Jun Xiao

Department of Materials Science and Engineering
The University of Wisconsin-Madison
1500 Engineering Drive, Room 729
Madison, WI 53717
https://xiaolab.wisc.edu/

Phone: 608-890-2462
jun.xiao@wisc.edu

Education

- University of California Berkeley, Ph. D in Applied Science & Technology, 2018.
- Nanjing University, B.S. in Physics, 2012.

Professional Experience

- **Assistant Professor,** 2021.8 - present
  Department of Materials Science and Engineering
  Department of Physics (Affiliate)
  Department of Electrical and Computer Engineering (Affiliate)
  The University of Wisconsin Madison

- **Postdoctoral Scholar**, 2018-2021
  Materials Science and Engineering, Applied Physics
  Stanford University

Research Expertise

Ultrafast optics, nonlinear spectroscopy, 2D quantum materials, THz optoelectronics

Past Research Significance

- Nonlinear electrodynamics in 2D correlated topological semimetals for high-performance THz sensing [Nature Electronics 2025]
- Colossal THz emission from 2D ferroelectric semiconductor [Advanced Optical Materials 2025]
- Magnetostriction with large strain tunability in 2D magnets [Nano Letters 2024]
- Stacking ordering engineering of 2D materials for novel physics and device applications [Chemical Reviews 2023]
- Discovery of new ferro orderings including dipole-locking and sliding ferroelectricity [Physical Review Letter 2018; Nature Physics 2020]
- Invention of Berry curvature memory device based on quantum geometrical properties and nonlinear Hall effect in 2D semimetals [Nature Physics 2020]
- Demonstration of electrically controlled phase transition and nonlinear optical modulators at 2D limit [Nature 2017; Nature Electronics 2021]
- Observation of chiral phonon dynamics [Science 2018]
- Demonstration of 2D Janus materials [Nature Nanotechnology 2017]

Honors and Awards

- 2023 NSF CAREER award
- 2022 The Gordon and Betty Moore Foundation EPiQS Flexible Funding, Finalist
- 2022 APS FECS 2022 Physical Electronics Conference Mini-Grants
- 2022 Madison Teaching and Learning Excellence Fellow
- 2021 AVS NSTD Early Career Award, Finalist
- 2021 AVS EMPD Postdoctoral Travel Award

Invited Research Presentations

1. "Spin-lattice coupling and ultrafast spin dynamics in vdW magnets", SPIE Optics + Photonics 2025
2. "Strong light-matter interactions in 2D ferroelectrics with nontrivial topology", Argonne National Laboratory CNM Colloquium 2025
3. "High-performance THz optoelectronics enabled by 2D quantum materials", Workshop on Innovative Nanoscale Devices and Systems (WINDS) 2024
4. "High-performance THz sensing based on layered topological semimetals", MRS Fall 2024
5. "Ultrafast dynamics and THz optoelectronics of layered topological semimetals", XII Ultrafast dynamics & Metastability and Ultrafast Bandgap Photonics conference (UDM & UBP) 2024
6. "Spin-mechanical coupling and dynamics in strained magnetic membranes", ACerS EMA/Electronic Materials and Applications 2024
7. "Layered topological semimetals for novel high-performance electronics and THz optoelectronics", 23rd American Conference on Crystal Growth and Epitaxy (ACCGE-23) 2023
8. " Dynamic control of structural phase transitions in layered materials for information applications", Physical Electronics Conference (PEC) 2022
9. "Berry Curvature Memory Through Stacking Transitions in Topological Semimetals", NSTD Early Career Competition, AVS 2021 (Virtual)
10. "Novel structure and quantum properties of emergent 2D materials", School of Micro-Nano Electronics, Zhejiang University, China, October 2021 (Virtual).

