

Tiancheng Song

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Employment

- *Assistant Professor of Physics*, University of Wisconsin - Madison May 2024 – present
- *Affiliated Professor of MSE*, University of Wisconsin - Madison Sep. 2024 – present
- *Honorary Appointment*, University of Wisconsin - Madison Aug. 2023 – May 2024
- *Dicke Fellow*, Department of Physics, Princeton University Sep. 2021 – May 2024

Education

- *Ph.D. in Physics*, University of Washington Sep. 2016 – Aug. 2021
Advisor: Prof. Xiaodong Xu
Thesis: "Emergent phenomena and device applications in magnetic van der Waals heterostructures"
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- *M.S. in Physics*, University of Washington Sep. 2016 – Jun. 2017
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- *B.S. in Physics*, University of Science and Technology of China (USTC) Sep. 2012 – Jun. 2016
Advisor: Prof. Chaoyang Lu, Prof. Allan MacDonald, Prof. Matthias Weidemüller

Selected Awards

- DOE Early Career Research Program Award, 2025
- Lee Osheroff Richardson (LOR) Science Prize, 2024
- Dicke Fellowship, Princeton University, 2021-2024
- Miller Scholarship, University of Washington, 2019
- Clean Energy Institute Fellowship, University of Washington, 2016 and 2017
- Physics Department Fellowship, University of Washington, 2016
- Guo Moruo Presidential Scholarship (the Highest honor for USTC students), USTC, 2016
- Bachelor's degree with honors, USTC, 2016
- Undergraduate Research Excellence Award, USTC, 2015

Selected Publications

* equal contribution † corresponding author [Google Scholar](#)

1. W. Zhao[†], **T. Song[†]**, Z. Tao[†], Y. Ren[†], K. Luo[†], "Emergent magnetism in twisted 2D materials", *review paper submitted* (2025).

2. **T. Song**, Y. Jia, G. Yu, Y. Tang, A. J. Uzan, Z. J. Zheng, H. Guan, M. Onyszczak, R. Singha, X. Gui, K. Watanabe, T. Taniguchi, R. J. Cava, L. M. Schoop, N. P. Ong, S. Wu, "Unconventional Superconducting Phase Diagram of Monolayer WTe_2 ", *Physical Review Research*, 7, 013224 (2025).
3. Y. Jia*, **T. Song***, A. J. Uzan, G. Yu, Y. Tang, C. Pollak, M. Onyszczak, Z. Zheng, K. Watanabe, T. Taniguchi, S. Lei, L. M. Schoop, N. P. Ong, S. Wu, "Anomalous superconductivity in twisted $MoTe_2$ nanojunctions", *Science Advances*, 11, eadq5712 (2025).
4. **T. Song**[†], X. Xu[†], "The future of 2D spintronics", *Nature Reviews EE*, 1, 696–697 (2024).
5. Y. Jia, G. Yu, **T. Song**, F. Yuan, A. J. Uzan, Y. Tang, P. Wang, R. Singha, M. Onyszczak, Z. Zheng, K. Watanabe, T. Taniguchi, L. M. Schoop, S. Wu, "Superconductivity from on-chip metallization on 2D topological chalcogenides", *Physical Review X*, 14, 021051 (2024).
6. **T. Song**, Y. Jia, G. Yu, Y. Tang, P. Wang, R. Singha, X. Gui, A. J. Uzan, M. Onyszczak, K. Watanabe, T. Taniguchi, R. J. Cava, L. M. Schoop, N. P. Ong, S. Wu, "Unconventional superconducting quantum criticality in monolayer WTe_2 ", *Nature Physics*, 20, 269–274 (2024).
 - Highlighted at Princeton News || Princeton Research || EurekAlert!
7. C.-C. Tseng*, **T. Song***, Q. Jiang, Z. Lin, C. Wang, J. Suh, K. Watanabe, T. Taniguchi, M. A. McGuire, D. Xiao, J.-H. Chu, D. H. Cobden, X. Xu, M. Yankowitz, "Gate-tunable proximity effects in graphene on layered magnetic insulators", *Nano Letters*, 22, 8495-8501 (2022).
8. **T. Song***, Q.-C. Sun*, E. Anderson*, C. Wang, J. Qian, T. Taniguchi, K. Watanabe, M. A. McGuire, R. Stöhr, D. Xiao, T. Cao, J. Wrachtrup, X. Xu, "Direct visualization of magnetic domains and moiré magnetism in twisted 2D magnets", *Science*, 374, 1140–1144 (2021).
 - Highlighted at Science Perspective || PHYS.ORG || UW News
9. **T. Song**, E. Anderson, M. W.-Y. Tu, K. Seyler, T. Taniguchi, K. Watanabe, M. A. McGuire, X. Li, T. Cao, D. Xiao, W. Yao, X. Xu, "Spin photovoltaic effect in magnetic van der Waals heterostructures", *Science Advances*, 7: eabg8094 (2021).
 - Highlighted at PHYS.ORG
10. Q.-C. Sun*, **T. Song***, E. Anderson, A. Brunner, J. Förster, T. Shalomayeva, T. Taniguchi, K. Watanabe, J. Gräfe, R. Stöhr, X. Xu, J. Wrachtrup, "Magnetic domains and domain wall pinning in atomically thin $CrBr_3$ revealed by nanoscale imaging", *Nature Communications*, 12, 1989 (2021).
11. W. Zhao, Z. Fei, **T. Song**, H. K. Choi, T. Palomaki, B. Sun, P. Malinowski, M. A. McGuire, J.-H. Chu, X. Xu, D. H. Cobden, "Magnetic proximity and nonreciprocal current switching in a monolayer WTe_2 helical edge", *Nature Materials*, 19, 503–507 (2020).
12. **T. Song***, Z. Fei*, M. Yankowitz, Z. Lin, Q. Jiang, K. Hwangbo, Q. Zhang, B. Sun, T. Taniguchi, K. Watanabe, M. A. McGuire, D. Graf, T. Cao, J.-H. Chu, D. H. Cobden, C. R. Dean, D. Xiao, X. Xu, "Switching 2D magnetic states via pressure tuning of layer stacking", *Nature Materials*, 18, 1298–1302 (2019).
 - Highlighted at Nature Materials News & Views
13. Z. Sun*, Y. Yi*, **T. Song**, G. Clark, B. Huang, Y. Shan, S. Wu, D. Huang, C. Gao, Z. Chen, M. McGuire, T. Cao, D. Xiao, W.-T. Liu, W. Yao, X. Xu, S. Wu, "Giant and nonreciprocal second-

