

Wei-Sheng Lee

Curriculum Vitae
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EDUCATION

- Ph. D.** - Physics, Stanford University, Stanford, California, USA (June, 2008)
- M. S.** - Physics, National Taiwan University, Taipei, Taiwan (June, 1998)
- B. S.** - Physics, National Taiwan University, Taipei, Taiwan (June, 1996)

PROFESSIONAL APPOINTMENTS

- 2012 – Present** Staff Scientist
Stanford Institute for Materials and Energy Science (SIMES), SLAC National Accelerator Lab.
- 2010 – 2012** Associated Staff Scientist
SIMES, SLAC National Accelerator Lab.
- 2008 – 2009** Post-Doctoral Research Associate
SIMES, SLAC National Accelerator Lab.

HONORS AND AWARDED RESEARCH FUNDS

- DOE, FWP Funding to partially support an early career proposal (2017-2018)**
- Laboratory Directory Research and Development (LDRD) proposal (2014-2016)**
- Single-Investigator and Small-Group Proposal (SISGR, 2010-2012)**, one of the co-proposers
This proposal has evolved into one of the core Field Work Proposals (FWP) in SIMES.
- Seed Research Fund**
Dean of Research, Stanford University. (starting from FY2009)
- Young Investigator (poster) Award (2012)**
Gordon Conference of Ultrafast Phenomena in Cooperative Systems
- Graduate Student Poster Award (2006)**
33rd Annual Stanford Synchrotron Laboratory SSRL User's meeting

RESEARCH EXPERIENCE

- 2012 – Present**, Staff Scientist
Stanford Institute for Materials and Energy Science (SIMES), SLAC National Accelerator Lab.

Investigating dynamics of complex quantum materials, such as high temperature superconductors and transition metal oxides, via performing and innovating novel x-ray scattering measurements.

- Performing ultra-high resolution resonant inelastic x-ray scattering (RIXS) measurements to map out elementary excitations in energy-momentum domains.
- Co-led the first x-ray scattering under extreme magnetic field using x-ray free electron laser and a pulsed magnet.
- Performing time-resolved (resonant) x-ray diffraction using x-ray free electron laser at LCLS to study non-equilibrium dynamics of lattice, spin, charge, and orbital orders.

2010 - 2012, Associated Staff Scientist
SIMES, SLAC National Accelerator Lab.

- Co-led the first time-resolved resonant soft x-ray diffraction experiment at LCLS.
- Performed static and time-resolved resonant x-ray diffraction measurements to study the properties of spin, charge, and orbital orders.

2008 – 2009, Post Doctoral Research Associate
SLAC National Accelerator Lab.
Advisor: Prof. Z. X. Shen

- Performed ultra-high resolution Laser angle-resolved photoemission spectroscopy (ARPES) study on high temperature superconducting cuprates.
- Designed and constructed a 7 eV laser for ultra-high resolution Laser ARPES system.

2001 – 2008, Research Assistant
Department of Physics, Stanford University
Advisor: Prof. Z. X. Shen

- Performed ARPES measurement on high temperature superconductors, including Bi-based, Hg-based, and Tl-Based cuprates.
- Jointly developed the ARPES endstation of BL5-4 in Stanford Synchrotron Radiation Lightsource and a lab-based ARPES system in Stanford campus.

2000 – 2001, Research Assistant
Institute of Physics, Academia Sinica, Taiwan
Advisor: Prof. T. K. Lee

Used Monte Carlo simulation for relaxation dynamics of interacting classical spins, and ferromagnetic nanoparticles.

1996 – 1998, Research Assistant
Department of Physics, National Taiwan University
Advisor: Prof. Y. Y. Chen

Numerical study of the synchronization of distinct chaos systems.

1995 – 1996, Research Assistant
Department of Physics, National Taiwan University
Advisor: Prof. M. Y. Chern

Designed and constructed a magneto-optical Kerr Effect system (MOKE) to study magnetic properties of ferrimagnetic super-lattices.

TEACHING EXPERIENCE AND OTHER

2003 Teaching assistant, Modern Physics, Stanford University

2003 Teaching assistant, Intermediate Physics Lab, Stanford University

1996 – 1998 Teaching assistant, Freshmen Physics, National Taiwan University, Taiwan

1996 – 1998 Assistant, Physics Course Committee, National Taiwan University, Taiwan

1998 – 2000 Mandatory Military Service, 2nd Lieutenant, Combined Service Force, Taiwan

INVITED TALKS

As of June. 2017, **37** invited talks.

2017 “X-ray Scattering Studies of CDW and Excitations in Superconducting Cuprates”, International Symposium on Frontier of Superconductivity Research (VII), Beijing, China

2017 “X-ray Scattering Studies of CDW and Excitations in Superconducting Cuprates”, Colloquium in Department of Physics, SUNY – Binghamton, New York, USA.

