

Alexander F. Kemper

Associate Professor

North Carolina State University
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Google Scholar

RESEARCH APPOINTMENTS

- 2020 **Associate Professor**,
Department of Physics, North Carolina State University, Raleigh, NC
- 2015 – 2020 **Assistant Professor**,
Department of Physics, North Carolina State University, Raleigh, NC
- 2012 – 2015 **Luiz W. Alvarez Postdoctoral Fellow**,
Scientific Computing Group, Computational Research Division, Lawrence Berkeley National
Laboratory, Berkeley, CA
Group Leader: Bert de Jong
- 2010 – 2012 **Postdoctoral Research Associate**,
Stanford Institute for Materials and Energy Science (SIMES), Stanford University, Menlo Park,
CA
Advisor: T.P. Devereaux
- 2009 – 2010 **McLaughlin Fellow**,
Department of Physics, University of Florida, Gainesville, FL
- 2008 – 2009 **Graduate Research Assistant**,
Department of Physics, University of Florida, Gainesville, FL
- 2004 – 2008 **Alumni Fellow**,
Department of Physics, University of Florida, Gainesville, FL

VISITING RESEARCH APPOINTMENTS

- 2011 **Visiting researcher**, *Walther-Meißner-Institut*, Garching, Germany,
Host: Rudi Hackl
- 2010 **Visiting researcher**, *Walther-Meißner-Institut*, Garching, Germany,
Host: Rudi Hackl
- 2006 **Research Intern**, *Oak Ridge National Laboratory*, Oak Ridge, TN,
Host: Thomas Maier

EDUCATION

- 2010 **Ph.D. in Physics**,
University of Florida, Gainesville, FL,
Supervised by Drs. P.J. Hirschfeld and H.-P. Cheng
Thesis: Computational Studies of Correlated Electronic Systems
- 2004 **Bachelors of Science in Math and Physics**,
University of Florida, Gainesville, FL
Graduated *Magna Cum Laude*

FUNDED PROPOSALS

- 2022 **Robust Quantum Computing for Condensed Matter Physics**, Department of Energy, Basic Energy Sciences, PI: A.F. Kemper. Co-PI: J.K. Freericks (Georgetown)
Period 08/01/2022 – 07/31/2023.
- 2022 **North Carolina State University – Oak Ridge National Laboratory Collaboration on Quantum Computing**, Oak Ridge National Laboratory, PI: A.F. Kemper
Period 06/01/2022 – 05/31/2023.
- 2021 **BeQuEST: Benchmarking Quantum Enhancement in Science & Technology**, *Quantum Benchmarking Volume 1 : Technical and Management Volume*, DARPA, PI: I. Hen (University of Southern California)
Period: 12/01/2021–11/30/2024.
- 2021 **Modeling of and Co-Design for the Duke STAQ Platform**, National Science Foundation, PI: K. Brown (Duke University)
9/01/2021 – 08/31/2023.
- 2019 **Challenges and Opportunities in Noise-Aware Implementations of Quantum Field Theories on Near-Term Quantum Computing Hardware**, *Quantum Information Science Enabled Discovery (QuantISED) for High Energy Physics*, Department of Energy, High Energy Physics, PI: R. Pooser (ORNL). Co-PIs: P.A. Dreher, A.F. Kemper (NC State)
Period 09/01/2019 – 08/31/2022.
- 2018 **A JupyterHub server for ready integration of computing into science courses**, *NCSU STEM Education Initiative*, PI: A.F. Kemper. Co-PI: K. Daniels
- 2017 **Simulating long-time evolution of driven many-body systems with next generation quantum computers**, *Quantum Computing in Chemical and Materials Sciences*, Department of Energy, Basic Energy Sciences, PI: J.K. Freericks (Georgetown) Co-PI: A.F. Kemper (NC State)
Period 09/01/2018 – 08/31/2022.
- 2017 **CAREER: Excitons, electron-hole plasmas, and electron-hole liquids in the time domain**, National Science Foundation, PI: A.F. Kemper
Period: 09/15/2018–09/14/2023.

INVITED TALKS: 74

- Mar. 2023 **American Physical Society March Meeting**, *Las Vegas, NV*, “Non-equilibrium spectroscopy from the theoretical perspective.”
- Dec. 2022 **Yale Solid State and Optics Seminar**, *New Haven, CT*, “Non-equilibrium spectroscopy of matter: Excitons and Correlation Functions”
- Nov. 2022 **Quantrase Seminar at University of Tennessee**, *Knoxville, TN*, “Examining Topology and Thermodynamics using Quantum Computers”
- Nov. 2022 **International Workshop on Ultrafast Dynamics and Metastability**, *Virtual*, “Non-equilibrium spectroscopy from the theoretical perspective.”
- Sep. 2022 **Recent Progress in Many-Body Theory – XXI**, *Chapel Hill, NC*, “Lie Algebraic perspectives on time evolution of unitary quantum systems and simulators.”
- Jul. 2022 **American Chemical Society Fall Meeting 2022**, *Chicago, IL*, “Algebraic compression of quantum circuits”
- Jun. 2022 **IBM Q Hub Symposium**, *Raleigh, NC*, “Algebraic Compression of Quantum Circuits”
- May 2022 **2022 Southeast Quantum Computing Workshop**, *Virtual*, “Examining Thermodynamics using Quantum Computers”
- Mar. 2022 **Harvard Science & Technology Center for Integrated Quantum Materials (CIQM)**, *Virtual*, “Examining Topology and Thermodynamics using Current Quantum Computers”
- Mar. 2022 **Lawrence Berkeley National Laboratory Alvarez Fellow Seminar Series**, *Virtual*, “Robust Simulation of Condensed Matter on Quantum Computers”
- Feb. 2022 **Los Alamos National Laboratory Quantum Computing Group Seminar**, *Virtual*, “Robust Simulation of Condensed Matter on Quantum Computers”
- Dec. 2021 **University of Michigan Condensed Matter Seminar**, *Ann Arbor, MI*, “Examining topology and thermodynamics using quantum computers”
- Nov. 2021 **Pontifical Catholic University of Rio de Janeiro, Brazil**, *Virtual*, “Solving problems in condensed matter physics using quantum computing”
- Nov. 2021 **International Workshop on Ultrafast Dynamics and Metastability**, *Virtual*, “Time-Resolved Photoemission from Excitons and Coherences”
- Nov. 2021 **Photo-Induced Phase Transitions 7 (PIPT7)**, *Virtual*, “Time-Resolved Photoemission from Excitons and Coherences”
- Oct. 2021 **Department of Energy PI Meeting: Research Highlight**, *Virtual*, “Many Body Thermodynamics on Quantum Computers via Partition Function Zeros”
- Oct. 2021 **University of Florida Condensed Matter Seminar**, *Gainesville, FL*, “Examining topology and thermodynamics using quantum computers”
- Sep. 2021 **STAQ Meeting**, *Virtual*, “Many Body Thermodynamics on Quantum Computers via Partition Function Zeros”
- Sep. 2021 **RIKEN BNL Research Center Seminar**, *Brookhaven, NY*, “Examining topology and thermodynamics using quantum computers”
- Jul. 2021 **SPIE Optics & Photonics**, *San Diego, CA*, “Time-Resolved Photoemission from Excitons and Coherences”
- Jun. 2021 **IBM Q Hub Seminar**, *Raleigh, NC*, “Topological Physics on Quantum Computers”
- May 2021 **NorthEastern University Quantum Matter Seminar**, *Virtual*, “Examining topology and thermodynamics quantum quantum computers”
https://youtu.be/zxK3XAY_GSQ
- Apr. 2021 **ACS Spring National Meeting**, *Virtual*, “Examining topology and thermodynamics using quantum computers”
- Feb 2021 **NC State Quantum Lunch Seminar Series**, *Raleigh, NC*, “Many Body Thermodynamics on Quantum Computers via Partition Function Zeros”

- Dec 2020 **Triangle Hard Matter Workshop at Duke University**, *Durham, NC*, “A room temperature Electron-Hole Liquid in photoexcited semiconductors”
- Oct. 2020 **Concordia University Colloquium**, *Virtual*, “Solving problems in condensed matter physics using quantum computing.”
- Oct. 2020 **2020 SSRL/LCLS Users’ Meeting**, *Virtual*, “Time-Resolved Photoemission from excitons and coherences.”
- May 2020 **Quantum Leap Challenge Institute symposium on quantum computing for biology**, *Virtual*, “Topological quantum computing on NISQ hardware.”
- Mar. 2020 **ACS Spring National Meeting**, *Philadelphia, PA*, “Examining the physics of spin systems using quantum computers”
Cancelled due to CoViD19
- Feb. 2020 **Sanibel Symposium**, *St. Simons Island, GA*, “Examining the physics of spin systems using quantum computers”
- Dec. 2019 **Lawrence Berkeley National Laboratory CCMC Seminar**, *Berkeley, CA*, “Examining the physics of spin systems using quantum computers”
- Nov. 2019 **86th meeting of the APS Southeastern Section**, *Wrightville beach, NC*, “Physics of Spin Systems using Quantum Computers”
- Oct. 2019 **Temple University Condensed Matter Seminar**, *Philadelphia, PA*, “Light-induced phase transitions in complex matter”
- Oct. 2019 **West Virginia University Colloquium**, *Morgantown, WV*, “Light-induced phase transitions in complex matter”
- Jun. 2019 **Ultrafast and Nonlinear Dynamics of Quantum Materials**, *University of Paris-Diderot, Paris, France*, “A room temperature Electron-Hole Liquid in two-dimensional materials”
- May 2019 **Caltech Institute for Quantum Information and Matter Seminar**, *Pasadena, CA*, “A room temperature Electron-Hole Liquid in two-dimensional materials”
- Apr. 2019 **International Workshop on Ultrafast Dynamics and Metastability**, *Georgetown University, Washington*, “A room temperature Electron-Hole Liquid in two-dimensional materials”
- Dec. 2018 **SUNY Albany Colloquium**, *Albany, NY*, Assumptions and Realities in Non-Equilibrium Many-Body Physics
- Nov. 2018 **Michigan State University Condensed Matter Seminar**, *East Lansing, MI*, Assumptions and Realities in Non-Equilibrium Many-Body Physics
- May 2018 **Brookhaven National Laboratory CPMMSM Seminar**, *Upton, NY*, Developing theoretical understanding of non-equilibrium phenomena
- Feb. 2018 **Gordon Research Conference: Ultrafast Phenomena in Cooperative Systems**, *Galveston, TX*, Insights into Time-Resolved Spectroscopy from the Theoretical Perspective
- Dec. 2017 **Winter School: Ultrafast quantum control of matter: the path to solids**, *Vancouver, Canada*, What can we learn from time-resolved experiments?
- Nov. 2017 **International Workshop on Ultrafast Dynamics and Metastability**, *Georgetown University, Washington*, “Ultrafast dynamics of quantum materials: Lessons learned from Theory”
- Sept. 2017 **PCS International Workshop: Non-Linear Effects and Short-Time Dynamics in Novel Superconductors and Correlated Spin-Orbit Coupled Systems**, *IBS Center for Theoretical Physics of Complex Systems, Daejeon, South Korea*, “Time-Resolved Spectroscopy of Superconductors in the Time Domain: Some Observations from Theory”
- May 2017 **Stanford & SLAC Ultrafast Materials Science workshop**, *Menlo Park, CA*, “Led discussion on ultrafast spectroscopy in materials”
- Feb. 2017 **University of California San Diego Condensed Matter Seminar**, *La Jolla, CA*, “Theoretical modeling of non-equilibrium spectroscopy”
- Feb. 2017 **Johns Hopkins University Condensed Matter Seminar**, *Baltimore, MD*, “Theoretical modeling of non-equilibrium spectroscopy”

