RESUME

JIGANG WANG
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PERSONAL HISTORY

July 2017 – present	F. Wendell Miller Professor, Department of Physics and Astronomy Iowa State University
February 2019 – present	Senior Physicist in Materials Science and Engineering Division Group Leader of Light-Matter Quantum Control Ames National Laboratory of US Department of Energy
August 2013 – June 2017	Associate Professor, Department of Physics and Astronomy Iowa State University
August 2008 – March 2013	Assistant Professor, Department of Physics and Astronomy Iowa State University
August 2008 – February 2019	Associate Staff Scientist in Materials Science and Engineering Division Ames National Laboratory, US Department of Energy
March 2005 – August 2008	Physicist Postdoctoral Fellow with Dr. Daniel Chemla Materials Sciences Division Lawrence Berkeley National Laboratory
August 2005	Ph.D., Rice University with Dr. Junichiro Kono
May 2002	M.S., Rice University
July 2000	B.S., Physics, Jilin University, P. R. China

MEMBERSHIPS AND HONORS

2020	University Award for Mid-Career Achievement in Research, Iowa State University
2018	F. Wendell Miller Professor, College of Liberal Arts and Sciences, Iowa State University
2017	Ames National Laboratory Inventor Incentive Award
2016	Ames National Laboratory Inventor Incentive Award
2016	The M. W. Keck Award for Extreme Quantum Terahertz Nanoscope
2015	Ames National Laboratory Inventor Incentive Award
2011	National Science Foundation Faculty Early Career Development (CAREER) Award
2011	LAS Award for Early Achievement in Research, Iowa State University
2007	Luis Alvarez Award for Best Experimental Research, American Physical Society, 2007 California Section
2006	Top Ten Papers of 2006, *Journal of Physics: Condensed Matter*

SYNERGISTIC ACTIVITIES:

- Group Leader of Light-Matter Quantum Control, Ames National Laboratory, U.S. Department of Energy (responsible for science direction and research supervision for an annual budget of $1,060,000)
- Program Committee, the SPIE Terahertz Conference, San Diego, 2023
- Tutorial Speaker, Materials Research Society (MRS) Spring meeting, April 2020
- Program Committee, SPIE conference Ultrafast Nonlinear Imaging and Spectroscopy V, San Diego, 2017-2019
- Focus Session Co-Organizer, International Conference of Progress In Electromagnetics Research Symposium (PIERS), 2016
- Program Committee, SPIE conference Ultrafast Nonlinear Imaging and Spectroscopy IV, 2016 – 2019
- Program Committee, Optical Excitations and Ultrafast Phenomena in Condensed Matter, 2016 International Conference of Quantum Electronics (2016 CLEO/QELS)
- International Organizing Committee, The EMN Ultrafast Meeting 2015, Energy Materials Nanotechnology
- Program Committee, Optical Excitations and Ultrafast Phenomena in Condensed Matter, 2015 International Conference of Quantum Electronics (2015 CLEO/QELS)

- Organizer, Department of Defense workshop on Non-equilibrium Quantum Matter and Phase Transitions Created by Strongly-Correlated Ultrafast Excitations, 2014
- Program Committee, Optical Excitations and Ultrafast Phenomena in Condensed Matter, 2014 International Conference of Quantum Electronics (2014 CLEO/QELS)
- Discussion Leader, Gordon Research Conference (GRC) for Ultrafast Cooperative Phenomena, Galveston, TX, February, 2012
- Review panelist for NSF Condensed Matter Physics, Division of Materials Research (DMR), Arlington, Virginia, March, 2011
- Proposal reviewer for U.S. National Science Foundation, U.S. Department of Energy, U.S. Civilian Research & Development Foundation
- Frequent referee for Nature, Science, Physical Review Letters, Nature Nanotechnology, Nature Photonics, Nature Physics, Nature Materials, Nature Communications, Physical Review B, Nano Letter, Physical Review X, Applied Physics Letters

