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EDUCATION

University of Florida, Gainesville, Florida, USA

- Ph.D. in Physics — Sep 2009 – Dec 2011
  - Thesis: Conventional and time-resolved spectroscopy of magnetic properties of superconducting thin films
  - Adviser: Prof. David Tanner
- M.S. in Physics — Aug 2007 – Aug 2009

Nanjing University, Nanjing, Jiangsu, China

- B.S. in Astronomy — Sep 2003 – Jul 2007

EMPLOYMENT

Nanjing University, Nanjing, Jiangsu, China

- Professor, School of Physics — Oct 2016 – Present

Pensylvania State University, State College, Pennsylvania, USA

- Research Associate, Department of Physics — Oct 2014 – Jul 2016
  - Advisers: Prof. Kin Fai Mak & Prof. Jie Shan

Brookhaven National Laboratory, Upton, New York, USA

- Research Associate, Photon Sciences Directorate — Feb 2012 – Sep 2014
  - Adviser: Dr. G. Lawrence Carr

RESEARCH INTERESTS

In solid-state materials, the interplay of lattice, electronic, and spin degrees of freedom can often lead to novel ground states, intellectually interesting and potentially useful for applications. At reduced dimensions, even more exotic states can be uncovered, thanks to the concerted action of quantum mechanics and stronger Coulomb interaction. In the past two decades, a powerful set of tools have been developed, enabling investigation and control of materials confined in the two- and one-dimensional space.

My group explore the optical and electronic properties of low-dimensional quantum materials, with a focus on collective phenomena related to the multiple degrees of freedom in crystals. Some specific examples include:

- Charge-density waves
- Two-dimensional superconductivity
- Topological materials
- Ferroic materials

SELECTED PUBLICATIONS

1. G. Liu†, Y. Liu†, Q. Luo†, Z. Huang, K. Watanabe, T. Taniguchi, M. Wang, J. Wen, Y. Lu*, and X. Xi*, "Strongly enhanced charge-density waves and correlated insulating state in atomically thin $1T$-TaS_2", Physical Review Letters **137**, 066502 (2026)
2. Y. Liu, K. Watanabe, T. Taniguchi, and X. Xi*, "Shear-mode Raman imaging of ferroelectric switching in multilayer $3R$-MoS_2", Physicial Review Letters **136**, 206202 (2026)
3. K. Wei, Y. Luo, K. Watanabe, T. Taniguchi, Y. Guo*, and X. Xi*, "Gate tuning of coupled electronic and structural phase transition in atomically thin Ta_2NiSe_5", Nature Communications **16**, 10999 (2025)
4. Y. Du†, G. Liu†, W. Ruan†, Z. Fang, K. Watanabe, T. Taniguchi, R. Liu, J.-X. Li, and X. Xi*, "Unveiling resilient superconducting fluctuations in atomically thin $NbSe_2$ through Higgs mode spectroscopy", Physical Review Letters **134**, 066002 (2025)