- Jan. 2017 **Workshop on Time-resolved Photoelectron Spectroscopy**, *Elettra Sincrotrone, Trieste, Italy*, “Theoretical modeling of non-equilibrium spectroscopy”
- Dec. 2016 **Duke University, Condensed Matter Seminar**, *Durham, NC*, “Understanding complex materials using non-equilibrium spectroscopy: what can theory tell us?”
- Oct. 2016 **Workshop on Ultrafast Dynamics in Strongly Correlated Systems**, *Paul Scherrer Institute, Villigen, Switzerland*, “Understanding complex materials using non-equilibrium spectroscopy: what can theory tell us?”
- Oct. 2016 **(Declined to attend)**, *EMN Meeting on Ultrafast 2016*, Melbourne, Australia
- Aug. 2016 **International Research School: Electronic States and Phases Induced by Electric or Optical Impacts IMPACT 2016**, *Cargèse, France*, “Understanding complex materials using non-equilibrium spectroscopy: what can theory tell us?”
- Aug. 2016 **Workshop on Experiment and Theory of the Electronic Structure of Correlated f-electron Materials**, *Temple University, Philadelphia, PA*, “Understanding complex materials using non-equilibrium spectroscopy: what can theory tell us?”
- Jun. 2016 **(Declined) SUPERSTRIPES 2016**, *Ischia, Italy*, “Signatures of electron-boson coupling in the time domain: beyond the equilibrium interpretation”
- Mar. 2016 **American Physical Society March Meeting**, *Baltimore, MD*, Electron-boson coupling: Beyond the Equilibrium Interpretation
- Mar. 2016 **University of North Carolina: Wilmington Colloquium**, *Wilmington, NC*, “Non-equilibrium physics of quantum materials”
- Jul. 2015 **CORPES15: International workshop on strong correlations and angle-resolved photoemission spectroscopy**, *Paris, France*, “Theoretical studies of non-equilibrium spectroscopy”
- Jul. 2015 **Max Planck Institute for the Structure and Dynamics of Matter, CFEL**, *Hamburg, Germany*, “Theoretical studies of non-equilibrium spectroscopy”
- Mar. 2015 **Stanford Institute for Materials and Energy Sciences Seminar**, *Stanford, CA*, “Ultrafast spectroscopy of quantum materials”
- Jan. 2015 **North Carolina State University Colloquium**, *Raleigh, NC*, Non-equilibrium physics of quantum materials
- Nov. 2014 **University of Tennessee Condensed Matter Seminar**, *Knoxville, TN*, “Ultrafast spectroscopy of quantum materials”
- Aug. 2014 **Workshop on Many-body Quantum Systems Far from Equilibrium**, *Aspen, CO*, “Control of topological materials with light”
- Jan. 2014 **Science with SCG seminar**, *Lawrence Berkeley National Laboratory, Berkeley, CA*, “Numerical modeling of non-equilibrium phenomena and spectroscopy”
- Dec. 2013 **Bay Area Scientific Computing Day**, *Berkeley, CA*, “Numerical modeling of non-equilibrium phenomena and spectroscopy”
- Feb. 2013 **Short-time Dynamics in Strong Correlated Systems and Novel Superconductors**, *Bochum, Germany*, “Theory for time-domain photon spectroscopy”
- Feb. 2013 **Walther Meißner Institut Workshop on correlated systems**, *Garching, Germany*, “Insights from time-resolved X-ray diffraction on CDW formation in TbTe_3 ”
- Mar. 2012 **Workshop on superconductivity in iron-based compounds**, *Munich, Germany*, “Spectroscopy in the spin-density wave state of the iron pnictides: a mean field perspective”
- Mar. 2012 **Complex Systems Symposium**, *Walther Meißner Institut, Garching, Germany*, “Theory for pump-probe spectroscopy”
- Mar. 2012 **Fritz-Haber-Institut der Max-Planck-Gesellschaft**, *Berlin, Germany*, “Theory for pump-probe spectroscopy”
- Jan. 2012 **Lawrence Berkeley National Laboratory**, *Berkeley, CA*, “Theory for pump-probe spectroscopy”

- Jan. 2012 **SLAC RIXS/REXS Workshop**, *Stanford, CA*, “Theory for pump-probe spectroscopy”
- Jul. 2011 **Walther Meißner Institut Complex Order and Fluctuations workshop**, *Garching, Germany*, “Degeneracy-driven density waves in $R\text{Te}_3$ ”
- Jul. 2010 **Walther Meißner Institut Complex Order and Fluctuations workshop**, *Garching, Germany*, “Spin fluctuations in FeAs”
- Nov. 2006 **University of Florida Physics Graduate Student Seminar**, *Gainesville, FL*, “The effect of strong impurity scattering on superconductivity in the 2D Hubbard model”

PUBLICATIONS: 99 refereed, 11 preprints
4930 citations, h-index 37

- preprint **Quantum Eigenvector Continuation for Chemistry Applications**, *C. Mejuto-Zaera C, A.F. Kemper*
2305.00060
- preprint **Algebraic Compression of Free Fermionic Quantum Circuits: Particle Creation, Arbitrary Lattices and Controlled Evolution**, *E. Kökcü, D. Camps, L. Bassman Oftelie, W.A. de Jong, R. van Beeumen, A.F. Kemper*
arXiv:2303.09538
- preprint **A linear response framework for simulating bosonic and fermionic correlation functions illustrated on quantum computers**, *E. Kökcü, H.A. Labib, J.K. Freericks, A.F. Kemper*, Submitted to Science Advances
arXiv:2302.10219
- preprint **Low-energy quasi-circular electron correlations with charge order wavelength in $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+\delta}$** , *K. Scott, E. Kisiel, T. J. Boyle, R. Basak, G. Jargot, S. Das, S. Agrestini, M. Garcia-Fernandez, J. Choi, J. Pellicciari, J. Li, Y. D. Chuang, R. D. Zhong, J. A. Schneeloch, G. D. Gu, F. Légaré, A. F. Kemper, Ke-Jin Zhou, V. Bisogni, S. Blanco-Canosa, A. Frano, F. Boschini, E. H. da Silva Neto*, Submitted to Science Advances
arXiv:2301.08415
- preprint **Subspace Diagonalization on Quantum Computers using Eigenvector Continuation**, *A. Francis, A. A. Agrawal, J.H Howard, Kökcü, A.F. Kemper*, Submitted to PRX Quantum
arXiv:2209.10571
- preprint **An entanglement-based volumetric benchmark for near-term quantum hardware**, *K.E. Hamilton, N. Laanait, A. Francis, S. E. Economou, G. S. Barron, K. Yeter-Aydeniz, T. Morris, H. Cooley, Muhun Kang, A. F. Kemper, R. Pooser*, Submitted to PRX Quantum
arXiv:2209.00678
- preprint **Robust measurements of n-point correlation functions of driven-dissipative quantum systems on a digital quantum computer**, *L. Del Re, B. Rost, M. Foss-Feig, A.F. Kemper, J.K. Freericks*, Submitted to Physical Review Letters
arXiv:2204.12400
- preprint **Simulating the Mott transition on a noisy digital quantum computer via Cartan-based fast-forwarding circuits**, *T. Steckmann, T. Keen, A.F. Kemper, E. Dumitrescu, Y. Wang*, Submitted to Phys. Rev. Research
arXiv:2112.05688
- preprint **Demonstrating robust simulation of driven-dissipative problems on near-term quantum computers**, *B. Rost, L. Del Re, N. Earnest, A.F. Kemper, B. Jones, J. K. Freericks*, Under review at PRX Quantum
arXiv:2108.01183
- preprint **Bridging the Gap Between the Transient and the Steady State of a Nonequilibrium Quantum System**, *H. F. Fotso, E. Dohner, A.F. Kemper, J. K. Freericks*, Submitted to Phys. Rev. B
arXiv:2101.00795
- preprint **Observing coherences with time-resolved photoemission**, *A.F. Kemper and A. Rustagi*
arXiv:2005.08978
- 99 **Robust measurement of wave function topology on NISQ quantum computers**, *Xiao Xiao, J.K. Freericks and A.F. Kemper*, Quantum 7, 987 (2023)
doi:10.22331/q-2023-04-27-987
- 98 **Catalogue of phonon modes in several cuprate high-temperature superconductors from density functional theory**, *N. J. Jabusch, P. Dayal, A.F. Kemper*, SciPost Phys. Core 6, 018 (2023)
doi:10.21468/SciPostPhysCore.6.1.018