CURRENTLY FUNDED GRANTS

2022-2025: Lead-PI and Group Leader Light-Matter Quantum Control, U.S. Department of Energy
2020-2025: Co-PI, Superconducting Quantum Materials Science Center, a National Quantum Information Science (QIS) Research Center, Department of Energ
2021-2024: Co-PI, Metamaterials, U.S. Department of Energy
2019-2022: Single PI, NSF: Light Control of Superconductivity by Sub-cycle Dynamic Symmetry Breaking,

PREVIOUSLY FUNDED GRANTS (LAST 5 YEARS)

2019-2021: Lead PI, Light-Matter Quantum Control, U.S. Department of Energy
2018-2021: Co-PI, Metamaterials, U.S. Department of Energy
2016–2020: Single PI, NSF: Terahertz Quantum Electronics of Carbon Nanostructures: Population Inversion, Gain and Coherent Bandgap Engineering
2016–2019: NSF: Terahertz Quantum Electronics of Carbon Nanostructures: Population Inversion, Gain and Coherent Bandgap Engineering
2015-2018: DOD: Non-Equilibrium Quantum Phase Discovery via Non-thermal Ultrafast Quench near Quantum Critical Points, Army Research Office, Department of Defense
2016–2019: KECK award for Extreme Quantum Terahertz Nanoscope for Ultrafast Nanoscale Phase Switching
2016-2019 USDA: Development of a novel enzyme-enabled Raman spectroscopic imaging (e2RSI) system for deciphering and improving the molecular arrangement of the outer polymeric barrier of plant cells
2011–2017: Ultrafast Magnetism in Complex Materials: Coherent and Cooperative Phenomena, National Science Foundation)

U.S. PATENT

January 2015 Broadband Terahertz Generation of Metamaterials, #8,054,146

RESEARCH SUMMARY AND HIGHLIGHTS

I investigate diverse light-driven coherent and non-equilibrium quantum systems from superconducting, magnetic, and topological materials to nano-junctions and quantum circuits. The scientific driver is to both provide a fundamental understanding of quantum many-body correlations out-of-equilibrium and achieve coherent light-matter control at quantum limit. I implement this vision by developing cutting-edge ultrafast, coherent spectroscopy and nano-imaging tools over a wide frequency spectrum, spanning from terahertz, infrared to ultraviolet. My accomplishments, particularly in coherent and non-equilibrium dynamics of driven quantum systems, provide the linkage between different communities from condensed matter physics and nano-optics to quantum information science, and merge them to break new frontiers.