Synergistic Activities

- Organizer, "Symposium QT05: Emergent Quantum Orderings and Properties in 2D Materials and Heterostructures", MRS Spring 2025
- Co-organizer, MRSEC AMIC meeting, 2025
- Organizer, "2D Moire Materials" focus sessions (5 sessions), APS March meeting 2023
- Review panelist, NSF ECCS-EPMD, 2023
- Review panelist, NSF DMR-CMP, 2023
- Speaker, Wisconsin MRSEC Breakthrough Research and Education Workshop, 2023
- Host, Wisconsin MRSEC RET program, 2025
- Host, Wisconsin MRSEC REU program, 2025, 2024, 2023
- Faculty Participant, WiscProf: Future Faculty in Engineering Workshop, 2025, 2023, 2022
- Engineering EXPO, 2025, 2024, 2023
- Chair, Session M72 "Mn-Te Magnetic Topology III", APS March meeting 2022

- Judge, student poster prize competition, 82nd Physical Electronics Conference, 2022
- Fellow, Madison Teaching and Learning Excellence (MTLE), 2022
- Faculty Participant, Precollege Enrichment Opportunity Program for Learning Excellence, 2022
- Reviewers for *Nature, Nature Electronics, Physical Review Letters, Physical Review B, Physical Review Applied, Matter, Optical Communications, ACS Applied Materials and Interfaces, Laser & Photonics Review, Scientific Reports*

Patent

1. J. Xiao, A. Lindenberg, "Nanometer scale nonvolatile memory device and method for storing binary and quantum memory states", US 11,355,697
2. J. Xiao, Y. Wang, D. Van der Weide, "Terahertz radiation detectors based on thin films of non-centrosymmetric layered topological semimetals", US 18/448,648

Publications [* equal contribution]

[h-index: 23, i10-index: 25, total citations 8,700 by 07/2025. Google Scholar]

1. **T. Xi**, H. Jiang, J. Li, Y. He, Y. Gu, **C. Fox**, L. Primeau, Y. Mao, **J. Rollins**, T. Taniguchi, K. Watanabe, D. van der Weide, D. Rhodes, Y. Zhang, Y. Wang, **J. Xiao**, "Terahertz sensing based on the nonlinear electrodynamics of the two-dimensional correlated topological semimetal $TaIrTe_4$". ***Nature Electronics*** (2025).
2. **S. Subedi**, W. Liu, W. Fang, **C. Fox**, Z. Zhai, **F. Fei**, P. Yuan, B. Lv, **J. Xiao**, "Colossal terahertz emission with ultrafast tunability based on van der Waals ferroelectrics $NbOI_2$". ***Advanced Optical Materials*** 13, 2403471(2025).
3. Y. He, A. Strasser, N. Hagopian, B. Bierman, H. Ma, **C. Fox**, Z. Li, N. Pederson, T. Taniguchi, K. Watanabe, **J. Xiao**, Y. Wang, P. Voyles, X. Qian, D. Rhodes, "Evidence for topological states and a Lifshitz transition in metastable 2M-WSe_2", ***Advanced Functional Materials*** 13, 2420356 (2025).
4. Y. Liu, J. Gong, S. Acharya, Y. Li, A. Abrand, **F. Fei**, J. Rudie, J. Zhou, Y. Lu, H. Abbasi, D. Vincent, S. Haessly, T. Tsai, **J. Xiao**, P. Mohseni, S. Yu, Z. Ma, "Characterization of AlGaAs/GeSn heterojunction band alignment via X-ray photoelectron spectroscopy." ***Applied Surface Science*** 685, 162006 (2025).
5. Y. Mao, F. Fei, D. Zhang, H. Jiang, C. Fox, Y. He, D. Rhodes, C. Ma, **J. Xiao**, Y. Wang, "Reveal stacking phase transition via nanomechanical resonator". ***npj 2D Materials and Applications*** 8, 75 (2024).
6. F. Fei, Y. Mao, W. Fang, W. Liu, J. Rollins, ALN Kondusamy, B. Lv, Y. Ping, Y. Wang, **J. Xiao**, "Spin-mechanical coupling in 2D antiferromagnet CrSBr", ***Nano Letters*** 24, 10467 (2024).
7. E. Sie, M. Othman, C. Nyby, D. Pemmaraju, C. Garcia, Y. Wang, B. Guzelturk, C. Xia, **J. Xiao**, A. Poletayev, B. Okai, M. Hoffmann, S. Park, X. Shen, J. Yang, R. Li, A. Reid, S. Weathersby, P. Muscher, N. Finney, D. Rhodes, L. Balicas, E. Nanni, J. Hone, W. Chueh, T. Devereaux, P. Narang, T. Heinz, X. Wang, A. Lindenberg. "Giant Terahertz birefringence in an ultrathin anisotropic semimetal", ***Nano Letters***, 24, 6031 (2024).
8. **F. Carter**, Y. Mao, X. Zhang, Y. Wang, **J. Xiao**, "Stacking order engineering of two-dimensional materials and device applications", ***Chemical Reviews*** 124, 1862(2023).

