology in Superconductors," *Nature* 529, 329 (2015).

34) E. W. Carlson, S. Liu[G], B. Phillabaum[G], and K. A. Dahmen, "Decoding Spatial Complexity in Disordered Strongly Correlated Electronic Systems" J. Supercond. and Novel Magnetism, 28, 1237 (2015).

33) W.-J. Li[G], D.-X. Yao[P], and E. W. Carlson, “Tunable Peltier Nano-Cooling Device from Geometric Effects Using a Single Graphene Nanoribbon,” *Frontiers in Physics,* 9, 427 (2014). *Journal Cover.*

32) B. Phillabaum[G], E. W. Carlson, and K. A. Dahmen, “Spatial Complexity Due to Incipient Electronic Nematicity in Cupratess,” *Nature Communications* 3, 915 (2012).

31) S. Liu[G] and E. W. Carlson, “Thermoelectric Figure of Merit as a Function of Carrier Propagation Angle in Semiconducting Superlattices,” *Appl. Phys. Lett.,* 99, 102101 (2011).

30) E. W. Carlson and K. A. Dahmen, "Using Disorder to Detect Locally Ordered Electron Nematics via Hysteresis," *Nature Communications* 2, 379 (2011).

29) D.-X. Yao[P], J. Gustafsson, E. W. Carlson, and A. W. Sandvik, "Quantum Phase Transitions in Disordered Dimerized Quantum Spin Models and the Harris Criterion," Phys. Rev. B. 81, 224207 (2010).

28) Y. L. Loh[P], E. W. Carlson, and K. A. Dahmen, "Noise Predictions for STM in Systems with Local Electron Nematic Order," Phys. Rev. B. 81, 224207 (2010).

27) S. Li, D.-X. Yao[P] Y. Qiu, H. J. Kang, E. W. Carlson, J. P. Hu, G. Chen, N. Wang, and P. Dai, "Low-energy Ce spin excitations in CeFeAsO and CeFeAsO0.84F0.16," Frontiers of Physics in China 5, 161 (2010).

26) D.-X. Yao[P] and E. W. Carlson, "Magnetic Excitations of Undoped Iron Oxypnictides," Frontiers of Physics in China 5, 166 (2010).

25) P. G. Freeman, S. M. Hayden, C. D. Frost, M. Enderle, D.-X. Yao[P], E. W. Carlson, D. Prabhakaran, and A. T. Boothroyd, "Inward Dispersion of the Spin Excitation Spectrum of Stripe-Ordered $La_2NiO_{4+\delta}$," *Phys. Rev. B*, 80, 144523 (2009).

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23) Y. L. Loh[P], D.-X. Yao[P], and E. W. Carlson, “Close-packed Dimers on the Triangular Kagome Lattice,” arXiv:0803.0742, *Phys. Rev. B* 78, 224410 (2008).

22) J. Zhao, D.-X. Yao[P], S. Li, T. Hong, Y. Chen, S. Chang, W. Ratcliff, J. W. Lynn, H. A. Mook, G. F. Chen, J. L. Luo, N. L. Wang, E. W. Carlson*, J. P. Hu, and P. Dai, "Low energy Spin Waves and Magnetic Interactions in $SrFe_2As_2$," *Phys. Rev. Lett.,* 101, 167203 (2008).

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20) D.-X. Yao[P], Y. L. Loh[P], E. W. Carlson, and M. Ma, “XXZ and Ising Spins on the Triangular Kagome Lattice,” *Phys. Rev. B,* 78, 024428 (2008).

19) Y. Jiang, D.-X. Yao[P], E. W. Carlson, H.-D. Chen, and J. P. Hu, “Andreev Conductance in the *d+id*-wave Superconducting States of Graphene,” *Phys. Rev. B,* **77**, 235420 (2008).

18) B. Phillabaum[U] and E. W. Carlson, “Harmonic Peaks of Stripe Phases in Cuprates,” *Phys. Rev. B*, **77,** 104526 (2008).

17) Y. L. Loh[P], D.-X. Yao[P], and E. W. Carlson, “Thermodynamics of Ising Spins on the Triangular Kagome Lattice: Exact Analytic Methods and Monte Carlo Simulations,” *Phys. Rev. B*, **77**, 134402 (2008).

16) D.-X. Yao[P] and E. W. Carlson, “Incompatibility of Modulated Checkerboard Patterns with the Neutron Scattering Resonance Peak in Cuprate Superconductors,” *Phys. Rev. B,* **77**, 024503 (2008). Selected for the Jan. 15, 2008 issue of the Virtual Journal of Applications of Superconductivity.