- **Light-induced parametric superconductivity**: We demonstrate Higgs coherence tomography of light-controlled superconductivity (Nat Phys 2022). We achieve this by performing the THz multi-dimensional coherent spectroscopy (Commun Phys 2022) for the first time on superconductors.
- **Coherent and ultrafast manipulation of topological materials:** We discover light induced formation of Dirac (PRX 2020) and Weyl points (Nat Mater 2021), and topology switching using infrared and Raman phonon coherences. We observe frequency-dependent carrier cooling times that differentiate topological surface from bulk contributions (Nat Commun 2019). We report that coherent phonon generation can suppress surface-bulk coupling (npj Quan Mater 2020).
- **Forbidden Anderson pseudo-spin precessions** in superconductors: we show light--induced subcycle symmetry breaking to induce long-lived gapless superfluidity and high harmonic generations forbidden by the equilibrium symmetry (PRL 2020 and Nat Photon 2019).
- **Discovery of new collective modes** in correlated electrons: (1) we discover light-induced *hybrid Higgs* mode, a new collective mode driven by interband pairing fluctuations (Nat Commun 2021); we discover spin exciton modes in FeAs superconductors (PRL 2018); Ising-Nematic phase (Nat Commun 2014).
- **Quantum quench pre-thermalized quasi-particle states** in superconductors: we discover a metastable quasi-particle phase with *vanishing* scattering hidden by superconductivity by a THz quench without heating other degrees of freedoms (Nat Mater 2018).
- **THz imaging of advanced materials**: We use the THz near-field microscopy to: (1) map distinct dielectric heterogeneity due to charge trapping and degradation at the single grain boundary level in metal halide perovskite photovoltaic films (ACS photon 2022); (2) Reveal a clear Dirac fermion density variation in topological semimetals at sub-20 nm and THz frequency due to local strain heterogeneity (ACS photon 2021).
- **Femtosecond quantum magnetism**: we demonstrate femtosecond quantum spin switching in a colossal magento-resistive manganite during the fs optical pulse (Nature 2013).
- **Broadband terahertz generation in metamaterials and other nano-photonic structures:** We showed single-cycle, broadband terahertz (THz) emission up to 4 THz from deep subwavelength structures of split ring resonator metamaterials of a few tens of nanometers (Nat Commun 2014, Nat Commun 2021).
- **Femtosecond population inversion** of extremely dense Dirac fermions in graphene monolayer (PRL 2012)
- **Electronic coherence and collective modes in metal halide perovskite photovoltaics**: we use coherent time-frequency visualization methods to discover Rydberg excitons (Nat Commun 2017), Rashba excitons, polarons and phonons (PRL 2020).
- **Dark excitons in single-walled carbon nanotubes:** we accesses the dark excitonic ground state in resonantly-excited (6,5) SWNTs (PRL 2015). This follows our early discovery of ultrafast mid-infrared intra-excitonic resonances in single-walled carbon nanotubes (PRL 2010).
- **Ultrafast dynamics of the Ising-Nematic phase:** we pioneered in femtosecond-resolved polarimetry approach to quantum materials. One example is the Ising symmetry breaking from microscopic softening of magnetic order in the normal state of iron pnictide superconductors (Nat Commun 2014).
- **Ultrafast demagnetization in ferromagnetic semiconductors** (3 PRL papers in 2005, 2008, 2010).

Current Research – I highlight below some major ongoing activities in my group in addition to continuing and extending the above-mentioned published work:

- **Cryogenic magneto-THz nanoscope** for quantum microscopy: We recently report a first cryogenic magneto-THz scanning near-field optical microscope, cm-SNOM and proof of principle measurements of superconductors and topological semimetals (arXiv:2210.07319v1)
- **Spectroscopy and imaging of materials and nano-junctions used in transmon qubits**: (1) We perform nano-imaging to visualize heterogeneous nano-dipole fields of individual nano-junctions inside Josephson Junctions of transmon qubits from Rigetti Computing (arXiv:2207.05960); (2) We perform Higgs coherence tomography of Nb resonators used in the qubits
- **Deploying quantum processor units (QPUs)** with first applications for studying ultrafast quantum magnetism**.**

References:

- [Nat Phys 2022] L. Luo et al., "Quantum Coherence Tomography of Light–Controlled Superconductivity," **Nature Physics,** 10.1038/s41567-022-01827-1 (2022)
- [Commun Phys 2022]) M. Mootz et al., "Visualization and quantum control of light-accelerated condensates by terahertz multi-dimensional coherent spectroscopy," **Communication Physics** 5, 47 (2022).
- [PRX 2020] C. Vaswani et al., "Light-Driven Raman Coherence as a Non-Thermal Route to Ultrafast Topology Switching," **Phys. Rev. X** 10, 021013 (2020).
- [Nat Mater 2021] L. Luo, et al., "A Light-induced Phononic Symmetry Switch and Giant Dissipationless Topological Photocurrent in ZrTe5," **Nature Materials,** 20, 329–334 (2021)
- [Nat Commun 2019] L. Luo et al., "Ultrafast Manipulation of Topologically Enhanced Surface Transport Driven by Mid-Infrared and Terahertz Pulses in Bi_2Se_3", **Nature Communications,** 10.1038/s41467-019-08559-6 (2019)
- [npj Quan Mater 2020] L. Luo et al., "Light Control of Surface–Bulk Coupling by Terahertz Vibrational Coherence in a Topological Insulator," **npj Quantum Mater**. **5**, 13 (2020).
- [PRL 2020] C. Vaswani et al., "Terahertz Second Harmonic Generation from Lightwave Acceleration of Symmetry-Breaking Nonlinear Supercurrents", **Physical Review Letters** 124, 207003 (2020).
- [Nat Photon 2019] X. Yang et al., Lightwave-Driven Gapless Superconductivity and Forbidden Quantum Beats by Terahertz Symmetry Breaking. **Nature Photonics**, 13, 707 (2019)
- [Nat Commun 2021] C. Vaswani et al., "Light Quantum Control of Persisting Higgs Modes in Iron-Based Superconductors", **Nature Communications**, 12, 258 (2021).
- [PRL 2018] X. Yang et al., Nonequilibrium Pair Breaking in Ba(Fe1−xCox)2As2Superconductors: Evidence for Formation of a Photoinduced Excitonic State, **Phys. Rev. Lett.** 121, 267001 (2018)
- [Nat Commun 2014] "Ultrafast Observation of Critical Nematic Fluctuations and Giant Magnetoelastic Coupling in Iron Pnictides," **Nature Communications**, 5, 3229 (2014)
- [Nat Mater 2018] X. Yang et al., Terahertz-light quantum tuning of a metastable emergent phase hidden by superconductivity. **Nature Materials.** 17, 586 (2018).
- [ACS photon 2021] R. H. J. Kim, C. Huang, et al., "Terahertz Nano-Imaging of Electronic Strip Heterogeneity in a Dirac Semimetal," **ACS Photonics**, 8, 7, 1873–1880 (2021) (Cover)
- [ACS photon 2022] R. H. J. Kim et al., "Terahertz nano-imaging of perovskite solar cell materials," **ACS Photonics,** 10.1021/acsphotonics.2c00861 (2022) (cover)
- [Nature 2013] T. Li et al., "Femtosecond switching of magnetism via strongly correlated spin–charge quantum excitations," **Nature,** 496**,** 69 (2013)
- [Nat Commun 2014]
- [Nat Commun 2021] Deniz Turan et al., "Wavelength conversion through plasmon-coupled surface states," **Nature Communications**, 12, 4641 (2021)
- [PRL 2012] 26) T. Li et al., "Femtosecond population inversion and stimulated emission of dense Dirac fermions in graphene," **Physical Review Letters**, 108, 167401, (2012); *Editor's suggestion*
- [Nat Commun 2017] Liang Luo et al., "Directly Revealing Dark Excitonic Ground States of Selective Chirality Single-Walled Carbon Nanotubes via Ultrafast Terahertz Spectroscopy," **Nature Communications,** 8, 15565 doi: 10.1038/ncomms15565 (2017).

- [PRL 2020] Z. Liu, et al., Discovery of Hidden Rashba Fine Structure by Mode-Selective Quantum Beats in Perovskites, 1905.12373, **Phys. Rev. Lett** (2020).
- [PRL 2015] Liang Luo et al., "Directly Revealing Dark Excitonic Ground States of Selective Chirality Single-Walled Carbon Nanotubes via Ultrafast Terahertz Spectroscopy," **Physical Review Letts**, 114, 107402 (2015)
- [PRL 2010] Jigang Wang et al., "Ultrafast Spectroscopy of Midinfrared Internal Exciton Transitions in Separated Single-Walled Carbon Nanotubes," **Physical Review Letters**, 104, 177401 (2010)
- [Nat Commun2014] "Ultrafast Observation of Critical Nematic Fluctuations and Giant Magnetoelastic Coupling in Iron Pnictides," **Nature Communications**, 5, 3229 (2014)
- [3 *Phys. Rev Lett papers* 2005, 2008, 2010] M. D. Kapetanakis, et al., "Femtosecond Coherent Control of Spins in (Ga,Mn)As Ferromagnetic Semiconductors Using Light," **Physical Review Letters**, 103, 047404 (2009); J. Wang et al., "Ultrafast Enhancement of Ferromagnetism via Photoexcited Holes in GaMnAs", **Physical Review Letters**, 98, 217401 (2007); J. Wang et al., "Ultrafast Quenching of Ferromagnetism in InMnAs Induced by Intense Laser Irradiation," **Physical Review Letters**, 95, 167401 (2005)
- [arXiv:2210.07319] R. H. J. Kim et al., "Cryogenic Magneto-terahertz Scanning Near-field Optical Microscope (cm-SNOM)," **arXiv:2210.07319** (2022)
- [arXiv:2207.05960] R. H. J. Kim et al.,"Visualizing heterogeneous dipole fields by terahertz light coupling in individual nano-junctions used in transmon qubits," **arXiv:2207.05960** (2022)