- 97 **Measuring qubit stability in a gate-based NISQ hardware processor**, K. Yeter-Aydeniz, Z. Parks, A. Nair, E. Gustafson, A.F. Kemper, R.C. Pooser, Y. Meurice, P. Dreher, *Quantum Information Processing* (2023) 22:96
doi:10.1007/s11128-023-03826-4
- 96 **Fixed Depth Hamiltonian Simulation via Cartan Decomposition**, E. Kökcü, T. Steckmann, J.K. Freericks, E.F. Dumitrescu and **A.F. Kemper**, *Phys. Rev. Lett.* 129, 070501 (2022)
doi:10.1103/PhysRevLett.129.070501
- 95 **Determining ground-state phase diagrams on quantum computers via a generalized application of adiabatic state preparation**, A. Francis, E. Zelleke, Z. Zhang, **A.F. Kemper**, J.K. Freericks, *Symmetry* 14 (4), 809 (April 2022)
doi:10.3390/sym14040809
- 94 **An Algebraic Quantum Circuit Compression Algorithm for Hamiltonian Simulation**, D. Camps, E. Kökcü, L. Bassman, W. A. de Jong, **A.F. Kemper**, R. Van Beeumen, *SIAM Journal on Matrix Analysis and Applications* 2022 43:3, 1084-1108
doi:10.1137/21M1439298
- 93 **Quantum Markov Chain Monte Carlo with Digital Dissipative Dynamics on Quantum Computers**, M. Metcalf, E. Stone, K. Klymko, **A.F. Kemper**, M. Sarovar, W.A. de Jong, *Quantum Sci. Technol.* 7 025017 (2022)
doi:10.1088/2058-9565/ac546a
- 92 **Light-enhanced Charge Density Wave Coherence in a High-Temperature Superconductor**, S. Wandel, F. Boschini, E.H. da Silva Neto, L. Shen, M.X. Na, S. Zohar, Y. Wang, G.B. Welch, M.H. Seaberg, J.D. Koralek, G.L. Dakovski, W. Hettel, M-F. Lin, S.P. Moeller, W.F. Schlotter, A.H. Reid, M.P. Minitti, T. Boyle, F. He, R. Sutarto, R. Liang, D. Bonn, W. Hardy, R.A. Kaindl, D.G. Hawthorn, J.-S. Lee, **A.F. Kemper**, A. Damascelli, C. Giannetti, J.J. Turner, G. Coslovich, *Science* 376, 6595, pp.860-864 (2022)
doi:10.1126/science.abd7213
I was the **senior theorist** on this study.
- 91 **Algebraic Compression of Quantum Circuits for Hamiltonian Evolution**, E. Kökcü, D. Camps, L. Bassman, J. K. Freericks, W. A. de Jong, R. Van Beeumen, **A.F. Kemper**, *Phys. Rev. A* 105, 032420 (2022)
10.1103/PhysRevA.105.032420
- 90 **Quantum Fluctuations of Charge Order Induce Phonon Softening in a Superconducting Cuprate**, H.Y. Huang, A. Singh, C.Y. Mou, S. Johnston, **A.F. Kemper**, J. van den Brink, P.J. Chen, T.K. Lee, J. Okamoto, Y.Y. Chu, J.H. Li, S. Komiya, A.C. Komarek, A. Fujimori, C.T. Chen, and D.J. Huang, *Phys. Rev. X* 11, 041038 (2021)
10.1103/PhysRevX.11.041038
I was part of the theory collaboration and contributed to theoretical development of spectroscopy.
- 89 **Relaxation timescales and electron-phonon coupling in optically-pumped $\text{YBa}_2\text{Cu}_3\text{O}_{6+x}$ revealed by time-resolved Raman scattering**, N. Pellatz, S. Roy, J-W. Lee, J. L. Schad, H. Kandel, N. Arndt, C.B. Eom, **A.F. Kemper**, and D. Reznik, *Phys. Rev. B* 104, L180505 (2021)
10.1103/PhysRevB.104.L180505
I was the **senior theorist** on this study.
- 88 **What do the two times in two-time correlation functions mean for interpreting tr-ARPES?**, J.K. Freericks, **A.F. Kemper**, *J. Elec. Spec. Rel. Phenom.* 251, 147104 (2021)
10.1016/j.elspec.2021.147104
- 87 **Coherent control of asymmetric spintronic terahertz emission from two-dimensional hybrid metal halides**, Kankan Cong, Eric Vetter, Liang Yan, Yi Li, Qi Zhang, Yuzan Xiong, Hongwei Qu, Richard D. Schaller, Axel Hoffmann, **A.F. Kemper**, Yongxin Yao, Jigang Wang, Wei You, Haidan Wen, Wei Zhang, Dali Sun, *Nature Communications* volume 12, 5744 (2021)
doi:10.1038/s41467-021-26011-6,
I performed analysis of light propagation through halides.

- 86 **Simulating Quantum Materials with Digital Quantum Computers**, *L. Bassman, M. Urbanek, M. Metcalf, J. Carter, A.F. Kemper and W.A. de Jong*, Quantum Sci. Technol. 6 043002
doi:10.1088/2058-9565/ac1ca6
I contributed aspects of the review focusing on condensed matter theory.
- 85 **Topological Quantum Computing on a Conventional Quantum Computer**, *Xiao Xiao, J.K. Freericks and A.F. Kemper*, Quantum 5, 553 (2021)
doi:10.22331/q-2021-09-28-553
- 84 **Many Body Thermodynamics on Quantum Computers via Partition Function Zeros**, *A. Francis, D. Zhu, C. Huerta Alderete, S. Johri, X. Xiao, J.K. Freericks, C. Monroe, N. M. Linke, A.F. Kemper*, Science Advances Vol. 7, no. 34, eabf2447
doi:10.1126/sciadv.abf2447
- 83 **Automated tracking of S. pombe spindle elongation dynamics**, *A. S. M. Uzsoy, P. Zareiesfandabadi, J. Jennings, A.F. Kemper, M. W. Elting*, Journal of Microscopy 10.1111/jmi.13044
doi:10.1111/jmi.13044
I advised on mathematical analysis.
- 82 **Timescales of excited state relaxation in α -RuCl₃ observed by time-resolved two photon photoemission spectroscopy**, *D. Nevola, A. Bataller, S. Sridar, J. Frick, S. O'Donnell, B. Zoellner, P. Maggard, A. Kumar, A.F. Kemper, K. Gundogdu, D. B. Dougherty*, Phys. Rev. B 103, 245105 (2021)
doi:10.1103/PhysRevB.103.245105
I was the **senior theorist** on this study.
- 81 **Probing the interplay between lattice dynamics and short-range magnetic correlations in CuGeO₃ with femtosecond RIXS**, *E. Paris, C. W. Nicholson, S. Johnston, Y. Tseng, M. Rumo, G. Coslovich, S. Zohar, M.F. Lin, V.N. Strocov, R. Saint-Martin, A. Revcolevschi, A.F. Kemper, W. Schlotter, G. L. Dakovski, C. Monney, T. Schmitt*, npj Quantum Materials (2021) 6:51
doi:10.1038/s41535-021-00350-5
I was part of the theory collaboration and contributed to theoretical development of spectroscopy.
- 80 **Flat-band-induced itinerant ferromagnetism in RbCo₂Se₂**, *J. Huang, Z. Wang, H. Pang, H. Wu, H. Cao, S.-K. Mo, A. Rustagi, A.F. Kemper, M. Wang, M. Yi, and R. J. Birgeneau*, Phys. Rev. B 103, 165105 (2021)
doi:10.1103/PhysRevB.103.165105
I was the **senior theorist** on this study.
- 79 **Fermi Liquid Theory Sheds Light on "Hot" EHL in 1L-MoS₂**, *R. L. Wilmington, H. Ardekani, A. Rustagi, A. Bataller, A.F. Kemper R. A. Younts, and K. Gundogdu*, Phys. Rev. B 103, 075416 (2021)
doi:10.1103/PhysRevB.103.075416
I was the **senior theorist** on this study.
- 78 **Nonequilibrium dynamics of spontaneous symmetry breaking into a hidden state of charge-density wave**, *F_i Zhou, J. Williams, C. D. Malliakas, M. G. Kanatzidis, A.F. Kemper, C.-Y. Ruan*, Nature Communications 12, 566 (2021)
doi:10.1038/s41467-020-20834-5
I was the **senior theorist** on this study.
- 77 **Establishing non-thermal regimes in pump-probe electron-relaxation dynamics**, *M.X. Na, F. Boschini, A.K. Mills, M. Michiardi, R.P. Day, B. Zwartsenberg, G. Levy, S. Zhdanovich, A.F. Kemper, D.J. Jones, A. Damascelli*, Phys. Rev. B 102, 184307 (2020)
doi:10.1103/PhysRevB.102.184307
I was the **senior theorist** on this study.
- 76 **Driven-dissipative quantum mechanics on a lattice: Describing a fermionic reservoir with the master equation and simulating it on a quantum computer**, *L. Del Re, B. Rost, A.F. Kemper J. K. Freericks*, Phys. Rev. B 102, 125112 (2020)
doi:10.1103/PhysRevB.102.125112

- 75 **Quantum computation of magnon spectra**, *A. Francis, J.K. Freericks, A.F. Kemper*, Phys. Rev. B. 101, 014411 (2020)
doi:10.1103/PhysRevB.101.014411
- 74 **Direct determination of mode-projected electron-phonon coupling in the time-domain**, *MX Na, A. K. Mills, F. Boschini, M. Michiardi, B. Nosarzewski, R. P. Day, E. Razzoli, A. Sheyerman, M. Schneider, G. Levy, S. Zhdanovich, T. P. Devereaux, A.F. Kemper, D. J. Jones, A. Damascelli*, Science 336, 1231 (2019)
doi:http://dx.doi.org/10.1126/science.aaw1662
I was the **senior theorist** on this study and contributed to phenomenological analysis of scattering rates..
- 73 **Higgs Oscillations in time-resolved Optical Conductivity**, *A. Kumar and A.F. Kemper*, Phys. Rev. B 100, 174515 (2019)
doi:10.1103/PhysRevB.100.174515
- 72 **Theory of time-resolved optical conductivity of superconductors: comparing two methods for its evaluation**, *J.P. Reville, A. Kumar, and A.F. Kemper*, Condens. Matter 2019, 4(3), 79
doi:10.3390/condmat4030079
- 71 **Coherent Excitonic Quantum Beats in Time-Resolved Photoemission Measurements**, *A. Rustagi and A.F. Kemper*, Phys. Rev. B 99, 125303 (2019)
doi:10.1103/PhysRevB.99.125303
- 70 **Band resolved imaging of photocurrent in a topological insulator**, *H. Soifer, A. Gauthier, A.F. Kemper, C. R. Rotundu, S.-L. Yang, H. Xiong, D.-H. Lu, M. Hashimoto, P. S. Kirchmann, J. A. Sobota, Z.-X. Shen*, Phys. Rev. Lett. 122, 167401 (2019)
doi:10.1103/PhysRevLett.122.167401
I was the **senior theorist** on this study and performed electronic structure calculations.
- 69 **Observation of Chiral Surface Excitons in a Topological Insulator Bi₂Se₃**, *H.-H. Kung, P. Goyal, D. L. Maslov, X. Wang, A. Lee, A.F. Kemper S.-W. Cheong, and G. Blumberg*, Proceedings of the National Academy of Sciences Feb 2019, 201813514
doi:10.1073/pnas.1813514116
I performed electronic structure calculations as part of the theory collaboration.
- 68 **Dense Electron-Hole Plasma Formation and Ultra-Long Charge Lifetime in Monolayer MoS₂ via Material Tuning**, *A. W. Bataller, R. A. Younts, A. Rustagi, Y. Yu, H. Ardekani, A.F. Kemper, L. Cao, and K. Gundogdu*, Nano Letters, Article ASAP
doi:10.1021/acs.nanolett.8b04408
I was the **senior theorist** on this study and contributed phenomenological analysis.
- 67 **Detailed band structure of twinned and detwinned BaFe₂As₂ studied with ARPES**, *H. Pfau, C. R. Rotundu, J. C. Palmstrom, M. Hashimoto, D. Lu, A.F. Kemper, I. R. Fisher, and Z.-X. Shen*, Phys. Rev. B 99, 035118 (2019)
doi:10.1103/PhysRevB.99.035118
I was the **senior theorist** on this study and contributed phenomenological analysis.
- 66 **Identifying a forward scattering superconductor through pump-probe spectroscopy**, *A. Kumar, S. Johnston, A.F. Kemper*, Euro Phys Letters, 124 67002
doi:10.1209/0295-5075/124/67002
- 65 **Nonequilibrium Electron Dynamics In Pump-Probe Spectroscopy: Role Of Excited Phonon Populations**, *O. Abdurazakov, D. Nevola, A. Rustagi, J. K. Freericks, D. B. Dougherty, A.F. Kemper*, Phys. Rev. B 98, 245110 (2018)
doi:10.1103/PhysRevB.98.245110
I was the **senior theorist** on this study and contributed phenomenological analysis.
- 64 **Interfacial Structure of SrZr_xTi_{1-x}O₃ films on Ge**, *T. Chen, K. Ahmadi-Majlan, Z. H. Lim, Z. Zhang, J. H. Ngai, A.F. Kemper, D. P. Kumah*, Appl. Phys. Lett. 113, 201601 (2018)
doi:10.1063/1.5046394
I was the **senior theorist** on this study and performed electronic structure calculations.