harmonic generation from layered antiferromagnetism in bilayer CrI₃", *Nature*, 572, 497-501 (2019).

14. **T. Song**, M. W.-Y. Tu, C. Carnahan, X. Cai, T. Taniguchi, K. Watanabe, M. A. McGuire, D. H. Cobden, D. Xiao, W. Yao, X. Xu, "Voltage Control of a van der Waals Spin-Filter Magnetic Tunnel Junction", *Nano Letters*, 19, 915-920 (2019).
15. X. Cai, **T. Song**, N. P. Wilson, G. Clark, M. He, X. Zhang, T. Taniguchi, K. Watanabe, W. Yao, D. Xiao, M. A. McGuire, D. H. Cobden, X. Xu, "Atomically thin CrCl₃: an in-plane layered antiferromagnetic insulator", *Nano Letters*, 19, 3993-3998 (2019).
16. **T. Song***, X. Cai*, M. W.-Y. Tu, X. Zhang, B. Huang, N. P. Wilson, K. L. Seyler, L. Zhu, T. Taniguchi, K. Watanabe, M. A. McGuire, D. H. Cobden, D. Xiao, W. Yao, X. Xu, "Giant tunneling magnetoresistance in spin-filter van der Waals heterostructures", *Science*, 360, 1214-1218 (2018).
○ Highlighted at [Condat Journal Club](#) || [PHYS.ORG](#) || [UW News](#)