9. X. Andrade, C.D. Pemmaraju, A. Kartsev, **J. Xiao**, A. Lindenberg, S. Rajpurohit, L. Tan, T. Ogitsu, A. Correa, "INQ, a modern GPU-accelerated computational framework for (time-dependent) density functional theory", ***Journal of Chemical Theory and Computation*** 17, 7747 (2021).
10. Y. Wang, **J. Xiao**, T. Chung, Z. Nie, S. Yang, X. Zhang, "Direct electrical modulation of second-order optical susceptibility with record-high strength", ***Nature Electronics*** 4, 725 (2021).
11. D. Luo, J. Tang, X. Shen, F. Ji, J. Yang, S. Weathersby, M. Kozina, Z. Chen, **J. Xiao**, Y. Ye, T. Cao, G. Zhang, X. Wang, A. M. Lindenberg, "Twist-Angle-Dependent Ultrafast Charge Transfer in MoS_2-Graphene van der Waals Heterostructures", ***Nano Letters*** 21, 8051 (2021)
12. **J. Xiao**, Y. Wang, H. Wang, C.D. Pemmaraju, S. Wang, P. Muscher, E.J. Sie, C. Nyby, T.P. Devereaux, X. Qian, X. Zhang & A. M. Lindenberg, "Berry curvature memory through electrically driven stacking transitions", ***Nature Physics***, 16, 1028 (2020).
13. S. S. Cheema, D. Kwon, N. Shanker, R. Reis, S. Hsu, **J. Xiao**, H. Zhang, R. Wagner, A. Datar, M. R. McCarter, C. R. Serrao, A. K. Yadav, G. Karbasian, C. Hsu, A. J. Tan, L. Wang, V. Thakare, X. Zhang, A. Mehta, E. Karapetrova, R. Chopdekar, P. Shafer, E. Arenholz, C. Hu, R. Proksch, R. Ramesh, J. Ciston, S. Salahuddin, "Enhanced ferroelectricity in ultrathin films grown directly on silicon", ***Nature*** 580, 478 (2020).
14. R. Xu, J. Huang, E. Barnard, S.S. Hong, P. Singh, E. Wong, T. Jansen, V. Harbola, **J. Xiao**, B.Y. Wang, S. Crossley, D. Lu, S. Liu, H. Hwang, "Strain-Induced Room-Temperature Ferroelectricity in $SrTiO_3$ Membranes", ***Nature Communications*** 11, 3141(2020).
15. J. H. Lee, J. H. Lee, **J. Xiao**, M. S. Desai, X. Zhang, S.W. Lee, "Vertical self-assembly of polarized phage nanostructure for energy harvesting", ***Nano Letters***, 19, 2661 (2019).
16. H. Zhao, Y. Zhao, Y. Song, M. Zhou, W. Lv, L. Tao, Y. Feng, B. Song, Y. Ma, J. Zhang, **J. Xiao**, Y. Wang, D. Lien, M. Amani, H. Kim, X. Chen, Z. Wu, Z. Ni, P. Wang, Y. Shi, Ha. Ma, X. Zhang, J. Xu, A. Troisi, A. Javey, X. Wang, "Strong optical response and light emission from a monolayer molecular crystal", ***Nature Communications***, 10, 5589 (2019).
17. Y. Wang, **J. Xiao**, S. Yang, Yu. Wang, X. Zhang, "Second-harmonic generation spectroscopy on two-dimensional materials", ***Optical Materials Express***, 9, 1136 (2019).
18. **J. Xiao**, H. Zhu, Y. Wang, W. Feng, Y. Hu, A. Dasgupta, Y. Han, Yu. Wang, D.A. Muller, L. W. Martin, P. Hu & X. Zhang, "Intrinsic two-dimensional ferroelectricity with dipole locking", ***Physical Review Letters***, 120, 227601 (2018). **Editor's Suggestion**; News & Views by ***Nature***, "Stable and switchable electric polarization in two dimensions"
19. Y. Wan, **J. Xiao**, J. Li, X. Fang, K. Zhang, L. Fu, P. Li, Z. Song, H. Zhang, Yu. Wang, M. Zhao, J. Lu, N. Tang, G. Ran, X. Zhang, Y. Ye & L. Dai, "Epitaxial single-layer MoS_2 on GaN with enhanced valley helicity", ***Advanced Materials***, 30, 1703888 (2018).
20. M.S. Eggleston, S.B. Desai, K. Messer, S.A. Fortuna, S. Madhvapathy, **J. Xiao**, X. Zhang, E. Yablonovitch, A. Javey & M. Wu, "Ultrafast spontaneous emission from a slot-antenna coupled WSe2 monolayer", ***ACS Photonics***, 5, 2701 (2018).
21. H. Zhu, J. Yi, M. Li, **J. Xiao**, L. Zhang, C. Yang, Y. Wang, R. Kaindl, L. Li & X. Zhang, "Observation of chiral phonon", ***Science***, 359, 579 (2018).
22. Y. Wang[*], **J. Xiao**[*], H. Zhu, Y. Li, Y. Alsaid, K. Y. Fong, Y. Zhou, S. Wang, W. Shi, Yu. Wang, A. Zettl, E. J. Reed & X. Zhang, "Structural phase transition in monolayer $MoTe_2$ driven by electrostatic doping", ***Nature***, 550, 487 (2017).

