

# Yao Wang

## Curriculum Vitae

Kinard Laboratory 213

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## Professional Appointments

- 2020 - **Assistant Professor** *Department of Physics & Astronomy, Clemson University*  
2017 - 2020 **Postdoctoral Fellow** *Department of Physics, Harvard University*

## Education

- 2017 **Ph.D. in Applied Physics, Stanford University**  
**Minor in Computational and Mathematical Engineering**  
Advisor: Thomas P. Devereaux  
Thesis: *Nonequilibrium Dynamics and Spectroscopies in Quantum Matter*
- 2011 **B.S. in Applied Physics, University of Science and Technology of China**

## Research Interest

**Physical Problems:** quantum many-body systems, strongly correlated materials, electron-boson coupling  
nonequilibrium dynamics, high-order entanglement, quantum algorithm/simulation

**Computation:** advanced many-body algorithms, time-domain algorithm, massively parallel computing

**Simulated Characterization:** photoemission, scattering, nonlinear spectroscopies, pump-probe techniques

## Professional Records

### Grants and Allocations:

NSF (PI): “*Quantum Algorithms for Correlated Electron-Phonon System*” \$299,827 (Jan 2021 - Dec 2022)

NERSC (PI): “*Nonlinear Pump-Probe Theory and Simulation*” 2,100,000 CPU hours (Sep 2020 - Jan 2022)

**Journal Referees:** *Nature, Nat. Phys., Phys. Rev. Lett., Phys. Rev. X, Phys. Rev. B, Phys. Rev. Mater., 2D Mater., Commun. Phys., J. Phys.-Condens. Mat., Sci. Rep., New J. Phys.* etc.

**Teaching:** Mathematical Methods in Theoretical Physics (2021)

**Outreach:** NetPals volunteer for underrepresented minorities in Putnam Avenue Upper School (2019)

## Honors and Awards

### Fellowships and Scholarships

- 2017 - 2020 **Harvard-MPQ Postdoctoral Fellowship in Quantum Science,** Harvard University  
2012 - 2015 **Stanford Graduate Fellowship,** Stanford University  
2011 **Guo Moruo Scholarship,** University of Science and Technology of China

### Awards

- 2020 **Outstanding Reviewer of the Month,** Communications Physics  
2019 **IUCr Young Scientist Award,** Inelastic X-ray Scattering Conference  
2017 **Outstanding Reviewer Award,** IOP Publishing  
2017 **Travel Award for Excellence in Graduate Research,** American Physical Society  
2010 **CSST Summer Research Final Award,** University of California, Los Angeles

## Full Publication List

† denotes equal contributions; \* denotes corresponding authors

