TANNER TRICKLE

CURRICULUM VITAE

Fermi National Accelerator Laboratory
Batavia, IL 60510, USA

Postdoctoral Research Associate
Theoretical Physics Division

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Education

2020 - 2022 **Ph.D.**
California Institute of Technology
Division of Physics, Astronomy, and Mathematics
Thesis: *Direct Detection of Light Dark Matter with Electrons, Phonons, and Magnons*
Advisor: Prof. Kathryn M. Zurek

2017 - 2020 Ph.D. Student
University of California, Berkeley
Initial progress towards Ph.D.
Advisor: Prof. Kathryn M. Zurek

2013 - 2017 **B.S.**
Massachusetts Institute of Technology
Department of Physics

2013 - 2017 **B.S.**
Massachusetts Institute of Technology
Department of Mathematics

Appointments

2022 - **Postdoctoral Research Associate**
Fermi National Accelerator Laboratory, Batavia, IL 60510, USA
Theoretical Physics Division

2022 - **Associate Member**
North American Nanohertz Observatory for Gravitational Waves (NANOGrav)

Publications

1. R. Linehan, T. Trickle, C. R. Conner, S. Ghosh, T. Lin, M. Sholapurkar, and A. N. Cleland, "Listening For New Physics With Quantum Acoustics," arXiv:2410.17308 [hep-ph]

2. G. Krnjaic, D. Rocha, and T. Trickle, "The Non-Relativistic Effective Field Theory Of Dark Matter-Electron Interactions," arXiv:2407.14598 [hep-ph]

3. A. Berlin, A. J. Millar, T. Trickle, and K. Zhou, "Physical signatures of fermion-coupled axion dark matter," *JHEP* **05** (2024) 314, arXiv:2312.11601 [hep-ph]

4. Y. Kahn, J. Schütte-Engel, and T. Trickle, "Searching for high-frequency gravitational waves with phonons," *Phys. Rev. D* **109** (2024) no. 9, 096023, arXiv:2311.17147 [hep-ph]

5. A. Mitridate, K. Pardo, T. Trickle, and K. M. Zurek, "Effective field theory for dark matter absorption on single phonons," *Phys. Rev. D* **109** (2024) no. 1, 015010, arXiv:2308.06314 [hep-ph]

6. **NANOGrav** Collaboration, A. Afzal *et al.*, "The NANOGrav 15 yr Data Set: Search for Signals from New Physics," *Astrophys. J. Lett.* **951** (2023) no. 1, L11, arXiv:2306.16219 [astro-ph.HE]

7. A. Berlin and T. Trickle, "Absorption of Axion Dark Matter in a Magnetized Medium," *Phys. Rev. Lett.* **132** (2024) no. 18, 181801, arXiv:2305.05681 [hep-ph]

8. G. Krnjaic and T. Trickle, "Absorption of vector dark matter beyond kinetic mixing," *Phys. Rev. D* **108** (2023) no. 1, 015024, arXiv:2303.11344 [hep-ph]

9. T. Trickle, "Extended calculation of electronic excitations for direct detection of dark matter," *Phys. Rev. D* **107** (2023) no. 3, 035035, arXiv:2210.14917 [hep-ph]

10. T. Trickle, *Direct Detection of Light Dark Matter with Electrons, Phonons, and Magnons*. PhD thesis, Caltech, 2022

11. D. E. Kaplan, A. Mitridate, and T. Trickle, "Constraining fundamental constant variations from ultralight dark matter with pulsar timing arrays," *Phys. Rev. D* **106** (2022) no. 3, 035032, arXiv:2205.06817 [hep-ph]

12. A. Mitridate, T. Trickle, Z. Zhang, and K. M. Zurek, "Snowmass white paper: Light dark matter direct detection at the interface with condensed matter physics," *Phys. Dark Univ.* **40** (2023) 101221, arXiv:2203.07492 [hep-ph]

13. H.-Y. Chen, A. Mitridate, T. Trickle, Z. Zhang, M. Bernardi, and K. M. Zurek, "Dark matter direct detection in materials with spin-orbit coupling," *Phys. Rev. D* **106** (2022) no. 1, 015024, arXiv:2202.11716 [hep-ph]