15) Y. L. Loh[P], E. W. Carlson, and M. Y. J. Tan, “Bond-Propagation Algorithm for Thermodynamic Functions in General 2D Ising Models,” *Phys. Rev. B,* **76**, 014404 (2007).

14) Y. L. Loh[P] and E. W. Carlson, “Using Inhomogeneity to Raise Superconducting Transition Temperatures,” *Phys. Rev. B*, **75**, 132506 (2007).

13) D. X. Yao[P] and E. W. Carlson, “Spin-Wave Dispersion in Half-Doped La3/2 Sr1/2 NiO4,” *Phys. Rev. B,* 75, 012414 (2007).

12) Y. L. Loh[P] and E. W. Carlson, “Efficient Algorithm for Random Bond Ising Models in 2D,” *Phys. Rev. Lett.,* 97, 227205 (2006).

11) D. X. Yao, E. W. Carlson, and D. K. Campbell, "Magnetic Excitations of Stripes Near a Quantum Critical Point," *Phys. Rev. Lett.*, 97**,** 017003 (2006).

10) D. X. Yao, E. W. Carlson, and D. K. Campbell, "Magnetic Excitations of Stripes and Checkerboards in Cuprates," *Phys. Rev. B*, 73, 224525 (2006).

9) E. W. Carlson, K.A. Dahmen, E. Fradkin, S.A.Kivelson, “Hysteresis and Noise from Electronic Nematicity in High Temperature Superconductors,” *Phys. Rev. Lett.,* 96, 097003 (2006).

8) E. W. Carlson, D. X. Yao, and D. K. Campbell, "Spin Waves in Striped Phases," Phys. Rev. B, 70**,** 064505 (2004).

7) E. W. Carlson, A. H. Castro Neto, and D. K. Campbell, "Reply to Comment on Vortex Liquid Crystals in Anisotropic Type II Superconductors," *Phys. Rev. Lett.* 92, 209702 (2004).

6) E. W. Carlson, A. H. Castro Neto, and D. K. Campbell, “Vortex Liquid Crystals in Anisotropic Type II Superconductors,” *Phys. Rev. Lett.*, 90, 087001 (2003).

5) E. W. Carlson, D. Orgad, S. A. Kivelson, and V. J. Emery, “Stripes, Electron Fractionalization, and ARPES,” *J. Phys. Chem. Sol.*, 63, pp. 2213-2218 (2002).

4) D. Orgad, S. A. Kivelson, E. W. Carlson, V. J. Emery, X. J. Zhou, and Z.-X. Shen, “Evidence of Electron Fractionalization from ARPES Spectra in the High Temperature Superconductors,” *Phys. Rev. Lett.*, 86, pp. 4362-4365 (2001).

3) E. W. Carlson, S. A. Kivelson, D. Orgad, and V. J. Emery, “Dimensional Crossover in Quasi-One-Dimensional and High T_c Superconductors,” *Phys. Rev. B*, 62, pp. 3422-3437 (2000).

2) E. W. Carlson, S. A. Kivelson, V. J. Emery, and E. Manousakis, “Classical Phase Fluctuations in High-Temperature Superconductors,” *Phys. Rev. Lett*., 83, pp. 612-615 (1999).

1) E. W. Carlson, S. A. Kivelson, Z. Nussinov, and V. J. Emery, “Doped Antiferromagnets in High Dimension,” *Phys. Rev. B*, 57, pp. 14704-14721 (1998).

Book Contributions

2) Contributed the articles entitled "Nature," "Quantum Vacuum State," and "James Clerk Maxwell" to the "Dictionary of Christianity and Science," ed. P. Copan, T. Longman III, C. L. Reese, and M. Strauss (Zondervan, 2017).

1) E. W. Carlson, V. J. Emery, S. A. Kivelson, D. Orgad, “Concepts in High Temperature Superconductivity,” in "The Physics of Superconductors," ed. K.H. Bennemann and J.B. Ketterson (Springer-Verlag 2004), 180 pages. Updated version to appear in Springer Handbook of Physics, 2007.

Selected Research Presentations

** Most APS contributed talks are suppressed.**

109) “Spontaneous Electronic Fractals in Disordered Quantum Materials,” **Invited Talk**, conference on Topology and Correlations in Crystals and Quantum Matter, Les Houches, FRANCE, September 2024. *(upcoming)*

108) “Fractal Electronic Textures in Quantum Materials,” **Invited Talk** at Quantum in Complex Matter, Ischia, ITALY, June 2024. *(upcoming)*

107) “Universality and Electronic Fractals in Quantum Materials,” **Invited Talk**, American Physical Society, March Meeting, Minneapolis, MN, March 2024

106) “Deep Learning Complexity in Neuromorphic Quantum Materials,” Virtual Seminar, Quantum Science Center and Elmore ECE Emerging Frontiers Center, Purdue University, February 2024.