2017 “Probing electron-phonon coupling via RIXS”, ALS user meeting/Workshop - Trends in Multimodal Tools for Quantum Materials Studies at Synchrotrons, Berkeley, California, USA

2017 “Probing electron-phonon coupling via RIXS”, NSRRC User meeting/Workshop - High Resolution X-ray Spectroscopy of Quantum Materials, Hsinchu, Taiwan

2017 “Probing electron-lattice coupling via RIXS”, ESRF User Meeting Microsymposium - Advances and new science with resonant elastic and inelastic X-ray scattering, Grenoble, France

2016 “Case studies of elementary excitations in cuprates using Soft X-ray RIXS”, SSRL/LCLS Users’ Meeting Workshop: LCLS-II Instrumentation Workshops, Menlo Park, CA, USA

2016 “X-ray Scattering studies of CDW and excitations in Cuprates”, MIT Condensed Matter Physics "Chez Pierre" Seminars, Cambridge, MA, USA

2016 “Three-dimensional charge density wave order in YBCO at high magnetic field”, Spectroscopy of Novel Superconductors (SNS 2016), Ludwigsburg, Germany

2016 “Three-dimensional charge density wave order in YBCO at high magnetic field”, APS March meeting, Baltimore, Maryland, USA

2016 “Case studies of elementary excitations in cuprates using Soft X-ray RIXS”, ALS-CXRO Seminar Series, Lawrence Berkeley Lab., Berkeley, CA, USA

2015 “Case studies of elementary excitations in cuprates using Soft X-ray RIXS”, the 9th International Conference on Inelastic X-ray Scattering (IXS2015), National Synchrotron Radiation Research Center, Hsinchu, Taiwan

2015 “RIXS studies of elementary excitations in cuprates”, ALS user meeting workshop - Unraveling Emergent Phenomena in Quantum System with Experimental and Theoretical Advances in RIXS, Berkeley, CA, USA

2015 “Studies of elementary excitations and Field-induced CDW in high-T_c cuprates via novel x-ray scattering”, International Conference of Electron Spectroscopy and Spectroscopy, Stony Brook University, NY, USA

2015 “Three dimensionally ordered CDW in YBCO”, Gordon Conference - Superconductivity, Hong Kong, China

2015 “RIXS studies on Collective Excitations in Cuprates Across the Antiferromagnetic-Superconductivity Phase Boundary”, SIMES seminar, Menlo Park, CA, USA

2014 “Time-resolved RIXS”, SLAC-IXS workshop, Menlo Park, CA, USA

2014 “Lattice, magnetic, and charge excitation in Cuprates”, High resolution RIXS and Nano ARPES workshop, National synchrotron Radiation Center, Hsinchu, Taiwan

2014 “Lattice, magnetic, and charge excitations in Cuprates”, APS March Meeting, Denver, CO, USA

2014 “Asymmetry of collective excitations in high-T_c cuprates - a view from resonant inelastic X-ray scattering”, Condensed Matter Seminar, National Cheng Kung University, Tainan, Taiwan

2014 “Asymmetry of collective excitations in high-T_c cuprates - a view from resonant inelastic X-ray scattering”, UC Berkeley Condensed Matter Seminar 290K, Berkeley, CA, USA

2013 “Collective excitations in electron-doped cuprates $Nd_{2-x}Ce_xCuO_4$ ”, 8th International Conference on Inelastic X-ray Scattering (IXS 2013), Menlo Park, CA, USA

2013 “Photo-induced dynamics of strongly coupled charge and spin order parameters”, Spectroscopy of Novel Superconductors (SNS 2013), Berkeley, CA, USA

2013 “Photo-induced dynamics of strongly coupled charge and spin order parameters”, APS/CNM/EMC User Meeting Workshop: Ultrafast Dynamics in Strongly Correlated Materials, Atoms, Molecules, and Clusters, Argonne, IL, USA

2012 “A Study of Orbital, Phonon, and Spin Excitations in Quasi 1D Cuprates via Resonant Inelastic Soft X-ray Scattering”, ALS-CXRO Seminar Series, Lawrence Berkeley Lab., Berkeley, CA, USA