TEACHING AND STUDENT TRAINING

GRADUATE TEACHING AND ADVISING

(Current)

1. Chuankun Huang, Ph.D, expected 2022
2. Samuel Haeuser, Ph. D, expected 2026

(Completed)

1. Tianqi Li, Ph.D, 2014
2. Liang Luo, Ph.D 2015
3. Aaron Patz, Ph.D 2016
4. Xu, Yang, Ph.D 2019
5. Chirag Vaswani, Ph.D, 2020
6. Din Herath Mudiyanselage, Master, 2021
7. Zhaoyu Liu, Ph.D, 2021
8. Di Chen, Ph.D, 2022

POSTDOC FELLOWS

(Current)

Dr. Bing Cheng

(Completed)

Dr. Liang Luo, 2016-2019, currently Staff Scientist, Ames National Laboratory
Dr. Chatzakis, Ioannis, 2009-2012, currently Assistant Professor, Texas Tech University
Dr. Richard Kim, currently Staff Scientist, Ames National Laboratory
Dr. Martin Mootz, currently Staff Scientist, Ames National Laboratory

STUDENT HONORS AND AWARDS

1. **Zhaoyu Liu**, LAS College Graduate Student Research Excellence Award, Iowa State University, 2019
2. **Chirag Vaswani**, Qiming Li and Xiaosha Wang Graduate Student Scholarship for Excellent Research in Physics Award, Department of Physics and Astronomy, Iowa State University, 2020
3. **Xu Yang,** National Award for Outstanding Self-Financed Chinese Students Abroad, 2020
4. **Xu Yang**, LAS College Graduate Student Research Excellence Award, Iowa State University, 2019
5. **Xu Yang**, Best student presentation award, the 4th International Symposium on Microwave/Terahertz Science and Applications (MTSA2017)
6. **Chirag Vaswani**, Teaching Excellence Award, Iowa State University, 2016
7. **Aaron Patz,** LAS College Graduate Student Research Award, Iowa State University, 2015
8. **Tianqi Li,** National Award for Outstanding Self-Financed Chinese Students Abroad, 2014
9. **Liang Luo**, LAS College Graduate Student Research Award, Iowa State University, 2013
10. **Tianqi Li**, Fox Research Award, Department of Physics and Astronomy, Iowa State University, 2012
11. **Aaron Patz,** travel award for XVIIIth International Conference on Ultrafast Phenomena (UP2012), July 2012, Lausanne, Switzerland

PUBLICATION – Jigang Wang

https://faculty.sites.iastate.edu/jgwang/publications

Preprint

1) R. H. J. Kim et al., "Cryogenic Magneto-terahertz Scanning Near-field Optical Microscope (cm-SNOM)," arXiv:2210.07319
2) R. H. J. Kim et al.,"Visualizing heterogeneous dipole fields by terahertz light coupling in individual nano-junctions used in transmon qubits," https://doi.org/10.21203/rs.3.rs-1772698/v1
3) B. Song, X. Yang et al., "Ultrafast Martensitic Phase Transition Driven by Intense Terahertz Pulses"
4) D. Cheng et al., "Ultrafast photoacoustic method for measuring structural and mechanical properties of ultrathin films: case study of Iron Pnictides"
5) L. Luo et al., "Room temperature persisting surface current driven by intense terahertz electric fields in a topological Insulator" https://doi.org/10.21203/rs.3.rs-1954284/v1
6) C. Huang, et al., "Discovery and Coherent Control of Extreme Magnonic High Harmonics"