23. A.Y. Lu*, H. Zhu*, **J. Xiao***, C.-P. Chuu, Y. Han, M.-H. Chiu, C.-C. Cheng, C.-W. Yang, K.-H. Wei, Y. Yang, Yu. Wang, D. Sokaras, D. Nordlund, P. Yang, D. A. Muller, M.-Y. Chou, X. Zhang & L.-J. Li, "Janus monolayers of transition metal dichalcogenides", ***Nature Nanotechnology***, 12, 744 (2017).
24. **J. Xiao**, M. Zhao, Yu. Wang & X. Zhang, "Excitons in atomically thin 2D semiconductors and their applications", ***Nanophotonics***, 6, 1309 (2017).
25. Q. Hu, D. Jin, **J. Xiao**, S. H. Nam, X. Liu, Y. Liu, X. Zhang & N. X. Fang, "Ultrafast fluorescent decay induced by metal-mediated dipole–dipole interaction in two-dimensional molecular aggregates", ***PNAS***, 114, 10017 (2017).
26. Y. Ye, **J. Xiao**, H. Wang, Z. Ye, H. Zhu, M. Zhao, Yu. Wang, J. Zhao, X. Yin & X. Zhang, "Electrical generation and control of the valley carriers in a monolayer transition metal dichalcogenide", ***Nature Nanotechnology***, 11, 598–602 (2016)
27. M. Zhao, Z. Ye, R. Suzuki, Y. Ye, H. Zhu, **J. Xiao**, Yu. Wang, Y. Iwasa & X. Zhang, "Atomically Phase-Matched Second-Harmonic Generation in a 2D Crystal", ***Light: Science & Applications***, 5, e16131 (2016).
28. M. Amani*, D. Lien*, D. Kiriya*, **J. Xiao**, A. Azcatl, J. Noh, S. R. Madhvapathy, R. Addou, S. KC, M. Dubey, K. Cho, R. M. Wallace, S.-C. Lee, J.-H. He, J. W. Ager, X. Zhang, E. Yablonovitch & A. Javey, "Near-unity photoluminescence quantum yield in MoS_2." ***Science***, 350, 1065 (2015).
29. H. Zhu*, Yu. Wang*, **J. Xiao**, M. Liu, S. Xiong, Z. Wong, Z. Ye, Y. Ye, X. Yin & X. Zhang, "Observation of piezoelectricity in free-standing monolayer MoS_2", ***Nature Nanotechnology***, 10, 151-155 (2015).
30. **J. Xiao**, Z. Ye, Y. Wang, H. Zhu, Yu. Wang & X. Zhang, "Nonlinear optical selection rule based on valley-exciton locking in monolayer WS_2", ***Light: Science & Applications*** 4, e366 (2015).
31. **J. Xiao**, Y. Wang, Z. Hua, X. Wang, C. Zhang & M. Xiao, "Carrier multiplication in semiconductor nanocrystals detected by energy transfer to organic dye molecules", ***Nature Communications***, 3, 1170 (2012).