- 2012** *“Non-thermal Dynamics of Striped Nickelates via Femtosecond Resonant X-ray Diffraction”*, SIMES Inelastic X-ray Scattering Workshop, SLAC National Accelerator Lab., Menlo Park, USA
- 2011** *“Non-thermal Dynamics of Striped Nickelates via Femtosecond Resonant X-ray Diffraction”*, Special Seminar, Academia Sinica, Taiwan
- 2011** *“Non-thermal dynamics of the spin and charge order in striped nickelates”*, BESSY Users’ Meeting 2011 workshop: X-ray View of Ultrafast Dynamics in Solids, BESSY, Berlin, Germany
- 2011** *“Non-thermal Dynamics of Striped Nickelates via Femtosecond Resonant X-ray Diffraction”*, SSRL/LCLS Users’ Meeting Workshop: Time-Resolved X-ray Science at High Repetition Rate, SLAC National Accelerator Lab., Menlo Park, CA, USA
- 2011** *“Non-thermal Dynamics of Striped Nickelates via Femtosecond Resonant X-ray Diffraction”*, Frontiers in Optics 2011 and Laser Science XXVII: Ultrafast X-ray, San Jose, CA, USA
- 2011** *“Ultrafast non-thermal dynamics of spin and charge order in striped nickelate via femtosecond resonant soft x-ray scattering”*, JUM@P: Joint Users’ Meeting at PSI 2011: Resonant Inelastic and Elastic X-ray Scattering, Paul Scherrer Institute, Villigen, Switzerland
- 2011** *“Ultrafast non-thermal dynamics of spin and charge order in striped nickelate via femtosecond resonant soft x-ray scattering”*, International Workshop on Strong Correlations and Angle-Resolved Photoemission Spectroscopy (CORPES11), Berkeley, CA, USA
- 2011** *“Ultrafast dynamics of the stripe phase in nickelate via time-resolved resonant soft x-ray scattering”*, APS/CNM/EMC User Meeting Workshop 2011: Intermediate-energy X-rays: A window into Collective Behavior in Interacting Electron Systems, Argonne, IL, USA
- 2011** *“Time and Energy Domains Experiments using synchrotron-based Spectroscopy - exploring the frontier electronic degrees of freedom”*, Condensed Matter Seminar, Department of Physics, National Tsing-Hua University, Taiwan
- 2011** *“Time and Energy Domains Experiments using synchrotron-based Spectroscopy - exploring the frontier electronic degrees of freedom”*, Special Seminar, Applied Physics Department, Stanford University, Stanford, CA, USA
- 2010** *“First Resonant Diffraction Experiment at LCLS: Ultrafast Dynamics of the Stripe State in Doped Nickelates”*, Joint SSRL/LCLS User Meeting 2010: LCLS User Science Highlight, Menlo Park, CA, USA
- 2010** *“Study Charge/Spin Excitations in Correlated Materials as Functions of Momentum, Energy, and Time using RIXS”*, Next Generation Light Source (NGLS) Workshop, Berkeley, CA, USA
- 2009** *“Some Recent Progress of Angle Resolved Photoemission Studies on Strongly Correlated Systems”*, Condensed Matter Seminar, National Taiwan Synchrotron Center, Hsinchu, Taiwan
- 2009** *“Some Recent Progress of Angle Resolved Photoemission Studies on Strongly Correlated Systems”*, ASPEN winter conference- Unifying themes in condensed matter, Aspen, Colorado, USA

2008 “Time-Resolved and Momentum-Resolved Resonant Soft X-ray Scattering on Strongly Correlated Systems”, Joint SSRL/LCLS/ALS Workshop: Soft X-ray Beam Line for Material and Energy Science at LCLS, Menlo Park, CA, USA

2007 “Pseudogap and Superconducting gap -Same or Different?”, Dynamic Energy Landscape Functional System- Dynamics in Complex System, Port Jefferson, Long Island, New York, USA

2005 “The Study of Electron-Phonon Coupling in Bi-based High Tc Superconductors by ARPES”, Condensed Matter Seminar, National Taiwan Synchrotron Center, Hsinchu, Taiwan

2005 “Band Renormalization Effect of $\text{Bi}_2\text{Ba}_2\text{Ca}_2\text{Cu}_3\text{O}_{10}$, Electron-phonon interaction in high-Tc superconductors workshop, Tsukuba, Japan, January, 2005

SELECTED PUBLICATIONS

As of June 2017: **65** total publications.