105) “Critical Nematic Correlations throughout the Superconducting Doping Range in BSCO,” **Invited Talk** at Disorder and Quantum Phases of Matter, Aspen Center for Physics, December 2023.

104) “Critical Nematic Correlations throughout the Superconducting Doping Range in BSCO,” Seminar, École Supérieure de Physique et de Chimie Industrielles, Paris, FRANCE, June 2023

103) “New phases of matter in quantum materials,” **Colloquium**, Purdue University, January 2023

102) “Critical Nematic Correlations throughout the Superconducting Doping Range in BSCO” **Invited Talk** at the International Conference on Quantum Materials and Technologies, Milas-Bodrum, TURKEY, October 2022

101) “Critical Nematic Correlations throughout the Superconducting Doping Range in BSCCO” **Invited Talk** at Superstripes 2022, Frascati-Rome, ITALY, June 2022 (delivered online)

100) “AI-enhanced detection of Fractal Electronic Textures in Vanadium Dioxide ” Seminar, École Supérieure de Physique et de Chimie Industrielles, Paris, FRANCE, June 2022

99) “Fractal Electronic Textures in Quantum Materials,” **Nico van Kampen Colloquium Series** at Utrecht University, Utrecht, THE NETHERLANDS, April 2022 (delivered online)

98) “Critical Nematic Correlations throughout the Doping Range in BSCCO,” Seminar, University of Illinois at Urbana-Champaign, October 2021 (delivered online)

97) “New Phases of Matter in Quantum Materials,” **Colloquium**, University of Southern California, Los Angeles, September 2021 (delivered online)

96) “Bulk vs. Surface Charge Order in Bi-2201,” **Invited Talk** at Quantum Complex Matter, Rome Frascati, ITALY, June 2021 (delivered online)

95) “New Phases of Matter in Quantum Materials,” **Colloquium**, University of British Columbia, CANADA, April 2021 (delivered online)

94) “Fractal Views on Quanum Materials,” Seminar, University of British Columbia, CANADA, February 2021 (delivered online)

93) “Fractal Views on Quantum Materials,” part of the international series *Frontiers of Condensed Matter Physics,* (online, organized by Yasutomo Uemura) Columbia University, February 2021

92) "Critical Pattern Formation at the Mott Metal-Insulator Transition," **Colloquium** for University of Pittsburgh and Carnegie Mellon, Pittsburgh, PA, November 2020 (delivered online)

91) "Universal Pattern Formation at the Mott Transition," **Invited Talk** at Quantum Complex Matter, Ischia, ITALY, June 2020 (delivered online)

90) "Critical Pattern Formation at the Mott Metal-Insulator Transition," Seminar, École Supérieure de Physique et de Chimie Industrielles, Paris, FRANCE, May 2020 (delivered online)

89) "Fractal Views on Quantum Materials: Learning Physics From Surface Probe Images," **Invited Talk** at Machine Learning Quantum Matter, Flatiron Institute, New York, January 2020

88) "Fractal Views on Quantum Materials," Purdue Quantum Science and Engineering Institute, December 2019

87) "Universality of Electronic Fractals in Correlated Oxides," **Invited Talk** at Quantum Complex Matter, Ischia, ITALY, June 2019

86) "Technology in the Physics Classroom," **Invited Talk** at Transforming Education for Student Success, Purdue University, March 2019

85) "Universal Pattern Formation in Correlated Oxides," **Colloquium***,* University of Illinois, Urbana-Champaign*,* September 2018

84) "Universal Pattern Formation in Correlated Oxides," **Invited Talk** at Quantum Complex Matter, Rome Frascati, ITALY, June 2018

83) "Distinguishing XY from Ising Nematics," **Seminar**, California Institute of Technology, March 2018

82) "Spatial Complexity in Correlated Electronic Systems," **Colloquium**, Wheaton College, Wheaton, IL, April 2018

81) "Spatial Complexity and Universality in Correlated Electronic Systems," **Joan van der Waals Colloquium Series** at the Leiden Institute of Physics, NETHERLANDS, January 2018

80) "Spatial Complexity and Universality in Correlated Electronic Systems," **Seminar** at University of Texas, Austin, January 2018

79) "Decoding Spatial Complexity in Strongly Correlated Electronic Systems," **Colloquium** at Oregon State University, April 2017

78) "Spatial Complexity in Correlated Electronic Systems," **Invited Talk**, American Physical Society, March Meeting, 2017, New Orleans, LA
https://absuploads.aps.org/presentation.cfm?pid=13341

77) "Decoding Spatial Complexity in Strongly Correlated Electronic Systems," **Theory Seminar**, Washington University St. Louis, March 2017