Refereed Publications in Print

81) B. Song, X. Yang et al., "Ultrafast Martensitic Phase Transition Driven by Intense Terahertz Pulses," **Ultrafast Science**, doi.org/10.34133/ultrafastscience.0007 (2022)
80) L. Luo et al., "Quantum Coherence Tomography of Light–Controlled Superconductivity," **Nature Physics,** 10.1038/s41567-022-01827-1 (2022)
79) R. H. J. Kim et al., "Terahertz nano-imaging of perovskite solar cell materials," **ACS Photonics,** 10.1021/acsphotonics.2c00861 (2022) (cover)
78) Z. Liu, et al., Laser terahertz emission microscope for imaging electronic qualities of CH3NH3PbI3 perovskite semiconductors, **Crystals,** *12*, 462; https://doi.org/10.3390/cryst12101462 (2022) (feature article)
77) J-H. Kang et al., "Local atomic configuration control of superconductivity in the undoped pnictide parent compound BaFe2As2," ***ACS Appl. Electron. Mater.*** 2022, **4**, 4, 1511–1517 (2022)
76) M. Mootz et al., "Visualization and quantum control of light-accelerated condensates by terahertz multi-dimensional coherent spectroscopy," **Communication Physics** 5, 47 (2022).
75) B.Q. Song, J.D.H. Smith, L. Luo, and J. Wang, "Geometric pumping and dephasing at topological phase transition," Phys. Rev. B 105, 035101 (2022)
74) L. Luo, I. E. Perakis, G. Gu, Q. Li, J. Wang, "Twisting Weyl Nodes with Light," **OPTICS & PHOTONICS NEWS (OPN)**, 51 (2021)
73) K. Cong, et al., "Coherent control of asymmetric spintronic terahertz emission from two-dimensional hybrid metal halides," **Nature Communications,** 12, 5744 (2021)
72) Y. Hu et al., "Laser-Induced Cooperative Transition in Molecular Electronic Crystal," **Advanced Materials**, doi.org/10.1002/adma.202103000 (2021)
71) Deniz Turan et al., "Wavelength conversion through plasmon-coupled surface states," **Nature Communications**, 12, 4641 (2021)
70) L. Luo et al., "Ultrafast bipolar conductivity driven by intense single-cycle terahertz pulses in a topological insulator Bi2Se3," **Journal of Optics**, 10.1088/2040-8986/ac0316 (2021)
69) R. H. J. Kim, C. Huang, et al., "Terahertz Nano-Imaging of Electronic Strip Heterogeneity in a Dirac Semimetal," **ACS Photonics**, 8, 7, 1873–1880 (2021) (Cover)
68) P. C. Lingos, M. D. Kapetanakis, J. Wang, I. E. Perakis, "Light-wave Control of Non-equilibrium Correlated States using Quantum Femtosecond Magnetism and Time-Periodic Modulation of Coherent Transport," **Communication Physics**, 4, 60 (2021)
67) E. H. Gamage et al., 'Tuning Fe–Se Tetrahedral Frameworks by a Combination of [Fe(en)3]2+ Cations and Cl– Anions," **Inorg. Chem**. 2020, 59, 18, 13353–13363
66) P. C. Lingos, M. D. Kapetanakis, J. Wang, I. E. Perakis, "Light-wave Control of Non-equilibrium Correlated States using Quantum Femtosecond Magnetism and Time-Periodic Modulation of Coherent Transport," **Communication Physics**, doi.org/10.1038/s42005-021-00561-z (2021)
65) C. Vaswani, J. H. Kang, M. Mootz, L. Luo, X. Yang, C. Sundahl, D. Cheng, C. Huang, R. H. J. Kim, Z. Liu, Y. G. Collantes, E. E. Hellstrom, I. E. Perakis, C. B. Eom and J. Wang, "Light Quantum Control of Persisting Higgs Modes in Iron-Based Superconductors", **Nature Communications**, 10.1038/s41467-020-20350-6 (2021)