- 63 **All-optical nonthermal pathway to stabilizing magnetic Weyl semimetals in pyrochlore iridates**, G. E. Topp, N. Tancogne-Dejean, **A.F. Kemper**, A. Rubio, M. A. Sentef, Nature Communications 9, 4452 (2018)
doi:10.1038/s41467-018-06991-8
I was part of the theory collaboration and hosted the first author.
- 62 **General principles for the non-equilibrium relaxation of populations in quantum materials**, **A.F. Kemper**, O. Abdurazakov, J.K. Freericks, Phys. Rev. X 8, 041009 (2018)
doi:10.1103/PhysRevX.8.041009
- 61 **Spectral evidence for emergent order in $\text{Ba}_{1-x}\text{Na}_x\text{Fe}_2\text{As}_2$** , M. Yi, A. Frano, D. H. Lu, Y. He, Meng Wang, B. A. Frandsen, **A.F. Kemper**, R. Yu, Q. Si, L. Wang, M. He, F. Hardy, P. Schweiss, P. Adelman, T. Wolf, M. Hashimoto, S. -K. Mo, Z. Hussain, M. Le Tacon, A. E. Böhrer, D. -H. Lee, Z.-X. Shen, C. Meingast, and R. J. Birgeneau, Phys. Rev. Lett. 121, 127001 (2018)
doi:10.1103/PhysRevLett.121.127001
I was the **senior theorist** on this study and contributed phenomenological analysis.
- 60 **Ultrafast multi-terahertz probes of symmetry breaking in a stripe-phase correlated oxide**, G. Coslovich, B. Huber, S. Behl, **A.F. Kemper**, T. Sasagawa, H. A. Bechtel, M. C. Martin, R. A. Kaindl, Proc. SPIE 10756, Terahertz Emitters, Receivers, and Applications IX, 107560K
doi:10.1117/12.2322682
I was the **senior theorist** on this study.
- 59 **Photoemission signature of excitons**, Avinash Rustagi, **A.F. Kemper**, Phys. Rev. B 97, 235310 (2018)
doi:10.1103/PhysRevB.97.235310
- 58 **Nonequilibrium electron and lattice dynamics of strongly correlated $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+\delta}$ single crystals**, T. Konstantinova, J. D. Rameau, A. H. Reid, O. Abdurazakov, L. Wu, R. Li, X. Shen, G. Gu, Y. Huang, L. Rettig, I. Avigo, M. Ligges, J. K. Freericks, **A.F. Kemper**, H. A. Dürr, U. Bovensiepen, P. D. Johnson, X. Wang and Y. Zhu, SCIENCE ADVANCES — 27 APR 2018 : EAAP7427
doi:10.1126/sciadv.aap7427,
I was the **senior theorist** on this study and contributed to the data interpretation.
- 57 **Dynamics of correlation-frozen antinodal quasiparticles in superconducting cuprates**, F. Cilento, G. Manzoni, A. Sterzi, S. Peli, A. Ronchi, A. Crepaldi, F. Boschini, C. Cacho, R. Chapman, E. Springate, H. Eisaki, M. Greven, M. Berciu, **Alexander F. Kemper**, A. Damascelli, M. Capone, C. Giannetti, F. Parmigiani, SCIENCE ADVANCES — 23 FEB 2018 : EAAR1998
doi:10.1126/sciadv.aar1998,
I was part of the theory team and contributed to the data interpretation.
- 56 **Theoretical Phase Diagram for the Room-Temperature Electron-Hole Liquid in Photoexcited Quasi-Two-Dimensional Monolayer MoS₂**, A. Rustagi, **A.F. Kemper**, Nano Lett. 18, 1, 455-459
doi:10.1021/acs.nanolett.7b04377
- 55 **Ultrafast Dynamics of Vibrational Symmetry Breaking in a Charge-ordered Nickelate**, G. Coslovich, **A.F. Kemper**, S. Behl, B. Huber, H. A. Bechtel, T. Sasagawa, M. C. Martin, A. Lanzara, R. A. Kaindl, Science Advances 24 Nov 2017: Vol. 3, no. 11, e1600735
doi:10.1126/sciadv.1600735
I was the **senior theorist** on this study and contributed electronic structure calculations and added to the data interpretation.
- 54 **Amplitude mode oscillations in pump-probe photoemission spectra from a d-wave superconductor**, B. Nosarzewski, B. Moritz, J. K. Freericks, **A.F. Kemper**, T. P. Devereaux, Phys. Rev. B 96, 184518 (2017)
doi:10.1103/PhysRevB.96.184518,
I was part of the theory team and provided major software components.

- 53 **Review of the theoretical description of time-resolved angle-resolved photoemission spectroscopy in electron-phonon mediated superconductors**, **A.F. Kemper**, *M. A. Sentef, B. Moritz, T. P. Devereaux, J. K. Freericks*, ANNALEN DER PHYSIK 2017, 529, 1600235
doi:10.1002/andp.201600235
- 52 **Surface vibrational modes of the topological insulator Bi₂Se₃ observed by Raman spectroscopy**, *H.-H. Kung, M. Salehi, I. Boulares, A.F. Kemper, N. Koirala, M. Brahlek, P. Lošťák, C. Uher, R. Merlin, X. Wang, S.-W. Cheong, S. Oh, G. Blumberg*, Phys. Rev. B 95, 245406 (2017)
doi:10.1103/PhysRevB.95.245406
I was the **senior theorist** on this study and contributed electronic structure calculations and added to the data interpretation.
- 51 **The role of average time dependence on the relaxation of excited electron populations in nonequilibrium many-body physics**, **A.F. Kemper**, *H.R. Krishnamurthy, and J.K. Freericks*, Fortschr. Phys. 2017, 65, 1600042
doi:10.1002/prop.201600042
- 50 **Relaxation of nonequilibrium populations after a pump: the breaking of Mathiessen's rule**, *J. K. Freericks, O. Abdurazakov, A.F. Kemper*, Proc. SPIE 10193, Ultrafast Bandgap Photonics II, 1019303
doi:10.1117/12.2261872
- 49 **Creating stable Floquet-Weyl semimetals by laser-driving of 3D Dirac materials**, *Hannes Hübener, Michael A. Sentef, Umberto de Giovannini, Alexander F. Kemper, Angel Rubio*, Nature Communications 8,13940 (2017)
doi:10.1038/ncomms13940
I was part of the theory team and the originators of this study, and contributed to the analysis.
- 48 **Energy dissipation from a correlated system driven out of equilibrium**, *J. D. Rameau, S. Freutel, A.F. Kemper, M. A. Sentef, Y. Yoshida, H. Eisaki, J. K. Freericks, I. Avigo, M. Ligges, L. Rettig, J. Schneeloch, R. D. Zhong, Z. J. Xu, G. D. Gu, P. D. Johnson, U. Bovensiepen*, Nature Communications 7, 13761 (2016)
doi:10.1038/ncomms13761
I was the primary theorist on this study and contributed phenomenological analysis and data analysis.
- 47 **Spin-Polarized Surface Resonances Accompanying Topological Surface State Formation**, *C. Jozwiak, J.A. Sobota, K. Gotlieb, A.F. Kemper, C.R. Rotundu, R.J. Birgeneau, Z. Hussain, D.-H. Lee, Z.-X. Shen, and A. Lanzara*, Nature Communications 7, 13143 (2016)
doi:10.1038/ncomms13143
I was the **senior theorist** on this study and contributed electronic structure calculations and added to the data interpretation.
- 46 **Relationship between Population Dynamics and the Self-Energy in Driven Non-Equilibrium Systems**, **A.F. Kemper**, *J.K. Freericks*, Entropy 2016, 18(5), 180
doi:10.3390/e18050180
- 45 **The rate of quasiparticle recombination probes the onset of coherence in cuprate superconductors**, *J.P. Hinton, E. Thewalt, Z. Alpichshev, F. Mahmood, J.D. Koralek, M.K. Chan, M.J. Veit, C.J. Dorow, N. Barisic, A.F. Kemper, D.A. Bonn, W.N. Hardy, Ruixing Liang, N. Gedik, M. Greven, A. Lanzara, J. Orenstein*, Scientific Reports 6, 23610 (2016)
doi:10.1038/srep23610
I was the **senior theorist** on this study and contributed electronic structure calculations and added to the data interpretation.
- 44 **Theory of light-enhanced phonon-mediated superconductivity**, *M.A. Sentef, A.F. Kemper, A. Georges, C. Kollath*, Phys. Rev. B 93, 144506 (2016)
doi:10.1103/PhysRevB.93.144506
I was part of the theory collaboration and contributed to analysis and writing.