76) "Complejidad Espacial en Sistemas Electrónicos Fuertemente Correlacionados," (with Spanish translation by Fe Aguayo) **Colloquium**, Universidad Nacional de Ingeniería, Lima, PERU, June 2016

75) "Charge vs. Superconductivity," **Invited Talk**, Gordon Research Conference on Correlated Electronic Systems, South Hadley, MA, June 2016

74) "Random Field Driven Spatial Complexity at the Mott Transition in VO2," American Physical Society, March Meeting, 2016, Baltimore, MD

73) "Decoding Spatial Complexity in Strongly Correlated Electronic Systems," **Colloquium** at Wesleyan University, February 2016

72) "Decoding Spatial Complexity in Strongly Correlated Electronic Systems," **Colloquium** at Boston University, January 2016

71) "Decoding Spatial Complexity of Local Charge Modulations in Superconducting Pb-Bi-2201," American Physical Society, March Meeting, 2015, San Antonio, TX

70) "Decoding Spatial Complexity in Strongly Correlated Electronic Systems," **Colloquium** at University of California Davis, October 2015

69) "Spatial Complexity of Cuprate Superconductors and Other Oxides," **Invited Talk** at Superstripes 2015 Conference on Novel Superconductivity, Magnetism, Ferroelectric, Thermoelectric, and Multiferroic Phenomena in Complex Materials, Ischia, ITALY, June 2015

68) "Decoding Spatial Complexity in Strongly Correlated Electronic Systems," **Seminar** at the National High Magnetic Field Lab, Florida State University, April 2015

67) "Decoding Spatial Complexity of Local Charge Modulations in Superconducting Pb-Bi-2201," **Seminar** at University of Illinois at Urbana-Champaign, February 2015

66) "Random Field Driven Spatial Complexity at the Mott Transition in VO2," **Invited Talk** at Indo-US Workshop on Nanomaterials for Energy, Discovery Park, Purdue University. September 2014

65) "Decoding Spatial Complexity in Strongly Correlated Electronic Systems," **Invited Talk** at Superstripes 2014, at the Ettore Majorana Foundation and Centre for Scientific Culture, Erice, ITALY, July 2014

64) "New Geometric Universality Classes Shed Light on Scanning Probe Data," **Seminar** at University of Cincinnati, Cincinnati, OH, March 2014

63) "Spatial Complexity in Bi-2212 and Bi-2201," **Seminar** at Harvard University, Boston, MA, May 2013

62) **TEDx talk**: "Are You More Than Your Atoms?" **Invited Talk** at TEDxPurdueU, Purdue University, April 2013 http://www.youtube.com/watch?v=fbU9l46Lz7c (**15,000+ views**)

61) **Lecture Series** on Strongly Correlated Electronic Systems at Jawaharlal Nehru Center for Advanced Scientific Research (JNCASR), Bangalore, INDIA, April 2013

60) "Living the good life: Pursuing Excellence as a Scientist and as a Teacher," **Invited Talk** sponsored by the Forum on Education, March Meeting of the American Physical Society, Baltimore, MD, March 2013

59) "Decoding Spatial Complexity in Strongly Correlated Systems," **Physical Chemistry Seminar**, Purdue University, West Lafayette, IN, January 2013

58) "Decoding Spatial Complexity in Strongly Correlated Systems," **Colloquium**, Purdue University, West Lafayette, IN, August 2012

57) "A Fractal Nematic Superconductor," **Colloquium** at Emory University, Atlanta, GA, October 2011

56) "Spatial Complexity Due to Incipient Electronic Nematicity in Cuprates," **Invited Talk** at Quantum Phenomena in Complex Matter & Quantum Physics of Living Matter, Università di Roma La Sapienza, Rome, ITALY, July 2011

55) "Spatial Complexity Due to Incipient Electronic Nematicity in Cuprates," **Seminar** at Brookhaven National Laboratory, Upton, NY, May 2011

54) "Spatial Complexity Due to Incipient Electronic Nematicity in Cuprates," **Invited Talk** at the Workshop on Large Fluctuations & Collective Phenomena in Disordered Materials, Institute for Condensed Matter Theory, University of Illinois at Urbana-Champaign, May 2011

53) "Detecting Disordered Electron Nematics," Seminar at University of Illinois at Urbana-Champaign, February 2011

52) "Detecting Disordered Electron Nematics," **Invited Talk** at the 47th International School of Solid-State Physics: Quantum Phenomena in Complex Matter, Ettore Majorana Foundation and Centre for Scientific Culture, Erice, ITALY, July 2010