1. L. Chaix, G. Ghiringhelli, Y. Y. Peng, M. Hashimoto, B. Moritz, K. Kummer, N. Brookes, Y. He, S. Chen, S. Ishida, Y. Yoshida, H. Eisaki, L. Braicovich, Z.-X. Shen, T. P. Devereaux, **W.-S. Lee**, Dispersive charge density wave excitations in underdoped cuprates $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+d}$. Nature Physics **13**, 952 (2017). (as one of the corresponding authors).
2. S. Gerber, S.-L. Yang, D. Zhu, H. Soifer, J. A. Sobota, S. Rebec, J. J. Lee, T. Jia, B. Moritz, C. Jia, A. Gauthier, Y. Li, D. Leuenberger, Y. Zhang, L. Chaix, W. Li, H. Jang, J.-S. Lee, M. Yi, G. L. Dakovski, S. Song, J. M. Glowia, S. Nelson, K. W. Kim, Y.-D. Chuang, Z. Hussain, C.-C. Kao, R. G. Moore, T. P. Devereaux, **W.-S. Lee***, P. S. Kirchmann*, Z.-X. Shen*. Femtosecond electron-phonon lock-in via photoemission and x-ray free-electron laser. Science **357**, 71 (2017) (as one of the corresponding authors).
3. S. Gerber, H. Jang, H. Nojiri, S. Matsuzawa, Y. Yasumura, D. A. Bonn, R. Liang, H. N. Hardy, Z. Islam, A. Mehta, S. Song, M. Sikorski, D. Stefanescu, Y. Feng, J. Hastings, S. A. Kivelson, T. P. Devereaux, Z.-X. Shen, C.-C. Kao, **W.-S. Lee⁺**, D. Zhu[#], J.-S. Lee*. Three Dimensional Charge Density Wave Order in $\text{YBa}_2\text{Cu}_3\text{O}_{6.67}$ at High Magnetic Fields, Science **340**, 949 (2015). (as one of the corresponding authors).
4. 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. Glowia, 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** Direct characterization of photo-induced lattice dynamics in BaFe_2As_2 . Nature Communications **6**, 7377 (2015). (as one of the leading authors and supervisors)
5. **W. S. Lee**, J. J. Lee, E. A. Nowadnick, S. Gerber, W. Tabis, S. W. Huang, V. N. Strocov, E. M. Motoyama, G. Yu, B. Moritz, H. Y. Huang, R. P. Wang, Y. B. Huang, W. B. Wu, C. T. Chen, D. J. Huang, M. Greven, T. Schmitt, Z. X. Shen, and T. P. Devereaux.

Asymmetry of collective excitations in electron and hole doped cuprate superconductors.

Nature Physics **10**, 883–889 (2014)

6. **W. S. Lee**, S. Johnston, B. Moritz, J. Lee, M. Yi, K. J. Zhou, T. Schmitt, K. Kudo, Y. Koike, J. van den Brink, T. P. Devereaux, and Z. X. Shen
The Role of Lattice Coupling in Establishing Electronic and Magnetic Properties in Quasi-One-Dimensional Cuprates
Phys. Rev. Lett. **110**, 265502 (2013).
7. **W. S. Lee**, Y. D. Chuang, R. G. Moore, Y. Zhu, L. Patthey, M. Trigo, D. H. Lu, P. S. Kirchmann, O. Krupin, M. Yi, M. Langner, N. Huse, J. S. Robinson, Y. Chen, S. Y. Zhou, G. Coslovich, B. Huber, 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
Phase fluctuations and the absence of topological defects in photo-excited charge ordered nickelate
Nature Communications **3**, 838 (2012).
8. **W. S. Lee**, K. Tanaka, I. M. Vishik, D. H. Lu, R. G. Moore, H. Eisaki, A. Iyo, T. P. Devereaux, and Z. X. Shen
Dependence of band Renormalization effect on the number of copper-oxide layers in Tl-based copper-oxide superconductor using angle-resolved photoemission spectroscopy
Phys. Rev. Lett. **103**, 067002 (2009).
9. **W. S. Lee**, I. M. Vishik, K. Tanaka, D. H. Lu, T. Sasagawa, N. Nagaosa, T. P. Devereaux, Z. Hussain, and Z. -X. Shen
Abrupt onset of second energy gap at superconducting transition along the Fermi arc of underdoped Bi2212
Nature **450**, 81 (2007).
10. K. Tanaka, **W. S. Lee**, D. H. Lu, A. Fujimori, T. Fujii, Risdiana, I. Terasaki, D. J. Scalapino, T. P. Devereaux, Z. Hussain, Z.-X. Shen
Distinct Fermi-momentum-dependent energy gaps in deeply underdoped Bi2212
Science **314**, 1910 (2006).

For a full list, please see “PUBLICATION LIST”.

SERVICE TO PROFESSION

- Member of American Physic Society (APS)
- Proposal Review Panel for Swiss Free Electron Laser (2018 -)
- Instrument Advisory Panel Members for soft x-ray RIXS instrument at NEH 2.1, LCLS-II
- Co-organizer of quantum material working group and workshops to developing scientific case for LCLS-II and LCLS-II-HE. (2015 - 2017)
- Organizer of 2015 SSRL/LCLS user meeting workshop – Probing Structure and Dynamics of Quantum Materials via X-ray Scattering at LCLS.

- **Panelist of REDSOX Conceptual Design Review**, SXR instrument, LINAC Coherent Light Source, SLAC National Accelerator Lab.
- **Referee** of a number of peer-review Journals, including Nature, Science, Nature Physics, Nature Materials, Nature Communications, Physical Review Letter, and Physics Review X.