5. Y. Li†*, L. Xu†, G. Liu†, Y. Fang†, H. Zheng, S. Dai, E. Li, G. Zhu, S. Zhang, S. Liang, L. Yang, F. Huang, X. Xi*, Z. Liu*, N. Xu*, and Y. Chen, "Evidence of strong and mode-selective electron–phonon coupling in the topological superconductor candidate 2M-WS_2", Nature Communications **15**, 6235 (2024)
6. G. Liu†, T. Qiu†, K. He†, Y. Liu, D. Lin, Z. Ma, Z. Huang, W. Tang, J. Xu, K. Watanabe, T. Taniguchi, L. Gao, J. Wen, J.-M. Liu, B. Yan*, and X. Xi*, "Electrical switching of ferro-rotational order in nanometre-thick 1*T*-TaS_2 crystals", Nature Nanotechnology **18**, 854–860 (2023)
7. H. F. Yang†, K. Y. He†, J. Koo†, S. W. Shen, S. H. Zhang, G. Liu, Y. Z. Liu, C. Chen, A. J. Liang, K. Huang, M. X. Wang, J. J. Gao, X. Luo, L. X. Yang, J. P. Liu, Y. P. Sun, S. C. Yan, B. H. Yan*, Y. L. Chen*, X. Xi*, and Z. K. Liu*, "Visualization of chiral electronic structure and anomalous optical response in a material with chiral charge density waves", Physical Review Letters **129**, 156401 (2022)
8. G. Liu, X. Ma, K. He, Q. Li, H. Tan, Y. Liu, J. Xu, W. Tang, K. Watanabe, T. Taniguchi, L. Gao, Y. Dai, H.-H. Wen, B. Yan*, and X. Xi*, "Observation of anomalous amplitude modes in the kagome metal CsV_3Sb_5", Nature Communications **13**, 3461 (2022)
9. D. Lin, S. Li, J. Wen, H. Berger, L. Forró, H. Zhou, S. Jia, T. Taniguchi, K. Watanabe, X. Xi*, and M. S. Bahramy*, "Patterns and driving forces of dimensionality-dependent charge density waves in 2H-type transition metal dichalcogenides", Nature Communications **11**, 2406 (2020)
10. X. Xi, H. Berger, L. Forró, J. Shan*, and K. F. Mak*, "Gate tuning of electronic phase transitions in two-dimensional $NbSe_2$", Physical Review Letters **117**, 106801 (2016)
11. X. Xi†, Z. Wang†, W. Zhao, J.-H. Park, K. T. Law, H. Berger, L. Forró, J. Shan*, and K. F. Mak*, "Ising pairing in superconducting $NbSe_2$ atomic layers", Nature Physics **12**, 139–143 (2016)
12. X. Xi, L. Zhao, Z. Wang, H. Berger, L. Forró, J. Shan*, and K. F. Mak*, "Strongly enhanced charge-density-wave order in monolayer $NbSe_2$", Nature Nanotechnology **10**, 765–769 (2015)
13. X. Xi, X.-G. He, F. Guan, Z. Liu, R. D. Zhong, J. A. Schneeloch, T. S. Liu, G. D. Gu, X. Du, Z. Chen, X. G. Hong, W. Ku, and G. L. Carr, "Bulk signatures of pressure-induced band inversion and topological phase transitions in $Pb_{1-x}Sn_xSe$", Physical Review Letters **113**, 096401 (2014)
14. X. Xi, C. Ma, Z. Liu, Z. Chen, W. Ku, H. Berger, C. Martin, D. B. Tanner, and G. L. Carr, "Signatures of a pressure-induced topological quantum phase transition in BiTeI", Physical Review Letters **111**, 155701 (2013)
15. X. Xi, J. Hwang, C. Martin, D. B. Tanner, and G. L. Carr, "Far-infrared conductivity measurements of pair breaking in superconducting $Nb_{0.5}Ti_{0.5}N$ thin films induced by an external magnetic field", Physical Review Letters **105**, 257006 (2010)

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1. G. Liu†, Y. Liu†, Q. Luo†, Z. Huang, K. Watanabe, T. Taniguchi, M. Wang, J. Wen, Y. Lu*, and X. Xi*, "Strongly enhanced charge-density waves and correlated insulating state in atomically thin 1T-TaS_2", Physical Review Letters **137**, 066502 (2026)
2. L. Cao†, Y. Zhang†, L.-P. Gong, S. Han, G. Liu, D.-H. Wang, H.-Q. Wang, Y.-Y. Lv*, S.-H. Yao*, J. Zhou, J.-L. Zhang*, H. Liu, D. Liu, X. Xi, H.-J. Zhang, Y. Chen*, M.-L. Tian, X. Xie, and Y.-F. Chen, "Fingerprints of Efimov quasi-bound-state and topological phase transition in $Cu_2HgSnSe_4$ under pressure", Acta Materialia **317**, 122560 (2026)