- 43 **Ultrafast resonant soft x-ray diffraction dynamics of the charge density wave in TbTe_3** , R. G. Moore, W. S. Lee, P. S. Kirchmann, Y. D. Chuang, **A.F. Kemper**, M. Trigo, L. Patthey, D.H. Lu, O. Krupin, M. Yi, D.A. Reis, D. Doering, P. Denes, W.F. Schlotter, J.J. Turner, G. Hays, P. Hering, T. Benson, J.-H. Chu, T.P. Devereaux, I.R. Fisher, Z. Hussain and Z.-X. Shen, *Phys. Rev. B* 93, 024304 (2016)
doi:10.1103/PhysRevB.93.024304
I was the primary theorist on this study and contributed electronic structure calculations, phenomenological analysis and data analysis.
- 42 **Direct observation of Higgs mode oscillations in the pump-probe photoemission spectra of electron-phonon mediated superconductors**, **A.F. Kemper**, M. A. Sentef, B. Moritz, J. K. Freericks, and T. P. Devereaux, *Phys. Rev. B* 92, 224517 (2015)
doi:10.1103/PhysRevB.92.224517
- 41 **Bandwidth and Electron Correlation-Tuned Superconductivity in $\text{Rb}_{0.8}\text{Fe}_2(\text{Se}_{1-z}\text{S}_z)_2$** , M. Yi, Meng Wang, **A.F. Kemper**, S.-K. Mo, Z. Hussain, E. Bourret-Courchesne, A. Lanzara, M. Hashimoto, D. H. Lu, Z.-X. Shen, Robert J. Birgeneau, *Phys. Rev. Lett.* 115, 256403 (2015)
doi:10.1103/PhysRevLett.115.256403
I was the primary theorist on this study and contributed phenomenological analysis and data analysis.
- 40 **Scattering bottleneck for spin dynamics in metallic helical antiferromagnetic dysprosium**, M.C. Langner, S. Roy, **A.F. Kemper**, Y.-D. Chuang, S.K. Mishra, R. Versteeg, Y. Zhu, M.P. Hertlein, T.E. Glover, K. Dumesnil, R.W. Schoenlein, *Phys. Rev. B* 92, 184423 (2015)
doi:10.1103/PhysRevB.92.184423
I was the primary theorist on this study and contributed phenomenological analysis and data analysis.
- 39 **Thickness-Dependent Coherent Phonon Frequency in Ultrathin $\text{FeSe}/\text{SrTiO}_3$ Films**, Shulong Yang, J.A. Sobota, D. Leuenberger, **A.F. Kemper**, J.J. Lee, F.T. Schmitt, W. Li, R.G. Moore, P.S. Kirchmann, and Z.-X. Shen, *Nano Lett.*, 2015, 15 (6), 4150-4154
doi:10.1021/acs.nanolett.5b01274
I was the primary theorist on this study and contributed electronic structure calculations and data analysis.
- 38 **Classification of Collective Modes in a Charge Density Wave by Momentum-Dependent Modulation of the Electronic Band Structure**, D. Leuenberger, J. A. Sobota, S.-L. Yang, **A.F. Kemper**, P. Giraldo-Gallo, R. G. Moore, I. R. Fisher, P. S. Kirchmann, T. P. Devereaux and Z.-X. Shen, *Phys. Rev. B* 91, 201106(R) (2015)
doi:10.1103/PhysRevB.91.201106
I was the primary theorist on this study and contributed electronic structure calculations and data analysis.
- 37 **Direct characterisation of photo-induced femtosecond lattice dynamics in BaFe_2As_2** , S. Gerber, K. W. Kim, Y. Zhang, D. Zhu, N. Plonka, M. Yi, G. L. Dakovski, D. Leuenberger, P.S. Kirchmann, R. G. Moore, M. Chollet, J. M. Glowina, Y. Feng, J.-S. Lee, A. Mehta, **A.F. Kemper**, T. Wolf, Y.-D. Chuang, Z. Hussain, C.-C. Kao, B. Moritz, Z.-X. Shen, T. P. Devereaux and W.-S. Lee, *Nature Communications* 6, 7337 (2015)
doi:10.1038/ncomms8377
I was the part of the theory team and contributed electronic structure calculations and data analysis.
- 36 **First-principles study of the phonon modes in bismuth-sillenites**, D.J. Arenas, Carl Middleton and **A.F. Kemper**, *Phys. Rev. B* 91, 144103 (2015)
doi:10.1103/PhysRevB.91.144103
- 35 **Transient Exchange Interaction in a Helical Antiferromagnet**, M. Langner, S. Roy, **A.F. Kemper** Y.-D. Chuang, S. Mishra, R. B. Versteeg, Yi Zhu, M. P. Hertlein, T. E. Glover, K. Dumesnil, and R. W. Schoenlein, *CLEO: 2015, OSA Technical Digest* (online) (Optical Society of America, 2015), paper FTu1B.6.
doi:10.1364/CLEO_QELS.2015.FTu1B.6
I was the primary theorist on this study and contributed phenomenological analysis.

- 34 **Theory of Floquet band formation and local pseudospin textures in pump-probe photoemission of graphene**, *M.A. Sentef, M. Claassen, A.F. Kemper, B. Moritz, T. Oka, J.K. Freericks and T.P. Devereaux*, Nature Communications 6, 7047 (2015)
doi:10.1038/ncomms8047
I was part of the theory team and contributed to software development and data analysis.
- 33 **Numerical integration for ab initio many-electron self energy calculations within the GW approximation**, *F. Liu, L. Lin, D. Vigil-Fowler, J. Lischner, A.F. Kemper, S. Sharifzadeh, F.H. da Jornada, J. Deslippe, C. Yang, J.B. Neaton, and S.G. Louie*, Journal of Computational Physics, Volume 286, p. 1-1 (2015)
doi:10.1016/j.jcp.2015.01.023
I was part of the theory team and contributed to software development.
- 32 **Balancing act: Evidence for a strong subdominant d -wave pairing channel in $\text{Ba}_{0.6}\text{K}_{0.4}\text{Fe}_2\text{As}_2$** , *T. Böhm, A.F. Kemper, B. Moritz, F. Kretzschmar, B. Muschler, H.-M. Eiter, R. Hackl, T.P. Devereaux, D.J. Scalapino, and Hai-Hu Wen*, Phys. Rev. X 4, 041046 (2014)
doi:10.1103/PhysRevX.4.041046
I was part of the theory team and contributed to software development and helped advise the first author.
- 31 **Manipulation of gap nodes by uniaxial strain in iron-based superconductors**, *J. Kang, A.F. Kemper and R.M. Fernandes*, Phys. Rev. Lett. 113, 217001 (2014)
doi:10.1103/PhysRevLett.113.217001
I was part of the theory team and contributed to software development.
- 30 **Distinguishing Bulk and Surface Electron-Phonon Coupling in a Photoexcited Topological Insulator**, *J.A. Sobota, S.-L. Yang, D. Leuenberger, A.F. Kemper, J.G. Analytis, I.R. Fisher, P.S. Kirchmann, T.P. Devereaux, Z.-X. Shen*, Phys. Rev. Lett. 113, 157401 (2014)
doi:10.1103/PhysRevLett.113.157401
I was primary theorist on this study and contributed electronic structure calculations and data analysis.
- 29 **Exact solution for high harmonic generation and the response to an AC driving field for a charge density wave insulator**, *Wen Shen, A.F. Kemper, T.P. Devereaux and J.K. Freericks*, Phys. Rev. B 90, 115113 (2014)
doi:10.1103/PhysRevB.90.115113
I was part of the theory team and contributed to software development.
- 28 **Effect of dynamical spectral weight distribution on effective interactions in time-resolved spectroscopy**, *A.F. Kemper, M.A. Sentef, B. Moritz, J.K. Freericks and T.P. Devereaux*, Phys. Rev. B 90, 075126 (2014)
doi:10.1103/PhysRevB.90.075126
- 27 **Ultrafast electron dynamics in the topological insulator Bi_2Se_3 studied by time-resolved photoemission spectroscopy**, *J.A. Sobota, S.-L. Yang, D. Leuenberger, A.F. Kemper, J.G. Analytis, I.R. Fisher, P.S. Kirchmann, T.P. Devereaux, Z.-X. Shen*, Journal of Electron Spectroscopy and Related Phenomena 195, 249, (2014)
doi:10.1016/j.elspec.2014.01.005
I was the part of the theory team and contributed electronic structure calculations and data analysis.
- 26 **Nonequilibrium sum rules for the Holstein model**, *J.K. Freericks, K. Najafi, A.F. Kemper and T.P. Devereaux*, Conference Proceedings for FEIS 2013
arXiv:1403.5604
- 25 **Bandgap closure and reopening in CsAuI_3 at high pressure**, *S. Wang, A.F. Kemper, M. Baldini, M.C. Shapiro, S.C. Riggs, Z. Zhao, Z. Liu, T.P. Devereaux, T.H. Geballe, I.R. Fisher, W.L. Mao*, Phys. Rev. B 89, 245109 (2014)
doi:10.1103/PhysRevB.89.245109
I was the part of the theory team and contributed electronic structure calculations and data analysis.

- 24 **Dynamic competition between spin-density wave order and superconductivity in under doped $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$** , M. Yi, Y. Zhang, Z.-K. Liu, X. Ding, J.-H. Chu, **A.F. Kemper**, N. Plonka, B. Moritz, M. Hashimoto, S.-K. Mo, Z. Hussain, T. P. Devereaux, I. R. Fisher, H. H. Wen, Z.-X. Shen, D. H. Lu, Nat. Comm. 5, 3711 (2014)
doi:10.1038/ncomms4711
I was the part of the theory team and contributed electronic structure calculations and phenomenological analysis.
- 23 **Examining electron-boson coupling using time-resolved spectroscopy**, M.A. Sentef, **A.F. Kemper**, B. Moritz, and T.P. Devereaux, Phys. Rev. X 3, 041033 (2013)
doi:10.1103/PhysRevX.3.041033
I was part of the theory team and contributed to software development and data analysis.
- 22 **Mapping of unoccupied states and relevant bosonic modes via the time dependent momentum distribution**, **A.F. Kemper**, Michael Sentef, B. Moritz, and T.P. Devereaux, Phys. Rev. B 87, 235139 (2013)
doi:10.1103/PhysRevB.87.235139
- 21 **Tunneling spectroscopy for probing orbital anisotropy in iron pnictides**, N. Plonka, **A.F. Kemper**, S. Graser, A.P. Kampf, T.P. Devereaux, Phys. Rev. B 88, 174518 (2013)
doi:10.1103/PhysRevB.88.174518
I was part of the theory team and contributed to software development and helped advise the first author.
- 20 **Direct optical coupling to an unoccupied Dirac surface state in the topological insulator Bi_2Se_3** , J.A. Sobota, S.-L. Yang, **A.F. Kemper**, J.J. Lee, F.T. Schmitt, W. Li, R.G. Moore, J.G. Analytis, I.R. Fisher, P.S. Kirchmann, T.P. Devereaux and Z.-X. Shen, Phys. Rev. Lett. 111, 136802 (2013)
doi:10.1103/PhysRevLett.111.136802
I was the part of the theory team and contributed electronic structure calculations and phenomenological analysis.
- 19 **Time-dependent charge-order and spin-order recovery in striped systems**, Y. F. Kung, W.-S. Lee, C.-C. Chen, **A.F. Kemper**, A. P. Sorini, B. Moritz, and T. P. Devereaux, Phys. Rev. B 88, 125114 (2013)
doi:10.1103/PhysRevB.88.125114
I was part of the theory team and contributed to phenomenological analysis and helped advise the first author.
- 18 **Electron-Mediated Relaxation Following Ultrafast Pumping of Strongly Correlated Materials: Model Evidence of a Correlation-Tuned Crossover between Thermal and Nonthermal States**, B. Moritz, **A.F. Kemper**, Michael Sentef, T.P. Devereaux, and J.K. Freericks, Phys. Rev. Lett. 111, 077401 (2013)
doi:10.1103/PhysRevLett.111.077401
I was part of the theory team and contributed to phenomenological analysis.
- 17 **Infrared study of the electronic structure of the metallic pyrochlore iridate $\text{Bi}_2\text{Ir}_2\text{O}_7$** , Y. S. Lee, S. J. Moon, Scott C. Riggs, M. C. Shapiro, I. R. Fisher, Bradford W. Fulfer, Julia Y. Chan, **A.F. Kemper**, and D. N. Basov, Phys. Rev. B 87, 195143 (2013)
doi:10.1103/PhysRevB.87.195143
I was the primary theorist and contributed electronic structure calculations and data analysis.
- 16 **Structure and functionality of bromine doped graphite**, R. Hamdan, **A.F. Kemper**, C. Cao and H.P. Cheng, J. Chem. Phys. 138, 164702 (2013)
doi:10.1063/1.4801786
I was the part of the theory team and contributed electronic structure calculations.
- 15 **Hot electron transport in a strongly correlated transition-metal oxide**, K. G. Rana, T. Yajima, S. Parui, **A.F. Kemper**, T. P. Devereaux, Y. Hikita, H.Y. Hwang, T. Banerjee, Nature Scientific Reports, 3, 1274 (2013)
doi:10.1038/srep01274
I was the part of the theory team and contributed phenomenological analysis.
- 14 **Theoretical description of high-order harmonic generation in solids**, **A.F. Kemper**, B. Moritz, J.K. Freericks, and T.P. Devereaux, New J. Phys. 15 (2013) 023003
doi:10.1088/1367-2630/15/2/023003