### Preprints and Manuscripts under Review

45. **Y. Wang\***, T. Shi, and C.-C. Chen\*, *Fluctuating Nature of Light-Induced  $d$ -Wave Superconductivity*, arXiv:2101.03495 (2021) under review of *Phys. Rev. Lett.*
44. **Y. Wang\***, A. Bohrdt, J. Koepsell, E. Demler, and F. Grusdt\*, *Higher-Order Spin-Hole Correlations around a Localized Charge Impurity*, arXiv:2101.00721 (2021) under review of *Phys. Rev. Research*
43. Z. Chen†, **Y. Wang†**, S.N. Rebec, T. Jia, M. Hashimoto, D. Lu, B. Moritz, R.G. Moore, T.P. Devereaux\*, and Z.-X. Shen\*, *Anomalously Strong Near-Neighbor Attraction in Doped 1D Cuprate Chains*, under review of *Science* (2020)
42. Y. Zhou, J. Sung, E. Brutschea, I. Esterlis, **Y. Wang**, G. Scuri, R.J. Gelly, H. Heo, T. Taniguchi, K. Watanabe, G. Zaránd, M.D. Lukin, P. Kim, E. Demler, and H. Park, *Signatures of Bilayer Wigner Crystals in a Transition Metal Dichalcogenide Heterostructure*, arXiv:2010.03037 (2020) under review of *Nature*
41. A. Alexandradinata, N.P. Armitage\*, A. Baydin, W. Bi, Y. Cao, H. Changlani, E. Chertkov, E. da Silva Neto, L. Delacretaz, I. Baggari, G.M. Ferguson, W. Gannon, S. Ghorashi, B. Goodge, O. Goulko, G. Grissonnanche, A. Hallas, I. Hayes, Y. He, E. Huang, A. Kogar, D. Kumah, J. Lee, A. Legros, F. Mahmood, Y. Maximenko, N. Pellatz, H. Polshyn, T. Sarkar, A. Scheie, K. Seyler, Z. Shi, B. Skinner, L. Steinke, K. Thirunavukkuarasu, T. Trevisan, M. Vogl, P. Volkov, **Y. Wang**, Y. Wang, D. Wei, K. Wei, S. Yang, X. Zhang, Y. Zhang, L. Zhao, and A. Zong, *The Future of the Correlated Electron Problem*, arXiv:2010.00584 (2020) under review of *npj Quantum Mater.*
40. S. Peng , C. Lane , Y. Hu , M. Guo , X. Chen , Z. Sun , M. Hashimoto , D. Lu , Z.-X. Shen , T. Wu , X. Chen , R. Markiewicz , **Y. Wang**, A. Bansil , S. Wilson, and J.-F. He, *Electronic Nature of the Pseudogap in Electron-Doped  $Sr_2IrO_4$*  under review of *Nat. Commun.* (2020)
39. J. Koepsell, D. Bourgund, P. Sompet, S. Hirthe, A. Bohrdt, **Y. Wang**, F. Grusdt, E. Demler, G. Salomon, C. Gross, and I. Bloch, *Microscopic Evolution of Doped Mott Insulators from Polaronic Metal to Fermi Liquid*, arXiv:2009.04440 (2020) under review of *Science*
38. E. Baldini, A. Zong, D. Choi, C. Lee, M.H. Michael, L. Windgatter, I.I. Mazin, S. Latini, D. Azoury, B. Lv, A. Kogar, **Y. Wang**, Y. Lu, T. Takayama, H. Takagi, A.J. Millis, A. Rubio, E. Demler, and N. Gedik, *Unraveling the Origin of Spontaneous Symmetry Breaking in  $Ta_2NiSe_5$* . arXiv:2007.02909 (2020) under review of *Sci. Adv.*