Full Publications

17. Y. Jia*, F. Yuan*, G. Cheng, Y. Tang, G. Yu, **T. Song**, P. Wang, R. Singha, A. J. Uzan, M. Onyszczak, K. Watanabe, T. Taniguchi, N. Yao, L. M. Schoop, S. Wu, "Surface-confined two-dimensional crystal growth on a monolayer", *Nature Synthesis*, 3, 386-393 (2024).
18. M. Onyszczak*, A. J. Uzan*, Y. Tang*, P. Wang*, Y. Jia, G. Yu, **T. Song**, R. Singha, J. F. Khoury, L. M. Schoop, S. Wu, "A platform for far-infrared spectroscopy of quantum materials at millikelvin temperatures", *Rev. Sci. Instrum.*, 94, 103903 (2023).
19. G. Yu*, P. Wang*, A. J. Uzan, Y. Jia, M. Onyszczak, R. Singha, X. Gui, **T. Song**, Y. Tang, K. Watanabe, T. Taniguchi, R. J. Cava, L. M. Schoop, S. Wu, "Evidence for two dimensional anisotropic Luttinger liquids at millikelvin temperatures", *Nature Communications*, 14, 7025 (2023).
20. J. Cai*, D. Ovchinnikov*, Z. Fei, M. He, **T. Song**, Z. Lin, C. Wang, D. Cobden, J.-H. Chu, Y.-T. Cui, C.-Z. Chang, D. Xiao, J. Yan, X. Xu, "Electric control of a canted-antiferromagnetic Chern insulator", *Nature Communications*, 13, 1668 (2022).
21. J. Cenker*, B. Huang*, N. Suri, P. Thijssen, A. Miller, **T. Song**, T. Taniguchi, K. Watanabe, M. A. McGuire, D. Xiao, X. Xu, "Direct observation of two-dimensional magnons in atomically thin CrI₃", *Nature Physics*, 17, 20-25 (2021).
22. D. Ovchinnikov*, X. Huang*, Z. Lin*, Z. Fei*, J. Cai, **T. Song**, M. He, Q. Jiang, C. Wang, H. Li, Y. Wang, Y. Wu, D. Xiao, J.-H. Chu, J. Yan, C.-Z. Chang, Y.-T. Cui, X. Xu, "Intertwined Topological and Magnetic Orders in Atomically Thin Chern Insulator MnBi₂Te₄", *Nano Letters*, 21, 25442550 (2021).
23. Y.-F. Zhao, L.-J. Zhou, F. Wang, G. Wang, **T. Song**, D. Ovchinnikov, H. Yi, R. Mei, K. Wang, M. H. W. Chan, C.-X. Liu, X. Xu, and C.-Z. Chang, "Even-Odd Layer-Dependent Anomalous Hall Effect in Topological Magnet MnBi₂Te₄ Thin Films", *Nano Letters*, 21, 7691-7698 (2021).
24. Q. Jiang, C. Wang, P. Malinowski, Z. Liu, Y. Shi, Z. Lin, Z. Fei, **T. Song**, D. Graf, S. Chikara, X. Xu, J. Yan, D. Xiao, J.-H. Chu, "Quantum oscillations in the field-induced ferromagnetic state of MnBi_{2-x}Sb_xTe₄", *Physical Review B*, 103, 205111 (2021).

25. B. Huang*, J. Cenker*, X. Zhang, E. L. Ray, **T. Song**, T. Taniguchi, K. Watanabe, M. A. McGuire, D. Xiao, X. Xu, "Tuning inelastic light scattering via symmetry control in the two-dimensional magnet CrI₃", *Nature Nanotechnology*, 15, 212–216 (2020).
26. Z. Fei*, B. Huang*, P. Malinowski, W. Wang, **T. Song**, J. Sanchez, W. Yao, D. Xiao, X. Zhu, A. F. May, W. Wu, D. H. Cobden, J.-H. Chu, X. Xu, "Two-dimensional itinerant ferromagnetism in atomically thin Fe₃GeTe₂", *Nature Materials*, 17, 778–782 (2018).
- Patent: X. Xu, **T. Song**, X. Cai, "Magnetic tunnel barriers and related heterostructure devices and methods", *US Patent* US-11422209-B2 (2022).

Invited Talks and Presentations

1. "Discovering and Engineering Two-Dimensional Magnetism and Superconductivity", *Condensed Matter/Materials and Biological Physics Seminar*, Washington University in St. Louis (April. 2025).
2. "Quantum LEGO in 2D flatland", *Wisconsin Summer School for Quantum Science*, University of Wisconsin-Madison (Aug. 2024).
3. "Emergent phenomena in magnetic and superconducting van der Waals heterostructures", *Quantum Materials Seminar*, University of Wisconsin-Madison (Nov. 2023).
4. "Discovering and engineering quantum materials in 2D flatland", *Seminar*, University of California Los Angeles (May 2023).
5. "Unconventional superconducting quantum criticality in monolayer WTe₂", *PQI Quantum Group Meeting*, Princeton University (Apr. 2023).
6. "Discovering and engineering quantum materials in 2D flatland", *Seminar*, University of California San Diego (Mar. 2023).
7. "Discovering and engineering two-dimensional magnetism and superconductivity", *Condensed Matter Seminar*, University of Wisconsin-Madison (Feb. 2023).
8. "Discovering and engineering two-dimensional magnetism and superconductivity", *Special Colloquium*, New York University (Feb. 2023).
9. "Emergent phenomena and device applications in magnetic van der Waals heterostructures", *Seminar*, Stevens Institute of Technology (Dec. 2022).
10. "Unconventional superconducting quantum criticality in monolayer WTe₂", *PCCM Seminar*, Princeton University (Dec. 2022).
11. "Quantum spin Hall insulator to superconductor transition in a 2D quantum material", *Quantum Workshop*, Stevens Institute of Technology (Oct. 2022).
12. "Vortex Nernst effect in a gate-tunable monolayer superconductor", *Dicke Symposium*, Princeton University (Sep. 2022).
13. "Direct visualization of magnetic domains and moiré magnetism in twisted 2D magnets", *MURI Seminar*, Seattle, WA (Jul. 2021).