- 13 **Alternative route to charge density wave formation in multiband systems**, *H.-M. Eiter, M. Lavagnini, R. Hackl, E. A. Nowadnick, A.F. Kemper, T.P. Devereaux, J.-H. Chu, J. G. Analytis, I.R. Fisher, and L. Degiorgi*, PNAS 110(1), 64-69 (2013)
doi:10.1073/pnas.1214745110
I was the part of the theory team and contributed phenomenological analysis.
- 12 **Pulsed high harmonic generation of light due to pumped Bloch oscillations in noninteracting metals**, *J.K. Freericks, A.Y. Liu, A.F. Kemper and T.P. Devereaux*, Physica Scripta, Volume T151, pp. 014062 (2012)
doi:10.1088/0031-8949/2012/T151/014062
- 11 **Density functional study of gold and iron clusters on perfect and defected graphene**, *Manoj K. Srivastava, Yan Wang, A.F. Kemper, and Hai-Ping Cheng*, Phys. Rev. B 85, 165444 (2012)
doi:10.1103/PhysRevB.85.165444
- 10 **Phase fluctuations and the absence of topological defects in a photo-excited charge-ordered nickelate**, *W. S. Lee, Y. D. Chuang, R. G. Moore, L. Patthey, M. Trigo, D.-H. Lu, P. S. Kirchmann, M. Yi, O. Krupin, M. Langner, N. Huse, J. S. Robinson, Y. Chen, Y. Zhu, S. Y. Zhou, D. A. Reis, R. A. Kaindl, R. W. Schoenlein, D. Doering, P. Denes, W. F. Schlotter, J. J. Turner, S. L. Johnson, M. Först, T. Sasagawa, Y. F. Kung, A.P. Sorini, A.F. Kemper, B. Moritz, T.P. Devereaux, D.-H. Lee, Z. X. Shen, and Z. Hussain*, Nature Communications 3, 838 (2012)
doi:10.1038/ncomms1837
- 9 **Anisotropic quasiparticle lifetimes in Fe-based superconductors**, *A.F. Kemper, M. M. Korshunov, T.P. Devereaux, J. N. Fry, H-P. Cheng, and P. J. Hirschfeld*, Phys. Rev. B 83, 184516 (2011)
doi:10.1103/PhysRevB.83.184516
- 8 **Symmetry breaking orbital anisotropy on detwinned $\text{Ba}(\text{Fe}_{1-x}\text{Co}_x)_2\text{As}_2$ above the spin density wave transition**, *M. Yi, D. H. Lu, J.-H. Chu, J. G. Analytis, A.P. Sorini, A.F. Kemper, S.-K. Mo, R. G. Moore, M. Hashimoto, W. S. Lee, Z. Hussain, T.P. Devereaux, I.R. Fisher, and Z.-X. Shen*, Proceedings of the National Academy of Sciences April 26, 2011 vol. 108 no. 17 6878-6883
doi:10.1073/pnas.1015572108
- 7 **Theory of Two-Magnon Raman Scattering in Iron Pnictides and Chalcogenides**, *C.C. Chen, C.J. Jia, A.F. Kemper, R.R.P. Singh, and T.P. Devereaux*, Phys. Rev. Lett. 106, 067002 (2011)
doi:10.1103/PhysRevLett.106.067002
- 6 **Spin fluctuations and superconductivity in a three-dimensional tight-binding model for BaFe_2As_2** , *S. Graser, A.F. Kemper, T. A. Maier, H.-P. Cheng, P. J. Hirschfeld, and D. J. Scalapino*, Phys. Rev. B 81, 214503 (2010)
doi:10.1103/PhysRevB.81.214503
- 5 **Sensitivity of the superconducting state and magnetic susceptibility to key aspects of electronic structure in ferropnictides**, *A.F. Kemper, T.A. Maier, S. Graser, H-P. Cheng, P.J. Hirschfeld, and D.J. Scalapino*, New Journal of Physics 12 073030 (2010), **Article selected for the New Journal of Physics 'Best of 2010'**
doi:10.1088/1367-2630/12/7/073030
- 4 **Effects of cobalt doping and three-dimensionality in BaFe_2As_2** , *A.F. Kemper, C. Cao, P.J. Hirschfeld, and H.-P. Cheng*, Phys. Rev. B 80, 104511 (2009)
doi:10.1103/PhysRevB.80.104511
- 3 **Insensitivity of d-wave pairing to disorder in the high-temperature cuprate superconductors**, *A.F. Kemper, D.G.S.P. Doluweera, T.A. Maier, M. Jarrell, P.J. Hirschfeld, and H-P. Cheng*, Phys. Rev. B 79, 104502 (2009)
doi:10.1103/PhysRevB.79.104502

- 2 **Curvature effect on the interaction between folded graphitic surface and silver clusters**, **A.F. Kemper**, *H-P. Cheng, N. Kébaïli, S. Benrezzak, M. Schmidt, A. Masson and C. Bréchnac*, *Phys. Rev. B* 79, 193403 (2009)
doi:10.1103/PhysRevB.79.193403
- 1 **Nonequilibrium Green's function study of Pd₄-cluster-functionalized carbon nanotubes as hydrogen sensors**, *C. Cao, A.F. Kemper, Luis Agapito, Jian-Wei Zhang, Yao He, Andrew Rinzler, Hai-Ping Cheng, X.-G. Zhang, Alexandre Reily Rocha, and Stefano Sanvito.*, *Phys. Rev. B* 79, 075127 (2009)
doi:10.1103/PhysRevB.79.075127

SOFTWARE

Cartan Quantum Synthesizer, *Efehan Kökcü, Thomas Steckmann*, Time evolution exact unitary synthesis using Lie algebraic methods

<https://github.com/kemperlab/cartan-quantum-synthesizer>

F3C, *D. Camps, Roel van Beeumen, Efehan Kökcü*, Quantum Circuit Compiler for free-fermion based quantum gates

<https://github.com/quantumcomputinglab/f3c>

<https://github.com/quantumcomputinglab/f3cpp>

GRENDDEL, *A.F. Kemper*, Integro-differential equation solver for non-equilibrium many-body theory and pump-probe spectroscopy

MEDIA COVERAGE

- Aug. 19, 2021 **Peake, T.**, “**Partition Function Zeros are ‘Shortcut’ to Thermodynamic Calculations on Quantum Computers**”, *NC State Sciences News*
<https://go.ncsu.edu/apbgvdw>
<https://phys.org/news/2021-08-partition-function-zeros-shortcut-thermodynamic.html>
- Oct. 29, 2018 “**Shedding light on Weyl fermions**”, *Max Planck Institute for the Structure and Dynamics of Matter News*
<https://www.mpsd.mpg.de/17430/2018-10-weyl-sentef>
- Jun. 7, 2018 “**Invisible Worlds: Ultrafast Quantum Matter**”, *YouTube*, uploaded by *NCState*
<https://youtu.be/bENhaRq3Doo>
- Jun. 7, 2018 “**Exploring Invisible Worlds With Science and Design**”, *YouTube*, uploaded by *NCState*
<https://youtu.be/V5dHeOFmpMk>
- Jun. 1, 2018 **Sadler, C.**, “**Bringing Invisible Worlds to Light**”, *NC State Sciences News*,
<https://sciences.ncsu.edu/news/leading-strand-science-design-collaboration/>
- Mar. 2018 **Kleinmaier, S.**, “**Design Students Make Science Accessible**”, *NC State College of Design News*
<https://design.ncsu.edu/design-students-make-science-accessible/>
- Apr. 27, 2018 **Eure, J.** “**Scientists Pinpoint Energy Flowing Through Vibrations in Superconducting Crystals**”, *Brookhaven National Laboratory Newsroom*
<https://www.bnl.gov/newsroom/news.php?a=112871>
- Feb. 1, 2018 **Peake, T.**, “**Creating an Electron-Hole Liquid at Room Temperature**”, *NC State News*
<https://news.ncsu.edu/2018/02/kemper-ehl/>
- Nov. 29, 2017 **Yang, S.**, “**Watching a Quantum Material Lose Its Stripes**”, *Berkeley Lab News*
<https://bit.ly/loseStripes>
- Apr. 4, 2017 **Peake, T.**, “**Non-equilibrium Physics Explained: 5 Questions with Lex Kemper**”, *NC State News*
<https://news.ncsu.edu/2017/04/kemper-5qs/>
- Jan. 17, 2017 “**Studying fundamental particles in materials**”, *Max Planck Research*
<http://www.mpsd.mpg.de/326856/2016-11-floquet-weyl-huebener>
- Jan. 1, 2017 **Peake, T.**, “**Untangling Complex Interactions – With Lasers**”, *NC State News*
<https://news.ncsu.edu/2017/01/kemper-laser/>
- Jul. 28, 2016 **Matthews, D.**, “**Quantum weirdness in everyday life**”, *The News Reporter*
<https://www.physics.ncsu.edu/kemperlab/images/outreach/Lex-Kemper-Article.pdf>
- May 27, 2015 “**Spiraling Laser Pulses Could Change the Nature of Graphene**”, *SLAC News*
<https://www6.slac.stanford.edu/news/2015-05-27-spiraling-laser-pulses-could-change-nature-graphene.aspx>
- Jan. 31, 2014 **Ross, M.**, “**SIMES Simulations Track Energized Electrons to Understand Complex Materials**”, *SLAC News*, <https://www6.slac.stanford.edu/news/2014-01-31-simes-simulations-track-energized-electrons-understand-complex-materials.aspx>