### Journal Articles

37. M. Buzzi, G. Jotzu, A. Cavalleri, J.I. Cirac, E. Demler, B.I. Halperin, M.D. Lukin, T. Shi, **Y. Wang**, and D. Podolsky *Higgs-Mediated Optical Amplification in a Non-Equilibrium Superconductor*. accepted by *Phys. Rev. X* (2021)
36. A. Bohrdt, **Y. Wang**, J. Koepsell, M. Kánasz-Nagy, E. Demler, and F. Grusdt, *Dominant Fifth-Order Correlations in Doped Quantum Anti-Ferromagnets*, *Phys. Rev. Lett.* 126, 026401 (2021)
35. **Y. Wang\***, I. Esterlis, T. Shi\*, J.I. Cirac, and E. Demler, *Zero-Temperature Phases of the 2D Hubbard-Holstein Model: A Non-Gaussian Exact Diagonalization Study*. *Phys. Rev. Research* 2, 043258 (2020)

34. **Y. Wang\***, Y. He, K. Wohlfeld, M. Hashimoto, E.W. Huang, D. Lu, S.-K. Mo, S. Komiyama, C. Jia, B. Moritz, Z.-X. Shen, and T.P. Devereaux\*, *Emergence of Quasiparticle in Doped Mott Insulators*. *Comm. Phys.* 3, 210 (2020)
33. M. Mitrano\* and **Y. Wang\***, *Probing Light-Driven Quantum Materials with Ultrafast Resonant Inelastic X-Ray Scattering*. *Comm. Phys.* 3, 184 (2020)
32. Y. Chen, **Y. Wang\***, M. Claassen, B. Moritz, and T.P. Devereaux\*, *Observing Photo-Induced Chiral Edge States of Graphene Nanoribbons in Pump-Probe Spectroscopies*. *npj Quantum Mater.* 5, 84 (2020)
31. R. Li, P. Zhu, H. Zhang, **Y. Wang**, J. Chen, P.M. Rentzepis, and J. Zhang, *Evolution of Picosecond Surface Electric Fields Generated by Photon-induced Charge Emission from  $\text{La}_{0.67}\text{Sr}_{0.33}\text{MnO}_3$  Films*. *Phys. Rev. B* 102, 024302 (2020)
30. **Y. Wang**, Y. Chen, C.J. Jia, B. Moritz, and T.P. Devereaux *Time-Resolved Resonant Inelastic X-Ray Scattering in a Pumped Mott Insulator*. *Phys. Rev. B* 101, 165126 (2020)
29. J.P. Dehollain, U. Mukhopadhyay, V.P. Michal, **Y. Wang**, B. Wunsch, C. Reichl, W. Wegscheider, M.S. Rudner, E. Demler, and L.M.K. Vandersypen *Nagaoka Ferromagnetism Observed in a Quantum Dot Plaquette*. *Nature* 579, 528 (2020)
28. **Y. Wang**, J.P. Dehollain, F. Liu, U. Mukhopadhyay, M.S. Rudner, L.M.K. Vandersypen, and E. Demler *Ab Initio Exact Diagonalization Simulation of Nagaoka Transition in Quantum Dots*. *Phys. Rev. B* 100, 155133 (2019)
27. E.M. Pärshcke<sup>†</sup>, **Y. Wang**<sup>†</sup>, B. Moritz, T.P. Devereaux, C.-C. Chen and K. Wohlfeld *Numerical Study of the Spin Excitations in a Doped Spin Chain*. *Phys. Rev. B* 99, 205102 (2019)
26. Y. Chen, **Y. Wang**, C. Jia, B. Moritz, A.M. Shvaika, J.K. Freericks, T.P. Devereaux *Theory for Time-Resolved Resonant Inelastic X-ray Scattering*. *Phys. Rev. B* 99, 104306 (2019) [Editors' Suggestion]
25. H. Ruiz, **Y. Wang**, B. Moritz, A. Baum, R. Hackl, T.P. Devereaux *Frustrated Magnetism from Local Moments in FeSe*. *Phys. Rev. B* 99, 125130 (2019)
24. J.-F. He, C.R. Rotundu, M.S. Scheurer, Y. He, M. Hashimoto, K. Xu, **Y. Wang**, E.W. Huang, T. Jia, S.-D. Chen, B. Moritz, D.-H. Lu, Y.S. Lee, T.P. Devereaux and Z.-X. Shen *Fermi Surface Reconstruction in Electron-Doped Cuprates without Long-Range Order*. *Proc. Natl. Acad. Sci. U.S.A.* 116, 3449 (2019)
23. A. Baum, H.N. Ruiz, N. Lazarević, **Y. Wang**, T. Böhm, R. Hosseinian Ahangharnejhad *et. al.* *Frustrated Spin Order and Stripe Fluctuations in FeSe*. *Commun. Phys.* 2, 14 (2019)
22. **Y. Wang**, T.P. Devereaux, C.-C. Chen *Theory of Time-Resolved Raman Scattering in Correlated Systems: Ultrafast Engineering of Spin Dynamics and Detection of Thermalization*. *Phys. Rev. B* 98, 245106 (2018)
21. Y.Y. Peng, E.W. Huang, R. Fumagalli, M. Minola, **Y. Wang**, X. Sun *et. al.* *Paramagnon Damping Dependence on Doping and Momentum in  $(\text{Bi,Pb})_2(\text{Sr,Lu})_2\text{CuO}_{6+\delta}$* . *Phys. Rev. B* 98, 144507 (2018)
20. **Y. Wang**, M. Claassen, D. Pemmaraju, C. Jia, B. Moritz, T. P. Devereaux *Theoretical Understanding of Photon Spectroscopies in Correlated Materials In and Out of Equilibrium*. *Nat. Rev. Mater.* 3, 312 (2018)