51) "Using Disorder to Detect Local Order: Noise and Nonequilibrium Effects in Disordered Electron Nematics," University of Cambridge, UNITED KINGDOM, April 2010

50) "Using Disorder to Detect Local Order: Noise and Nonequilibrium Effects in Disordered Electron Nematics," Université Paris-Sud, Orsay, FRANCE, April 2010

49) "Using Disorder to Detect Local Order: Noise and Nonequilibrium Effects in Disordered Electron Nematics," University of Oxford, UNITED KINGDOM, March 2010

48) "Using Disorder to Detect Local Order: Noise and Nonequilibrium Effects in Disordered Electron Nematics," École Supérieure de Physique et de Chimie Industrielles de la Ville de Paris, FRANCE, February 2010

47) "Magnetic Excitations in the Iron-Based Superconductors", **Invited Talk** at FeAs High Tc Superconducting Multilayers and Related Phenomena, Università di Roma La Sapienza, Rome, ITALY, December 2008

46) "Electronic Noise Due to Thermal Stripe Switching," **Seminar**, University of Heidelberg, GERMANY, December 2008

45) "Stripe Switching Noise in Cuprate Superconductors: Predictions For Local STM Noise", **Invited Talk** at the 6th International Stripes Conference, Quantum Phenomena in Complex Matter, Ettore Majorana Foundation and Centre for Scientific Culture, Erice, ITALY, July 2008

44) E. W. Carlson, D. X. Yao, D. K. Campbell, “Magnetic Excitations of Stripes Near a Quantum Critical Point”, **Invited Talk** at the Theoretical and Experimental Magnetism Meeting organized by the Centre for Materials Physics and Chemistry and the Institute of Physics Magnetism Group, Abingdon, Oxfordshire, UNITED KINGDOM, July 2007

43) E. W. Carlson, B. Phillabaum, Y. Loh, K. A. Dahmen, E. Fradkin, and S. A. Kivelson, “Hysteresis and Noise from Electronic Nematicity in High Temperature Superconductors,” **poster** presented at the Cottrell Scholars’ Conference, Research Corporation, Tucson, AZ, July 2007

42) E. W. Carlson, D. X. Yao, D. K. Campbell, “Magnetic Excitations of Stripes Near a Quantum Critical Point”, **poster** presented at the Gordon Research Conference on Superconductivity, Buellton, CA, January 2006

41) E. W. Carlson, K. Dahmen, E. Fradkin, and S. A. Kivelson, "Using Disorder to Detect Local Order: Hysteresis and Noise of Nematic Stripe Domains in High Temperature Superconductors" **Seminar:** University of Illinois, Urbana-Champaign, September 2005

40) E. W. Carlson, K. Dahmen, E. Fradkin, and S. A. Kivelson, "Electronic Ising Nematic in High Temperature Superconductors: Can Electrons Crackle? " **Seminar**: University of Cincinnati, Ohio, June 2005

39) E. W. Carlson, D. X. Yao, D. K. Campbell, “Magnetic Excitations of Stripes”, **Invited Talk** at the Midwest Solid State Conference, Purdue University, October 2004

38) E. W. Carlson, D. X. Yao, D. K. Campbell, “Magnetic Excitations of Stripes”, **Invited Talk** at Nanoscale Heterogeneity and Quantum Phenomena in Complex Matter, Rome, ITALY, September 2004

37) E. W. Carlson, D. Orgad, S. A. Kivelson, and V. J. Emery, “The Role of Mesoscale Structure in High Temperature Superconductors,” **Invited Talk** at ICAM Workshop on Evolution of Quantum Effects from the Nano- to the Macroscale, Institut d'Etudes Scientifiques de Cargese, Corsica, FRANCE, May 2004

36) "Spin Waves in Stripe-Ordered Systems," **Seminar** at Purdue University, February 2004

35) " Spin Waves in Stripe-Ordered Systems," **Seminar** at Argonne National Laboratory, July 2003

34) "Concepts in High Temperature Superconductivity," **Colloquium** at Washington University, February 2003

33) "Concepts in High Temperature Superconductivity," **Seminar** at University of Michigan, Ann Arbor, March 2004

32) "Concepts in High Temperature Superconductivity," **Seminar** at Northwestern University, March 2004

31) "Concepts in High Temperature Superconductivity," **Seminar** at Ohio State University, February 2004

30) "Concepts in High Temperature Superconductivity," **Seminar** at Stanford University, February 2004.

29) "Concepts in High Temperature Superconductivity," **Seminar** at University of Notre Dame, November 2003

28) "Concepts in High Temperature Superconductivity," **Seminar** at University of Texas at Austin, February 2003

27) "Concepts in High Temperature Superconductivity," **Seminar** at City College of New York, February 2003

26) "Concepts in High Temperature Superconductivity," **Seminar** at Purdue University, February 2003.