PROFESSIONAL DEVELOPMENT

- Aug. 2017 - **Faculty Online Learning Community**, *Online*,
May 2018 Facilitated in a bi-weekly discussion aimed at exchange of ideas and experiences for a group of new faculty members
- Jul. 2017 **American Association of Physics Teachers (AAPT) New Faculty Workshop**, *College Park, MD*,
Attended as ambassador for the Faculty Online Learning Community
- Aug. 2016 - **Faculty Online Learning Community**, *Online*,
May 2017 Participated in a bi-weekly discussion aimed at exchange of ideas and experiences for a group of new faculty members
- Jul. 2016 **American Association of Physics Teachers (AAPT) New Faculty Workshop**, *College Park, MD*,
Attended a workshop focused on modern teaching techniques including active learning, just-in-time-teaching, web-based demo usage and concept inventories, as applied to physics courses at all levels
- Aug. 2015 **NC State University College of Sciences New Faculty Workshop**, *Raleigh, NC*,
Attended a workshop aimed at developing new faculty members as teachers with a focus on active learning techniques

TEACHING

Courses taught

- Spring 2023 **Physics 413 (Thermal Physics)**
Fall 2022 **Physics 753 (Condensed Matter II)**
- Spring 2022 **Physics 413 (Thermal Physics)**
Fall 2021 **Physics 753 (Condensed Matter II)**
Fall 2020 **Physics 753 (Condensed Matter II)**
- Spring 2020 **Physics 251 (Scientific Computing)**
Fall 2019 **Physics 753 (Condensed Matter II)**
- Spring 2019 **Physics 251 (Scientific Computing)**
Fall 2018 **Physics 810 (Physics of Quantum Computers)**
- Spring 2018 **Physics 251 (Scientific Computing)**
Fall 2017 **Physics 251 (Scientific Computing)**
- Spring 2017 **Physics 852 (Topological aspects of Materials)**
Fall 2016 **Physics 208 (Introduction to electricity and magnetism with calculus)**
Fall 2015 **Physics 208 (Introduction to electricity and magnetism with calculus)**
- 2009–2010 **Led undergraduate reviews for GRE Physics test**
- Spring 2010 **Discussion section —Introduction to electricity and magnetism without calculus, 2 sections**
Fall 2009 **Discussion section —Introduction to mechanics with calculus, 4 sections**
- 2004 – 2008 **Discussion section —Introduction to electricity and magnetism without calculus, 4 sections**
- 2004 – 2010 **Substituted in case of professor absence**,
Undergraduate Electrostatics, Electrodynamics, Mathematical Methods for Physics, Introductory Physics for non-majors

Workshop courses

- 2017 **UBC Winter School Lecture Series: “What can we learn from time-resolved phenomena?”**

Educational development

- 2021 **Set up single-photon interferometry in Senior Lab**
Obtained funding from the College to develop a local fundamental quantum mechanics experimental setup for the advanced lab course. With the recent focus on quantum computing at the university, we expect that this setup will be beneficial for students beyond the physics department and the college. Using single photon sources and detectors, when the lab is fully set up, students will be able to locally perform experiments that get at the foundations of quantum mechanics. Some of these include the quantum eraser and teleportation (a vivid demonstration of quantum entanglement), and testing of Bell's inequalities.
- 2021 **Sponsored Quantum Computing game development for Senior Design**
Guided a team from the the Physics' department senior design students in the development of a arcade/online game designed to convey the basic elements of quantum computing. QBI Game
- 2020 **Introduced Quantum Computing in Senior Lab**
PY452 is the undergraduate advanced laboratory course. During the pandemic, laboratory work of any kind was severely restricted. In order to develop the analytic and computational skills that would be acquired in this course, I guided two groups in using the cloud-based IBM Quantum Computers. These are actual functioning quantum computers, where you can run quantum computing programs and get the results from the hardware. As such, it is essentially a remote fundamental quantum mechanics experimental platform.
- 2018 **Jupyterhub server in PY251**
Obtained funding to purchase a Jupyter server for educational development in the College of Sciences. This server is now used in PY251 to provide all students access to equal hardware.
- 2018 **Deployed the use of Jupyter notebooks in PY251**
PY251 was developed using PDF notes for the students to follow. The notes contained code, background information and exercises. The students were copying the code into a python interpreter line by line, and doing their exercises there. After the 1st semester, I converted the PDF notes to Jupyter notebooks. The notebook/cell structure is ideal for scaffolded, student-led development and use since the instructor may provide all or parts of the code as a notebook with the pieces already filled in and assign the students to add to or modify those small pieces that illustrate the class concepts.
- 2017 **Introduced oral exams in PY251**
Transitioned PY251 exams from a traditional in-class exam to a set of take-home problems, where students got to tackle more complex ideas in a more relaxed setting. This turned the class from a skills-based course to a broader exposure to open problems in physics.
- 2016 **Implemented Just-In-Time-Teaching in PY208**
Just-in-time-teaching is an evidence-based method for gathering student feedback before class and to adjust the teaching according to what the students understand and what they do not. The rapid feedback provides the opportunity to spend less time on the known subjects, and more time on what is confusing to the students. It also pushes the students to learn outside of class time, and outside of class materials to gain a broader view of the material.
- 2015 **Spearheaded introduction of minicourses**
Due to the ever changing nature of physics research, new topics arise and old topics fall out of interest. However, the new topics do not always necessitate a full 3-credit course, and developing such a course is a lot of effort. To provide an intermediate option, where a topic can be taught with a smaller overhead, we have implemented 1-credit minicourses. I coordinated the deployment and the initial offerings, and have taught two.

PROFESSIONAL SERVICE

International & National

Service

- 2019: Member of South-East Section of APS (SESAPS) Jesse Beams award committee
- 2019: Organized invited session for SESAPS yearly meeting
- 2017 – 2018: Facilitated online development workshop for new faculty through FOLC

Reviewing

- Refereed proposals for the Deutsche Forschungsgemeinschaft (DFG – German Research Foundation), Austrian Science Fund (FWF), Israel Science Foundation (ISF), and Swiss National Science Foundation (SNSF).
- Refereed proposals for the National Science Foundation (NSF), Army Research Office (ARO), Department Of Energy (DOE)
- Sat on National Science Foundation “*Designing Materials to Revolutionize and Engineer our Future (DMREF)*” panel
- Refereed for Science journals, Nature journals, American Physical Society journals, MDPI journals, American Chemical Society journals, IOP journals, Superconducting Science & Technology

NC State

- 2022: Physics Department Faculty Search Committee (Chair)
- 2022: Physics Department Head Review Committee (Chair)
- 2021 – current: Department of Physics Personnel Committee (Chair)
- 2020 – current: NCSU Quantum Information Club faculty advisor
- 2020 – 2022: Department of Physics Faculty Advisory Committee
- 2020 – current: College of Sciences Diversity, Equity and Inclusion Committee (Chair)
- 2019 – current: Department of Physics Diversity, Equity and Inclusion Committee (Member)
- 2018 – current: Member of IBM Q Hub Research and Education Advisory Committee
- 2018 – current: NCSU Physics Undergraduate academic advisor
- 2017 – current: NCSU SPS (Society of Physics Students) faculty advisor
- 2018: Co-ran a NCSU DELTA short workshop on using Jupyter notebooks in education
- 2018 – 2020: NCSU College of Sciences Faculty Advisory Committee (Member)
- 2017 – 2017: Headed graduate curriculum task force at NC State University leading to the creation of mini-courses within the physics department
- 2015 – 2017: NCSU Physics Graduate Recruiting Committee Member

Previous organizations

- 2015: Co-organized Postdoc Coordination Program at Lawrence Berkeley National Laboratory
- 2008: Served as graduate student representative on the Graduate Student Advisory Committee at the University of Florida

MENTORING

Postdoctoral

- Dr. Avinash Rustagi — Currently at Purdue University
- Dr. Xiao Xiao — Currently at Oak Ridge National Laboratory

Graduate

- Dr. Omadillo Abdurazakov, Dr. Ankit Kumar, Dr. Akhil Francis, Efehan Kökcü, Anjali Agrawal, Heba Soliman, Norman Hogan

Undergraduate

- Shannon Dwyer, Elliot Holliday, Kevin Lively, Tim Willard, Noah Jabusch, Pavan Dayal, John Revelle, Maggie Loughlin, Anna Honeycutt, Emma Stone, Thomas Steckmann, Viktoriya Anissimova, Sanskriti Deva, Natalia Wilson, Jack Howard, Daniel Brandon, Sarah Klas, Ethan Blair, Arvin Kushwaha

K-12

- Abhijit Gupta (NCSSM), Paarth Tara (NCSSM)

Visiting Researchers

- Gabriel Topp: Max Planck Institut for Structure and Dynamics of Matter, Hamburg, Germany

STUDENT AWARDS

- 2022 Natalya Wilson – Meera travel award, Office of Undergraduate Research Travel Award
- 2022 Sanskriti Deva – Office of Undergraduate Research Summer Research Award
- 2020 Noah Jabusch – Provost’s Professional Experience Program Scholarship
- 2020 Maggie Loughlin – Provost’s Professional Experience Program Scholarship
- 2019 Timothy Willard – NCSU Physics McCormick Symposium Honorable Mention
- 2018 Timothy Willard – Provost’s Professional Experience Program Scholarship
- 2018 Omadillo Abdurazakov – APS DCMP Honorable Mention Travel Grant Award
- 2018 Omadillo Abdurazakov – Future Of Materials II Oral Presentation Award
- 2018 Ankit Kumar – Travel Grant for the 2018 Gordon Conference on Ultrafast Dynamics in Cooperative Systems
- 2016 Shannon Dwyer – NC State Undergraduate Research Grant Awards
- 2016 Shannon Dwyer – Society of Physics Students (SPS) Travel Award to attend SPS Symposium

OUTREACH

Highlights

- 2022 **Nobel Prize Lecture on Quantum Information**, *North Carolina Museum of Natural Sciences*, Together with an undergraduate student, gave a public lecture about the Nobel Prize in Physics in 2022.
https://www.youtube.com/watch?v=_kadhVPo85w
- 2020 **Teen Science Cafe**, *North Carolina Museum of Natural Sciences*, Presented at the first-ever virtual Teen Science Cafe at the NC Museum of Natural Sciences. This is normally done in person, and we collaborated in the pre-event organization. This is now a standing feature at the NC Museum
<https://www.youtube.com/watch?v=Eo8NvARvFog>
- 2019 **Remote Teaching Workshop**, *NC State University, American Modeling Teachers Association, and American Association of Physics Teachers*, As part of the CAREER award, helped organize and advised a remote workshop with AMTA and AAPT. This workshop took place in Spring of 2019 (during the beginnings of the Covid-19 pandemic), where online learning was still arguably in its infancy

2018 **Invisible Worlds**, *NC State University and The Leading Strand*, As part of a collaboration between the Colleges of Sciences and Design, and The Leading Strand, we participated in an art exhibit with design students building a piece based on the work done in Sciences. This semester long project culminated in an art installation in soon-to-be Transfer Food Company in Raleigh, NC

Other

2020 **Skype A Scientist**, *The Episcopal Academy*

2020 **Spring 2020 K-12 Outreach**, *Wake County Elementary Schools*

2017 **Teen Science Cafe**, *North Carolina Museum of Natural Sciences at Whiteville*