19. **Y. Wang**, C.-C. Chen, B. Moritz, T.P. Devereaux *Light-Enhanced Spin Fluctuations and d-Wave Superconductivity at a Phase Boundary*. *Phys. Rev. Lett.* 120, 246402 (2018)
18. **Y. Wang**, E.W. Huang, B. Moritz, T.P. Devereaux *Magnon Splitting Induced by Charge Transfer in the Three-Orbital Hubbard Model*. *Phys. Rev. Lett.* 120, 246401 (2018)
17. L. Chaix, E.W. Huang, C. Jia, S. Gerber, X. Lu, Y. Huang, D. McNally, **Y. Wang** et. al. *Resonant Inelastic X-Ray Scattering Studies of Magnons and Bimagnons in the Lightly Doped Cuprate  $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$* . *Phys. Rev. B* 97, 155144 (2018)
16. H.-M. Guo, E. Khatami, **Y. Wang**, T.P. Devereaux, R.R.P. Singh, R.T. Scalettar *Unconventional Pairing Symmetry of Interacting Dirac Fermions on a  $\pi$ -Flux Lattice*. *Phys. Rev. B* 97 155146 (2018)
15. **Y. Wang**, B. Moritz, C.-C. Chen, T.P. Devereaux, K. Wohlfeld *Influence of Magnetism and Correlation on the Spectral Properties of Doped Mott Insulators*. *Phys. Rev. B* 97, 115120 (2018)
14. C.Y. Chen, J. Avila, S. Wang, **Y. Wang**, C. Shen, R. Yang et. al., *Emergence of Interfacial Polarons from Electron-Phonon Coupling in Graphene/h-BN van der Waals Heterostructure*. *Nano Lett.* 18, 1082 (2018)
13. C.J. Jia<sup>†</sup>, **Y. Wang**<sup>†</sup>, B. Moritz, T.P. Devereaux *Paradeisos: A Perfect Hashing Algorithm for Many-Body Eigenvalue Problems*. *Comput. Phys. Commun.* 224, 81 (2018)
12. **Y. Wang**, M. Claassen, B. Moritz, T.P. Devereaux *Producing Coherent Excitations in Pumped Mott Antiferromagnetic Insulators*. *Phys. Rev. B* 96, 235142 (2017)
11. S.-L. Yang, J. Sobota Y. He, **Y. Wang**, D. Leuenberger, H. Soifer et. al. *Revealing the Coulomb Interaction Strength in a Cuprate Superconductor*. *Phys. Rev. B* 96, 195106 (2017)
10. Y.F. Kung, C. Bazin, K. Wohlfeld, **Y. Wang**, C.-C. Chen, C.J. Jia et. al. *Numerically Exploring the 1D-2D Dimensional Crossover on Spin Dynamics in the Doped Hubbard Model*. *Phys. Rev. B* 96, 195106 (2017)
9. T.P. Devereaux, A. Shvaika, K. Wu, K. Wohlfeld, C.J. Jia, **Y. Wang**, B. Moritz et. al. *Directly Characterizing the Relative Strength and Momentum Dependence of Electron-Phonon Coupling Using Resonant Inelastic X-Ray Scattering*. *Phys. Rev. X* 6, 041019 (2016)
8. C.J. Jia, K. Wohlfeld, **Y. Wang**, B. Moritz, T.P. Devereaux *Using RIXS to Uncover Elementary Charge and Spin Excitations*. *Phys. Rev. X* 6, 021020 (2016)
7. Z. Wang, S. McKeown Walker, A. Tamai, **Y. Wang**, Z. Ristic, F.Y. Bruno, A. de la Torre et. al. *Tailoring the Nature and Strength of Electron-Phonon Interactions in the  $\text{SrTiO}_3(001)$  Two-Dimensional Electron Liquid*. *Nat. Mater.* 15, 835 (2016)
6. Y.F. Kung, C.-C. Chen, **Y. Wang**, E.W. Huang, et. al. *Characterizing the Three-Orbital Hubbard Model with Determinant Quantum Monte Carlo*. *Phys. Rev. B* 93, 155166 (2016) [Editors' Suggestion]
5. **Y. Wang**, B. Moritz, C.-C. Chen, C.J. Jia, M. van Veenendaal, T.P. Devereaux *Using Nonequilibrium Dynamics to Probe Competing Orders in Mott-Peierls System*. *Phys. Rev. Lett.* 116, 086401 (2016)
4. **Y. Wang**<sup>†</sup>, K. Wohlfeld<sup>†</sup>, B. Moritz, C.J. Jia, M. van Veenendaal, K. Wu, C.-C. Chen, T.P. Devereaux *Origin of Strong Dispersion in Hubbard Insulators*. *Phys. Rev. B* 92, 075119 (2015)

3. N. Plonka, C.J. Jia, **Y. Wang**, B. Moritz, T.P. Devereaux *Fidelity Study of Superconductivity in Extended Hubbard Models*. *Phys. Rev. B* 92, 024503 (2015)
2. **Y. Wang**, C.J. Jia, B. Moritz, T.P. Devereaux *Real-Space Visualization of Remnant Mott Gap and Magnon Excitations*. *Phys. Rev. Lett.* 112, 156402 (2014)
1. H. Chen, **Y. Wang**, X. Chen, Z. Lin. *Gas Phase Conformations of Tetrapeptide Glycine-Phenylalanine-Glycine-Glycine*. *Chin. J Chem. Phys.* 25, 77 (2012)