25) "Concepts in High Temperature Superconductivity," **Seminar** at University of Connecticut, July 2002.

24) "The Secret Life of Electrons in Cuprate Oxides," **Colloquium** at Wesleyan University, February 2003

23) "Vortex Liquid Crystals," **Colloquium** at Clark University, December 2002

22) "Vortex Liquid Crystals," **Colloquium** at Los Alamos National Laboratory, December 2002

21) "Vortex Liquid Crystals," **Seminar** at Washington University, February 2003

20) "Vortex Liquid Crystals," **Seminar** at Wesleyan University, February 2003

19) "Vortex Liquid Crystals," **Seminar** at Argonne National Laboratory, October 2002

18) "Vortex Liquid Crystals," **Seminar** at University of Illinois at Chicago, October 2002

17) "Vortex Liquid Crystals," **Seminar** at University of Illinois at Urbana-Champaign, October 2002

16) "Vortex Liquid Crystals," **Seminar** at University of Connecticut, March 2002

15) "Vortex Liquid Crystals," **Seminar** at Brandeis University, May 2002

14) "Dimensional Crossover in Quasi One-Dimensional and High T_c Superconductors," **Seminar** at University of Connecticut, June 2001

13) "Dimensional Crossover in Quasi One-Dimensional and High T_c Superconductors," **Seminar** at Brown University, February 2001

12) "Dimensional Crossover in Quasi One-Dimensional and High T_c Superconductors," **Seminar** at Northeastern University, February 2001

11) "Dimensional Crossover in Quasi One-Dimensional and High T_c Superconductors," **Seminar** at Harvard University, February 2001

10) "Dimensional Crossover in Quasi One-Dimensional and High T_c Superconductors," **Seminar** at Boston University, July 2000.

9) "Dimensional Crossover in Quasi One-Dimensional and High T_c Superconductors," **Seminar** at Ohio State University, February 2000.

8) "Dimensional Crossover in Quasi One-Dimensional and High T_c Superconductors," **Seminar** at McMaster University, February 2000

7) E. W. Carlson, D. Orgad, S. A. Kivelson, V. J. Emery, X. J. Zhou, and Z. X. Shen "Stripes, Electron Fractionalization, and ARPES," **Invited Talk** at Spectroscopies of Novel Superconductors, Chicago, Illinois, May 2001

6) E. W. Carlson, D. Orgad, S. A. Kivelson, V. J. Emery, X. J. Zhou, and Z. X. Shen, "Quasi One-Dimensional Behavior in High Temperature Superconductors", **Invited Talk** at the March 2001 meeting of the American Physical Society, Seattle, Washington

5) E. W. Carlson, S. A. Kivelson, D. Orgad, V. J. Emery , "Dimensional Crossover in QuasiOne-Dimensional and High T_c Superconductors", **Invited Talk** at M2S-HTSC-VI 2000, Houston, Texas, February 2000

4) E. W. Carlson, S. A. Kivelson, D. Orgad, V. J. Emery , "Spectral Signatures of Quasi One-Dimensional Superconductors", **Invited Talk** at the US-Japan Neutron Scattering Workshop, Honolulu, Hawaii, February 2000

3) E. W. Carlson, S. A. Kivelson, D. Orgad, V. J. Emery , "Stripes and ARPES", **poster** presented at the XI Workshop on Strongly Correlated Electrons at the Abdus Salaam International Center for Theoretical Physics,Trieste, ITALY, July 1999

2) E. W. Carlson, S. A. Kivelson, V. J. Emery, E. Manousakis, "Classical Phase Fluctuations in High-Temperature Superconductors", **contributed talk** presented at the March 1999 meeting of the American Physical Society, Atlanta, Georgia

1) E. W. Carlson, S. A. Kivelson, Z. Nussinov, V. J. Emery, "Doped Antiferromagnets in High Dimension", **contributed talk** presented at the March 1998 meeting of the American Physical Society, Los Angeles, California

Students and Postdoctoral Researchers

Postdoctoral Mentor
Dr. Sayan Basak (2020)
Dr. Daoxin Yao (2007-2009)
Professor of Physics, Sun-Yat Sen University, Guangzhou, CHINA
Dr. Yen-Lee Loh (2005-2008)
Associate Professor of Physics, University of North Dakota

PhD Dissertation Advisor

Yuxin Sun PhD Expected 2025
Shashank Anand PhD Expected 2025
Dr. Forrest Simmons PhD 2023
Dr. Sayan Basak PhD 2019
Data Scientist, KLA
Dr. Shuo Liu PhD 2016
Data Scientist, Emerald Cloud Lab
Dr. Benjamin Phillabaum PhD 2012
Data Scientist, Allstate Insurance
Dr. Wan-Ju Li PhD 2012
Institute of Physics, Academia Sinica, Taiwan
Dr. Trinanjan Datta PhD 2007
Professor of Physics, Augusta State University