3. Y. Han†, S. Jiang†, J. Xiao†, J. Jiang, Y. Liu, J. Huang, Y. Du, D. Zhang, F. Lian, W. Xu, S. Wang, K. Watanabe, T. Taniguchi, X. Xi, A. S. Mayorov, R. Du, K. Chang, H. Yang, L. Wang*, and G. Yu*, "Tailoring pure valley-zeeman spin-orbit coupling in WSe_2-encapsulated monolayer graphene", Phys. Rev. Lett. **137**, 027001 (2026)
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8. C. Chen†, Y. Liu†, H. Lu†, Z. Wang†, B. Zheng, Q. Guo, J. Xiao, P. Wang, W. Xu, Y. Han, M. Chen, X. Cai, J. Huang, Y. Han, D. Zhang, R. Du, A. S. Mayorov*, Z. Li, S. Zhang, Y. Huang, T. Cheng, Z. Chen, R. Liu, N. Tang, H. Ni, D. Wu, L. Gao, X. Xi, Q. Wang, L. Wang*, K. S. Novoselov*, and G. Yu*, "Chemical vapor deposition growth of continuous monolayer antiferromagnetic CrOCl films", Nature Communications **16**, 11178 (2025)
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14. W.-J. Li†, S.-L. Li†, G. Liu, X. Xi, J.-W. Liu, D.-F. Sun, Y. Zhou*, and N.-J. Tang*, "Flat-band driven ordered magnetism in sp^3 supermodulated defected fluorinated graphene", Carbon **237**, 120131 (2025)
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20. Y. Li†*, L. Xu†, G. Liu†, Y. Fang†, H. Zheng, S. Dai, E. Li, G. Zhu, S. Zhang, S. Liang, L. Yang, F. Huang, X. Xi*, Z. Liu*, N. Xu*, and Y. Chen, "Evidence of strong and mode-selective electron–phonon coupling in the topological superconductor candidate 2M-WS_2", Nature Communications **15**, 6235 (2024)
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22. Z. Chen†, H. Qiu†, X. Cheng†, J. Cui, Z. Jin, D. Tian, X. Zhang, K. Xu, R. Liu, W. Niu, L. Zhou, T. Qiu, Y. Chen, C. Zhang, X. Xi, F. Song, R. Yu, X. Zhai*, B. Jin*, R. Zhang*, and X. Wang*, "Defect-induced helicity dependent terahertz emission in Dirac semimetal $PtTe_2$ thin films", Nature Communications **15**, 2605 (2024)
23. Z. Zhang†, G. Liu†, W. Qi, H. Xie, J. Guo, Y. Du, T. Wang, H. Zhang, F. Zhou, J. Li, Y. Zhang, Y. Yu, F. Fei*, X. Xi*, and F. Song*, "Variation of magnetic properties with current in ferrimagnetic semiconductor $Mn_3Si_2Te_6$", AIP Advances **14**, 035238 (2024)
24. G. Liu†, Y.-Y. Lv†, Z. Jiang, G.-Z. Liu, X. Zhou, Y. Zhang, J. Zheng, L. Xu, M.-H. Lu, S.-H. Yao*, Y. Chen, J. Zhou*, X. Xi*, and Y.-F. Chen, "Mode-selective anharmonicity induced by lone-pair electrons in layered oxyselenides", Physical Review B **109**, 024302 (2024)

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25. Z. Fang, Z. Tao, H. Sun, Y.-Y. Lv, Y.-B. Chen, Y. Nie, R. Liu, and X. Xi*, "Electrical gating of superconducting $NbSe_2$ using $SrTiO_3$-based field-effect transistors", Applied Physics Letters **123**, 132601 (2023)
26. Q. Tian, Z. Wang, W.-M. Zhao, Y.-J. Xu, G. Liu, L. Wang, P. Wang, L.-G. Dou, W. Chen, S. Jin, J. Zong, Q. Meng, F. Yu, C. Wang, X. Xi, F.-S. Li, S.-C. Li, J. Liu, and Y. Zhang*, "Observation of an abnormally large bandgap in monolayer 1T′-WS_2 grown on $SrTiO_3$(001)", Applied Physics Letters **123**, 123104 (2023)
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30. S. Duan†, F. Qin†, P. Chen†, X. Yang, C. Qiu, J. Huang, G. Liu, Z. Li, X. Bi, F. Meng, X. Xi, J. Yao, T. Ideue*, B. Lian*, Y. Iwasa, and H. Yuan*, "Berry curvature dipole generation and helicity-to-spin conversion at symmetry-mismatched heterointerfaces", Nature Nanotechnology **18**, 867–874 (2023)
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