## Presentations

### Invited Talks

- *Quantum Meets Computation*  
Physics Research Seminar, Clemson University, Clemson, SC, USA (Sep. 2020)
- *Novel and Pragmatic Perspectives on Nonequilibrium Quantum Materials*  
Physics Colloquium, University of Alabama at Birmingham, Birmingham, AL, USA (Feb. 2020)
- *Novel and Pragmatic Perspectives on Nonequilibrium Quantum Materials*  
Physics Colloquium, University of Delaware, Newark, DE, USA (Feb. 2020)
- *Novel and Pragmatic Perspectives on Nonequilibrium Quantum Materials*  
Physics Colloquium, University of Cincinnati, Cincinnati, OH, USA (Feb. 2020)
- *Novel and Pragmatic Perspectives on Nonequilibrium Quantum Materials*  
Physics Seminar, Emory University, Atlanta, GA, USA (Feb. 2020)
- *Novel and Pragmatic Perspectives on Nonequilibrium Quantum Materials*  
Physics Colloquium, Clemson University, Clemson, SC, USA (Feb. 2020)
- *Tracking Collective Spin and Charge Excitations through Time-Resolved Raman and RIXS Spectra*  
International Conference on Inelastic X-ray Scattering, Stony Brook, NY, USA (Jun. 2019)
- *Deciphering Ultrafast Phenomena using Nonequilibrium Spectroscopies*  
Special Seminar, Peking University, Beijing, China (June 2019)
- *Investigation of Nonequilibrium Physics in Electron-Phonon Systems using the Non-Gaussian Approach*  
MPHQ Spring Meeting, Harvard University, Cambridge, MA, USA (May 2019)
- *Deciphering Ultrafast Phenomena using Nonequilibrium Spectroscopies*  
Special Seminar, Tsinghua University, Beijing, China (May 2019)
- *Pump-Induced Superconductivity and Higgs Oscillations*  
Joint Quantum Seminar, Harvard University, Cambridge, MA, USA (Feb. 2019)
- *Nonequilibrium Manipulation of Bosonic Excitations and Superconductivity*  
Physics Colloquium, University of Alabama at Birmingham, Birmingham, AL, USA (Feb. 2018)
- *Competing Orders, Bosonic Excitations and Transient Dynamics Out of Equilibrium*  
Condensed Matter Physics Special Seminar, Harvard University, Cambridge, MA, USA (Feb. 2017)

- *Time-Domain Study of Competing Orders in Mott-Peierls System*  
Condensed Matter Physics Seminar, California Institute of Technology, Pasadena, CA, USA (Jan. 2017)
- *Nonequilibrium Study of Competing Orders*  
Theory Seminar, Max-Planck Institute of the Structure and Dynamics of Matter, Hamburg, Germany (Jun. 2016)
- *Spectra and Dynamics in Strongly Correlated Electronic System*  
Special Seminar, Hefei National Laboratory for Physical Sciences at the Microscale, Hefei, Anhui, China (Sep. 2015)

#### Contributed Conference Presentations

- *Extracting Dynamical Structure Factor from Cold Atom Simulator*  
**Y. Wang**, J. Koepsell, and E. Demler, *Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics*, Milwaukee, WI, USA (May 2019)
- *Manipulation of Superconductivity through Parametric Driven Phonons*  
**Y. Wang**, T. Shi, V. Kasper, J.I. Cirac, and E. Demler, *APS March Meeting*, Boston, MA, USA (Mar. 2019)
- *Light-Enhanced Spin Fluctuations and d-Wave Superconductivity at a Phase Boundary*  
**Y. Wang**, C.-C. Chen, B. Moritz, and T.P. Devereaux, *APS March Meeting*, Los Angeles, CA, USA (Mar. 2018)
- *Coherent Excitations Induced by Pumping a Mott System*  
**Y. Wang**, M. Claassen, B. Moritz, T.P. Devereaux, *APS March Meeting*, New Orleans, LA, USA (Mar. 2017)
- *Using Nonequilibrium Dynamics to Probe Competing Orders in Mott-Peierls System*  
**Y. Wang**, B. Moritz, C.-C. Chen, C.J. Jia, M. van Veenendaal, T.P. Devereaux, *APS March Meeting*, Baltimore, MD, USA (Mar. 2016)
- *Photoinduced Dynamics of Charge-Density-Waves in Mott-Peierls Systems*  
**Y. Wang**, C.-C. Chen, C.J. Jia, M. van Veenendaal, T.P. Devereaux, B. Moritz, *APS March Meeting*, San Antonio, TX, USA (Mar. 2015)
- *Real-Space Visualization of Remnant Mott Gap and Magnon Excitations*  
**Y. Wang**, C.J. Jia, B. Moritz, T.P. Devereaux, *APS March Meeting*, Denver, CO, USA (Mar. 2014)
- *Ultrafast Imaging of Real Space Response Functions*  
**Y. Wang**, C.J. Jia, B. Moritz, T.P. Devereaux, *APS March Meeting*, Baltimore, MD, USA (Mar. 2013)