Masters Students
Stylianos Gregoriou, MS
Yifan Wang, MS

Undergraduate Student Researchers
Po-Yu "Boyle" Chen
Amit Rajapurohita
Lukasz Burzawa
Oscar Dillman (Ascarelli Fellow)
Elisha Rothenbush
Jhan Harp (Ascarelli Fellow)
Nicole Pfeister
Paris Miles-Brendan
Kate Wooley (Ascarelli Fellow)

Graduate Student Awards:

Yuxin Sun	APS Travel Fellowship	$500	March 2023
Sayan Basak	Ramdas Prize (Departmental Outstanding Dissertation Award)	$5,000	2021
Sayan Basak	Bilsland Dissertation Fellowship	$11,270.50 plus tuition	Spring 2019
Sayan Basak	APS Travel Fellowship	$500	March 2018
Forrest Simmons	Purdue Research Foundation Summer Research Grant	$3,597	Summer 2018
Shuo Liu	Bilsland Dissertation Fellowship	$11,270.50 plus tuition	Spring 2015
Trinanjan Datta	Bilsland Dissertation Fellowship	$22,000 plus tuition	2008
Wan-Ju	PRF Summer Grant	$2625.00	2012
Shuo Liu	PRF Summer Grant	$2625.00	2012

Undergraduate Student Awards:

Amit Rajapurohita	Purdue Undergraduate Research Expo	3rd place, College of Science	Fall 2022
Lukasz Burzawa	SURF	$6,000	Spring 2019

Funding History

Since coming to Purdue, Prof. Carlson has attracted **over $2M in external funding** to Purdue. Carlson has **over $1M in active grants.**

Agency	Title	Amount	Dates
PQSEI Quantum Seed Grant Competition	Designing multiscale correlations in quantum materials for enhanced sensing of biomolecules	$50,000 (PI = J. Andrews, Purdue; Carlson's part: $25,000)	09/01/2024-08/31/2025 (Pending)
PQSEI Quantum Seed Grant Competition	Welcome to the Quantum Age: Expanding Public Engagement with Quantum Technologies and Quantum Materials Through Digital Media	$50,000 (PI = E. W. Carlson; co-PI = Muhsin Menekse, Purdue; Carlson's part: $25,000)	09/01/2024-08/31/2025 (Pending)
NSF EAGER	EAGER: Developing and Testing Innovations: Integrating Quantum Concepts and Technologies into Middle School Science Lessons: A Participatory Co-design Approach	$299,933 (PI = Muhsin Menekse; Carlson's part: $60,000)	08/01/2024-07/31/2026 (Pending)
APS DCMP	Welcome to the Quantum Age	$53,500 (PI = E. W. Carlson)	09/01/2024-08/31/2025 (Pending)
NSF-AISL	Welcome to the Quantum Age: Expanding Public Engagement with Quantum Technologies and Quantum Materials Through Digital Media	$3,003,804 (PI = E. W. Carlson; co-PI = Muhsin Menekse, Purdue; Carlson's part $2,032,652)	09/01/2024-08/31/2028 (Pending)
NSF-QISE	"NEUROCHIP: Coupling Neuristors on a single chip"	$913,830 (PI = E. W. Carlson; Carlson's part: $300,000)	09/01/2024-08/31/2027 (Invited for Full Proposal; Full Proposal Pending)
École Supérieure de Physique et de Chimie Industrielle, Paris	Chaire Paris-Science	**1,550**€	06/01/2023-06/30/2023
National Science Foundation QISE International Supplement	"International Supplement for DMR-2006192 Electronic Fractals in Strongly Correlated Quantum Materials"	**$30,000**	06/01/2023-05/31/2024
École Supérieure de Physique et de Chimie Industrielle, Paris	Chaire Joliot	**2,600**€	06/01/2022-06/30/2022
Department of Energy **DE-SC0022277**	QIS: Van der Waals Reprogrammable Quantum Simulator	$4,500,000 PI = Ben Hunt (Carnegie Mellon); co-PI Carlson's part: **$441,000**	09/01/2021-08/31/2024
Department of Defense	NDEP-STEM "Innovation in Quantum Pedagogy, Application, and its Relation to Culture (IQ-PARC)	$2,500,000 PI = Mahdi Hosseini (ECE); co-PI Carlson's part: **$600,000**	09/01/2021-08/31/2024