2017 **ORaCEL Educational outreach**, *NC State University*

2016 **"Meet me at the museum"**, *North Carolina Museum of Natural Sciences at Whiteville*

2016 **North Carolina Science Festival**, *North Carolina Museum of Natural Sciences*

2015 **ORaCEL Educational outreach**, *NC State University*

2015 **LBNL outreach**, *Lawrence Berkeley National Laboratory*

CONFERENCES ATTENDED

- Mar. 2023 **APS March Meeting**, *Las Vegas, NV*, Invited talk: "Non-equilibrium spectroscopy from the theoretical perspective."
- Nov. 2022 **International Workshop on Ultrafast Dynamics and Metastability**, *Virtual*, Invited talk: "Non-equilibrium spectroscopy from the theoretical perspective."
- Sep. 2022 **Recent Progress in Many-Body Theory XXI**, *Chapel Hill, NC*, Invited talk: Lie Algebraic perspectives on time evolution of unitary quantum systems and simulators"
- Jul. 2022 **ACS Fall Meeting**, *Chicago, IL*, Invited talk: "Algebraic compression of quantum circuits."
- May. 2022 **Southeast Quantum Computing Workshop**, *Virtual*, Invited talk: "Examining Thermodynamics using Quantum Computers."
- Mar. 2022 **APS March Meeting**, *Chicago, IL*
- Nov. 2021 **Photo-Induced Phase Transitions (PIPT) 7**, *Virtual*, Invited talk: "Time-Resolved Photoemission from excitons and coherences."
- Nov. 2021 **International Workshop on Ultrafast Dynamics and Metastability**, *Virtual*, Invited talk: "Time-Resolved Photoemission from excitons and coherences."
- Jul. 2021 **SPIE Optics & Photonics**, *San Diego, CA*, Invited talk: "Time-Resolved Photoemission from excitons and coherences."
- Apr. 2021 **ACS Spring National Meeting**, *Virtual*, Invited talk: "Examining topology and thermodynamics using quantum computers."
- Oct. 2020 **2020 SSRL/LCLS Users' Meeting**, *Virtual*, Invited talk: "Time-Resolved Photoemission from excitons and coherences."
- Feb. 2020 **Sanibel Symposium**, *St. Simons Island, Georgia*, Invited talk: Examining the physics of spin systems using quantum computers
- Feb. 2020 **Gordon Research Conference: Ultrafast Phenomena in Cooperative Systems**, *Lucca, Italy*, Invited session chair
- Jun. 2019 **Ultrafast and Nonlinear Dynamics of Quantum Materials**, *University of Paris-Diderot, Paris, France*, Invited talk: "A room temperature Electron-Hole Liquid in two-dimensional materials"
- Mar. 2019 **APS March Meeting**, *Boston, MA*, Contributed talk: Optical conductivity and charge fluctuation spectroscopy in the time domain
- Mar. 2018 **APS March Meeting**, *Los Angeles, CA*, Contributed talk: Observing excitons with time-resolved ARPES

- Feb. 2018 **Gordon Research Conference: Ultrafast Phenomena in Cooperative Systems**, Galveston, TX, Invited talk: Insights into Time-Resolved Spectroscopy from the Theoretical Perspective
- Dec. 2017 **Winter School: Ultrafast quantum control of matter: the path to solids**, Vancouver, Canada, Invited Lecture Series: What can we learn from time-resolved experiments?
- Nov. 2017 **International Workshop on Ultrafast Dynamics and Metastability**, Georgetown University, Washington, Invited talk: Ultrafast dynamics of quantum materials: Lessons learned from Theory
- Sept. 2017 **PCS Workshop: Non-Linear Effects and Short-Time Dynamics in Novel Superconductors and Correlated Spin-Orbit Coupled Systems**, IBS Center for Theoretical Physics of Complex Systems, Daejeon, South Korea, Invited talk: Time-Resolved Spectroscopy of Superconductors in the Time Domain: Some Observations from Theory
- May 2017 **Stanford & SLAC Ultrafast Materials Science workshop**, Invited discussion
- Mar. 2017 **APS March Meeting**, New Orleans, LA, Contributed talk: Signatures of forward scattering superconductivity in non-equilibrium experiments
- Jan. 2017 **Workshop on Time-resolved Photoelectron Spectroscopy**, Elettra Sincrotrone, Trieste, Italy, Invited talk: Theoretical modeling of non-equilibrium spectroscopy
- Oct. 2016 **Ultrafast Dynamics in Strongly Correlated Systems**, Paul Scherrer Institute, Villigen, Switzerland, Invited talk: Understanding complex materials using non-equilibrium spectroscopy: what can theory tell us?
- Aug. 2016 **International Research School: Electronic States and Phases Induced by Electric or Optical Impacts IMPACT 2016**, Cargèse, France, Invited talk: Understanding complex materials using non-equilibrium spectroscopy: what can theory tell us?
- Aug. 2016 **Workshop on Experiment and Theory of the Electronic Structure of Correlated f-electron Materials**, Temple University, Philadelphia, PA, Invited talk: Understanding complex materials using non-equilibrium spectroscopy: what can theory tell us?
- Jul. 2016 **Gordon Conference on Correlated Electron Systems**, Mount Holyoke College, MA, Contributed poster: Understanding correlated materials out of equilibrium
- Mar. 2016 **APS March Meeting**, Baltimore, MD, Invited talk: Electron-boson coupling: Beyond the Equilibrium Interpretation
- Jul. 2015 **CORPES15: International workshop on strong correlations and angle-resolved photoemission spectroscopy**, Paris, France, Invited talk: Theoretical studies of non-equilibrium spectroscopy
- Mar. 2015 **APS March Meeting**, San Antonio, TX, Contributed talk: Amplitude mode oscillations in BCS superconductors
- Aug. 2014 **Workshop on Many-body Quantum Systems Far from Equilibrium**, Aspen, CO, Invited talk: Control of topological materials with light
- Mar. 2014 **APS March Meeting**, Denver, CO, Contributed talk: Ultrafast transient decoupling and multi-phonon effects in driven electron-phonon systems
- Feb. 2014 **Gordon Conference on Ultrafast Phenomena in Cooperative Systems**, Ventura, CA, Contributed poster: Simulation of non-equilibrium superconductivity
- Dec. 2013 **Bay Area Scientific Computing Day**, Berkeley, CA, Invited talk: Numerical modeling of non-equilibrium phenomena and spectroscopy
- Mar. 2013 **APS March Meeting**, Baltimore, MD, Contributed talk: Interplay between electron-electron and electron-lattice interactions in the RTe₃ compounds
- Feb. 2013 **Short-time Dynamics in Strong Correlated Systems and Novel Superconductors**, Bochum, Germany, Invited talk: Theory for time-domain photon spectroscopy
- Feb. 2013 **International workshop on Novel Materials and Superconductors**, Donnersbach, Austria, Contributed poster: Modeling lattice interaction in non-equilibrium pump-probe experiments

- Feb. 2013 **Workshop on correlated systems**, *Walther Meißner Institut, Garching, Germany*, Invited talk: Insights from time-resolved X-ray diffraction on CDW formation in TbTe_3
- Oct. 2012 **2012 Advanced Light Source User Meeting**, *Lawrence Berkeley National Laboratory, Berkeley, CA*
- Aug. 2012 **Next Generation Light Source, Science workshop: Quantum Materials, Magnetism & Spin Dynamics**, *Berkeley, CA*
- Mar. 2012 **Workshop on superconductivity in iron-based compounds**, *Munich, Germany*, Invited talk: Spectroscopy in the spin-density wave state of the iron pnictides: a mean field perspective
- Mar. 2012 **Complex Systems Symposium**, *Walther Meißner Institut, Garching, Germany*, Invited talk: Theory for pump-probe spectroscopy
- Mar. 2012 **APS March Meeting**, *Boston, MA*, Contributed talk: Modeling lattice interaction in non-equilibrium pump-probe experiments
- Feb. 2012 **Gordon Conference on Ultrafast Phenomena in Cooperative Systems**, *Galveston, TX*, Contributed poster: Modeling lattice interaction in non-equilibrium pump-probe experiments
- Jan. 2012 **RIXS/REXS Workshop**, *Stanford, CA*, Invited talk: Theory for pump-probe spectroscopy
- Oct. 2011 **SSRL/LCLS Users' Conference and Workshops**, *SLAC National Accelerator Laboratory, Menlo Park, CA*
- Jul. 2011 **Complex Order and Fluctuations workshop**, *Walther Meißner Institut, Garching, Germany*, Invited talk: Degeneracy-driven density waves in $R\text{Te}_3$
- Aug. 2011 **Multiband and Multiorbital Effects in Novel Materials Summer School**, *Cargèse, France*, Contributed poster: Sensitivity of gap anisotropy to electronic structure in spin-fluctuation pairing models of Fe-pnictide superconductors
- Mar. 2011 **APS March Meeting**, *Dallas, TX*, Contributed talk: Modeling pump-probe spectroscopy in systems with electron-phonon coupling
- Oct. 2010 **2010 Advanced Light Source User Meeting**, *Lawrence Berkeley National Laboratory, Berkeley, CA*
- Jul. 2010 **Walther Meißner Institut, Garching, Germany**, Invited talk: *Spin fluctuations in FeAs*, Complex Order and Fluctuations workshop
- Mar. 2010 **APS March Meeting**, *Portland, OR*, Contributed talk: Sensitivity of gap anisotropy to electronic structure in spin-fluctuation pairing models of Fe-pnictide superconductors
- Mar. 2009 **APS March Meeting**, *Pittsburgh, PA*, Contributed talk: Cobalt doping and three-dimensionality in BaFe_2As_2
- Jun. 2008 **International Summer School on Numerical Methods for Correlated Systems in Condensed Matter**, *Sherbrooke, Canada*, Contributed poster: Influence of oxygen orbitals on impurity states in superconducting cuprates
- Mar. 2008 **APS March Meeting**, *New Orleans, LA*, Contributed talk: Electronic structure of graphene in the presence of disorder
- Jul. 2007 **50 years of BCS Summer School**, *Cargèse, France*, Contributed poster: The effect of strong impurity scattering on superconductivity in the 2D Hubbard model
- Mar. 2007 **APS March Meeting**, *Denver, CO*, Contributed talk: The effect of strong impurity scattering on superconductivity in the 2D Hubbard model
- Feb. 2007 **Sanibel Symposium**, *St. Simons Island, Georgia*, Contributed poster: The effect of strong impurity scattering on superconductivity in the 2D Hubbard model
- Jun. 2006 **Center for Nanophase Materials Sciences' 2006 Users Meeting**, *Oak Ridge, Tennessee*, Contributed poster: Electronic Transport using Green's Function Methodologies: From Mesoscopic to Superconducting
- Feb. 2006 **Sanibel Symposium**, *St. Simons Island, GA*, Contributed poster: Palladium Adsorbed Carbon Nanotubes as Hydrogen Sensors (Poster)