14. "Direct visualization of magnetic domains and moiré magnetism in twisted 2D magnets", *MRSEC Seminar*, University of Washington (May 2021).
15. "Emergent phenomena in magnetic van der Waals heterostructures", *HQI Seminar*, Harvard University (Jan. 2021).
16. "Emergent phenomena in magnetic van der Waals heterostructures", *Dicke Seminar*, Princeton University (Dec. 2020).
17. "Spin photovoltaic effect in magnetic van der Waals heterostructures", *NanoES Seminar*, University of Washington (Dec. 2020).
18. "Giant tunneling magnetoresistance in spin-filter van der Waals heterostructures", *UW MSE Industry Day*, Seattle, WA (Nov. 2020).
19. "Spin photovoltaic effect in magnetic van der Waals heterostructures", *Pro-QM Seminar*, New York City, NY (Nov. 2020).
20. "Helicity dependent spin photocurrent in magnetic van der Waals heterostructures", *MRSEC Seminar*, University of Washington (Aug. 2020).
21. "Giant tunneling magnetoresistance in spin-filter van der Waals heterostructures", *NanoES Seminar*, University of Washington (Feb. 2020).
22. "Giant tunneling magnetoresistance in van der Waals layered antiferromagnet", *Magnetism and Magnetic Materials Conference*, Las Vegas, NV (Nov. 2019).
23. "Magnetoelectric effect in gated trilayer CrI_3 ", *MRSEC Seminar*, University of Washington (Feb. 2019).

Contributed Talks:

24. "Unconventional superconducting quantum criticality in monolayer WTe_2 ", *APS March Meeting*, Las Vegas, NV (Mar. 2023).
25. "Direct visualization of magnetic domains and moiré magnetism in twisted 2D magnets", *APS March Meeting*, Chicago, IL (Mar. 2022).
26. "Switching 2D magnetic states via pressure tuning of layer stacking", *APS March Meeting*, Denver, CO (Mar. 2020).
27. "Voltage control of a van der Waals spin-filter magnetic tunnel junction", *APS March Meeting*, Boston, MA (Mar. 2019).
28. "Superconductivity in twisted bilayer graphene", *Condensed Matter Journal Club*, University of Washington (Feb. 2019).
29. "Giant tunneling magnetoresistance in spin-filter van der Waals heterostructures", *APS March Meeting*, Los Angeles, CA (Mar. 2018).

Synergistic Activities

- Journal review:

- *Review of Modern Physics* × 3
 - *Nature* × 7
 - *Nature Materials* × 2
 - *Nature Physics* × 1
 - *Nature Nanotechnology* × 2
 - *Nature Electronics* × 2
 - *Nature Communications* × 21
 - *PNAS* × 2
 - *Science Advances* × 1
 - *Physical Review Letters* × 2
 - *Physical Review X* × 2
 - *Physical Review B* × 3
 - *Nano Letters* × 12
 - *ACS Photonics* × 2
 - *Communications Physics* × 2
 - *npj 2D Materials and Applications* × 1
 - *Journal of Applied Physics* × 1
 - *Journal of Physical Chemistry Letters* × 2
 - *Journal of Physical Chemistry* × 4
 - *2D Materials* × 1
 - *Science Bulletin* × 2
- Proposal review: NSF, DOE, Gordon and Betty Moore Foundation, Israel Science Foundation
 - Symposium lead organizer and session chair for MRS Fall Meeting
 - Organizer for Wisconsin Summer School for Quantum Science 2024, 2025
 - Session organizer and session chair of APS March Meeting
 - Lee Osheroff Richardson Science Prize committee, 2026
 - Organizer for Princeton Summer School on Condensed Matter Physics 2022
 - UW Physics Outreach committee
 - Mentor in Princeton Physics Mentorship program
 - UW-Seattle Science Explorers volunteer

Teaching and Mentoring

- PHYS 551, Solid State Physics, UW-Madison Fall 2024, Fall 2025
- PHYS 701, Graduate Introductory Seminars, UW-Madison Fall 2023 - present
- PHYS 301, Physics Today, UW-Madison Spring 2025 - present
- Mentorship of 1 Ph.D. student for graduate experimental project and 1 undergraduate student in Wu Lab at Princeton University 2022 - 2024
- Mentorship of 1 Ph.D. student and 5 undergraduate students in Xu Lab 2017 – 2021
- PHYS 122 TA: Electromagnetism, University of Washington Winter 2017
- PHYS 121 TA: Mechanics, University of Washington Autumn 2016
- Optics TA, University of Science and Technology of China Fall 2015