64) L. Luo, D. Cheng, B. Song, L-L. Wang, C. Vaswani, P. M. Lozano, G. Gu, C. Huang, R. H. J. Kim, Z. Liu, J-M. Park, Y. Yao, K-M. Ho, I. E. Perakis, Q. Li and J. Wang, "A Light-induced Phononic Symmetry Switch and Giant Dissipationless Topological Photocurrent in ZrTe5," **Nature Materials**, **20**, 329–334(2021)
63) Zhaoyu Liu, et al., "Cryogenic spatial-temporal imaging of surface photocarrier dynamics in MAPbI3 at the single grain level", **AIP Advances**, 10, 125108 (2020)
62) Jialu Chen, Zijun Zhang, Liang Luo, Yunhao Lu, Cheng Song, Di Cheng, Xing Chen, Wei Li, Zhaohui Ren, JigangWang*, He Tian*, Ze Zhang*, Gaorong Han*, "Reversible magnetism transition at ferroelectric oxide hetero-interface," **Science Bulletin**, doi.org/10.1016/j.scib.2020.09.024 (2020) *Co-corresponding authors
61) Martin Mootz, Jigang Wang, Ilias E. Perakis, "Lightwave terahertz quantum manipulation of nonequilibrium superconductor phases and their collective modes", **Phys. Rev. B**, 101, 115125 (2020).
60) C. Vaswani, C. Sundahl, M. Mootz, D. H. Mudiyanselage, J. H. Kang, X. Yang, D. Cheng, C. Huang, R. H. J. Kim, Z. Liu, L. Luo, I. E. Perakis, C. B. Eom, J. Wang, "Terahertz Second Harmonic Generation from Lightwave Acceleration of Symmetry-Breaking Nonlinear Supercurrents", **Physical Review Letters** 124, 207003 (2020).
59) Light-Driven Raman Coherence as a Non-Thermal Route to Ultrafast Topology Switching, C. Vaswani, L.-L. Wang, D. H. Mudiyanselage, Q. Li, P. M. Lozano, G. Gu, D. Cheng, B. Song, L. Luo, R. H. J. Kim, C. Huang, Z. Liu, M. Mootz, I. E. Perakis, Y. Yao, K. M. Ho, J. Wang, **Phys. Rev. X** 10, 021013 (2020).
58) Z. Liu, C. Vaswani, L. Luo, D. Cheng, X. Yang, X. Zhao, Y. Yao, Z. Song, R. Brenes, R. Kim, J. Jean, V. Bulovic, Y. Yan, K.-M. Ho, J. Wang, Room Temperature Polaron Coherence in Perovskite Revealed by Terahertz Band Edge Modulation, **Phys. Rev. B**, 101, 115125 (2020).
57) Z. Liu*, C. Vaswani*, X. Yang, X. Zhao, Y. Yao, Z. Song, D. Cheng, Y. Shi, L. Luo, D.-H. Mudiyanselage, C. Huang, J.-M. Park, J. Zhao, Y. Yan, K.-M. Ho, J. Wang, Discovery of Hidden Rashba Fine Structure by Mode-Selective Quantum Beats in Perovskites, 1905.12373, **Phys. Rev. Lett** (2020). *equal contributions
56) Light Control of Surface–Bulk Coupling by Terahertz Vibrational Coherence in a Topological Insulator, X. Yang, C. Vaswani, L. Luo, X. Zhao, Y. Yao, D. Cheng, Z. Liu, R. H. J. Kim, X. Liu, M. Dobrowolska, J. K. Furdyna, I. E. Perakis, C-Z Wang, K-M Ho and J. Wang, **npj Quantum Mater**. (Nature publishing group) **5**, 13 (2020).
55) D. T. Harris, N. Cambell, C. Di, J.-M. Park, L. Luo, H. Zhou, G.-Y. Kim, K. Song, S.-Y. Choi, J. Wang, M. S. Rzchowski, C. B. Eom, Charge Density Wave Modulation in Superconducting BaPbO3/BaBiO3 Superlattices, Submitted, arXiv:1812.08589, **Phys. Rev. B, 101**, 064509 (2020).