COVID-19 Relief Fund (Purdue)	Understanding Surface Probe Images in Strongly Correlated Quantum Matter Via Machine Learning	**$25,000**	11/15/2021-02/15/2022
École Supérieure de Physique et de Chimie Industrielle, Paris	Chaire Joliot	**2,600**€	06/01/2020-06/30/2020
National Science Foundation, **DMR-2006192**	"Electronic Fractals in Strongly Correlated Quantum Materials"	**$330,000** (sole PI)	08/01/2020-07/31/2024
Research Corporation for Science Advancement, **SEED Award**	"Understanding Surface Probe Images in Strongly Correlated Quantum Matter Via Machine Learning"	**$50,000**	10/01/2019-09/30/2021
Fulbright Foundation (US Dept. of State)	Fulbright Fellow	**19,000**€	01/01/2020-06/30/2020
Purdue Research Foundation	"Quenched Disorder Effects in Quantum Hall Nematics"	**$30,144**	06/01/2018-05/31/2019
Purdue Research Foundation	International Travel Grant	**$1000**	2018
National Science Foundation	Decoding Spatial Complexity in Strongly Correlated Electronic Systems	**$356,765**	08/01/2015-07/31/2018
Department of Education, First in the World	STEAM (Success Through Transformation Education and Active Mentoring)	**$25,000** (Carlson, to transform Physics 272); Total grant $2,300,000 (PI = Chantal Levesque-Bristol)	2015-2017
IMPACT, Purdue	Transform Phys 272	**$10,000**	2014-2016
American Physical Society	Condensed Matter: Science in Your Pocket for RFP on Public Outreach and Informing the Public	($10,532.78)	8/2016-7/2018 (Not Funded)
American Physical Society	Condensed Matter: Science in Your Pocket for RFP on Public Outreach and Informing the Public	($10,532.78)	8/2015-7/2017 (Not Funded)
Purdue Research Foundation	International Travel Grant	**$1000**	2015
EdX	Ramp-Up Course to AP Physics C Electricity & Magnetism	($50,000)	2015-2016 (Not Funded)
National Science Foundation	“Spatial and Temporal Complexity in Disordered Strongly Correlated Electronic Systems”	**$285,000**	6/1/11-5/31/15

APS	APS-IUSSTF Professorship Award in Physics	**$4000**	2/2013-1/2014
Purdue Research Foundation	International Travel Grant	**$1000**	2010
National Science Foundation	Using Disorder to Detect Local Order: Noise and Nonequilibrium Effects of Stripes in the Presence of Quenched Disorder	**$240,000**	9/1/2008-8/31/2011
Research Corporation for Science Advancement	Quantum Soft Matter	**$100,000**	7/1/2006-6/30/2011
Purdue Research Foundation	Spin Waves in Stripe-Ordered Systems	**$29,430**	8/16/2004-8/15/2006

Proposals for Computational Time:

XSEDE DMR-190014	Electronic Fractals in Strongly Correlated Quantum Materials	550,000 core-hours (Equivalent to approx. $2,470 according to XSEDE)	03/01/2021-02/28/2022 (Renewed)
XSEDE DMR-190014	Bridges-2 Early Users Program: Electronic Fractals in Strongly Correlated Quantum Materials	11,800 core-hours	01/12/2021-2/11/2021
NSF PHY-180055 Through XSEDE	"Understanding the equilibrium and non-equilibrium phases of electron nematics in the presence of disorder"	65,142 Service Units (Equivalent to approx. $15,143 according to XSEDE)	01/04/2019-03/31/2020
NSF DMR-180098 Through XSEDE	"Understanding hysteresis of electron nematics in the presence of material disorder"	50,000 Service Units (Equivalent to approx. $4545, according to XSEDE.)	10/04/2018-10/03/2019
NSF DMR-160104 Through XSEDE	"Classifying pattern formation in strongly correlated electronic systems via machine learning"	50,000 Service Units	7/16/2016-8/15/2017

Diversity

Diversity Committee, Dept. of Physics and Astronomy 2012-2019

Founder and Advisor of Graduate Women in Physics 2003-present

Facilitator, Search Committee Training Workshops for Purdue 2015-2018

Science Cafe at the Conference for Undergraduate Women in Physics, Purdue January 2015

I informally mentor *several* young women and men in my field internationally, both experimentalists and theorists at various stages of their careers (from postdoctoral through full professor), providing, *e.g.* detailed career advice.

Through Graduate Women in Physics (and also informally), I mentor several junior women in the Department, including undergraduate and graduate students, postdocs, and faculty.

I informally mentor an African-American graduate student in our Department. We have had several conversations about career advice.

In my capacity as an Ombudsperson for the Department, I have done extensive work mentoring underrepresented faculty.