54) Helicity-Dependent Terahertz Photocurrent and Coherent Phonon Dynamics in Hybrid Metal Halide Perovskites, D. Cheng*, Z. Liu*, L. Luo, C. Vaswani, J.-M. Park, Y. Yao, Z. Song, C. Huang, D. -H. Mudiyanselage, R. Kim, Y. Yan, K.-M. Ho, J. Wang, **Journal of Chemical Physics**, **151** (24), 244706 *equal contribution (2019)
53) Bradley J. Ryan, et al., Silicene, Siloxene, or Silicane? Revealing the Structure and Optical Properties of Silicon Nanosheets Derived from Calcium Disilicide, **Chemistry of Materials**, dx.doi.org/10.1021/acs.chemmater.9b04180. (2019)
52) Tianbai Cui, Xu Yang, Chirag Vaswani, Jigang Wang, Rafael M. Fernandes, and Peter P. Orth, "Impact of damping on superconducting gap oscillations induced by intense Terahertz pulses", **Phys. Rev. B,** 100, 054504 (2019)
51) X. Yang, C. Vaswani, C. Sundahl, M. Mootz, L. Luo, J. H. Kang, I. E. Perakis, C. B. Eom, J. Wang, Lightwave-Driven Gapless Superconductivity and Forbidden Quantum Beats by Terahertz Symmetry Breaking. **Nature Photonics**, 13, 707 (2019)
50) Liang Luo, Zhaoyu Liu, Xu Yang, Chirag Vaswani, Di Cheng, Joong-Mok Park and Jigang Wang, "Anomalous variations of spectral linewidth in internal excitonic quantum transitions of ultrafast resonantly-excited single-walled carbon nanotubes," Accepted, **Phys. Rev. Materials,** 3, 026003 (2019).
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48) Joong-Mok Park, Di Cheng, Aaron Patz,Liang Luo, Zhaoyu Liu, Fadzai Fungura, Ruth Shinar, Kaiming Ho, Joseph Shinar,and Jigang Wang*,"Ultrafast nonlinear transparency driven at a telecom wavelength in an organic semiconductor system, **AIP Advances** 9, 025303 (2019) https://doi.org/10.1063/1.5042542
47) Andreas Herklotz, Stefania F. Rus, Nina Balke Wisinger, Christopher Rouleau, Er-Jia Guo, Amanda Huon, Santosh KC, Robert Roth, Xu Yang, Chirag Vaswani, Jigang Wang, Peter P. Orth, Mathias S. Scheurer and

Thomas Z. Ward, Designing Morphotropic Phases with Strain Doping, **Nano. Lett.,** 10.1021/acs.nanolett.8b04322 (2019)
46) L. Luo, X. Yang, X. Liu, Z. Liu, C. Vaswani, D. Cheng, M. Mootz, X. Zhao, Y. Yao, C.-Z. Wang, K.-M. Ho, I. E. Perakis, M. Dobrowolska, J. K. Furdyna, and J. Wang*, "Ultrafast Manipulation of Topologically Enhanced Surface Transport Driven by Mid-Infrared and Terahertz Pulses in Bi_2Se_3", ***Nature Communications,*** doi.org/10.1038/s41467-019-08559-6 (2019)
45) X. Yang, C. Vaswani, C. Sundahl, M. Mootz, P. Gagel, L. Luo, J. H. Kang, P. P. Orth, I. E. Perakis, C. B. Eom, J. Wang, Terahertz-light quantum tuning of a metastable emergent phase hidden by superconductivity. **Nature Materials.** 17, 586 (2018).
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