14. M. Papucci, T. Trickle, and M. B. Wise, "Radiative semileptonic $\overline{B}$ decays," *JHEP* **02** (2022) 043, arXiv:2110.13154 [hep-ph]

15. A. Mitridate, T. Trickle, Z. Zhang, and K. M. Zurek, "Dark matter absorption via electronic excitations," *JHEP* **09** (2021) 123, arXiv:2106.12586 [hep-ph]

16. S. M. Griffin, K. Inzani, T. Trickle, Z. Zhang, and K. M. Zurek, "Extended calculation of dark matter-electron scattering in crystal targets," *Phys. Rev. D* **104** (2021) no. 9, 095015, arXiv:2105.05253 [hep-ph]

17. V. S. H. Lee, S. R. Taylor, T. Trickle, and K. M. Zurek, "Bayesian Forecasts for Dark Matter Substructure Searches with Mock Pulsar Timing Data," *JCAP* **08** (2021) 025, arXiv:2104.05717 [astro-ph.CO]

18. A. Coskuner, T. Trickle, Z. Zhang, and K. M. Zurek, "Directional detectability of dark matter with single phonon excitations: Target comparison," *Phys. Rev. D* **105** (2022) no. 1, 015010, arXiv:2102.09567 [hep-ph]

19. V. S. H. Lee, A. Mitridate, T. Trickle, and K. M. Zurek, "Probing Small-Scale Power Spectra with Pulsar Timing Arrays," *JHEP* **06** (2021) 028, arXiv:2012.09857 [astro-ph.CO]

20. T. Trickle, Z. Zhang, and K. M. Zurek, "Effective field theory of dark matter direct detection with collective excitations," *Phys. Rev. D* **105** (2022) no. 1, 015001, arXiv:2009.13534 [hep-ph]

21. A. Mitridate, T. Trickle, Z. Zhang, and K. M. Zurek, "Detectability of Axion Dark Matter with Phonon Polaritons and Magnons," *Phys. Rev. D* **102** (2020) no. 9, 095005, arXiv:2005.10256 [hep-ph]

22. H. Ramani, T. Trickle, and K. M. Zurek, "Observability of Dark Matter Substructure with Pulsar Timing Correlations," *JCAP* **12** (2020) 033, arXiv:2005.03030 [astro-ph.CO]

23. S. M. Griffin, K. Inzani, T. Trickle, Z. Zhang, and K. M. Zurek, "Multichannel direct detection of light dark matter: Target comparison," *Phys. Rev. D* **101** (2020) no. 5, 055004, arXiv:1910.10716 [hep-ph]

24. T. Trickle, Z. Zhang, K. M. Zurek, K. Inzani, and S. M. Griffin, "Multi-Channel Direct Detection of Light Dark Matter: Theoretical Framework," *JHEP* **03** (2020) 036, arXiv:1910.08092 [hep-ph]

25. T. Trickle, Z. Zhang, and K. M. Zurek, "Detecting Light Dark Matter with Magnons," *Phys. Rev. Lett.* **124** (2020) no. 20, 201801, arXiv:1905.13744 [hep-ph]

26. J. A. Dror, H. Ramani, T. Trickle, and K. M. Zurek, "Pulsar Timing Probes of Primordial Black Holes and Subhalos," *Phys. Rev. D* **100** (2019) no. 2, 023003, arXiv:1901.04490 [astro-ph.CO]

Talks

Sep. 2024 — High Energy Physics Seminar
University of Illinois, Urbana-Champaign
The Non-Relativistic Effective Field Theory of Dark Matter-Electron Interactions

Sep. 2024 — Particle Physics Seminar
Notre Dame University
The Non-Relativistic Effective Field Theory of Dark Matter-Electron Interactions

Apr. 2024 — Particle Theory Seminar
Harvard University
New Ways To Search For Axion Dark Matter

Apr. 2024	Nuclear Seminar University of Kentucky *New Ways To Search For Axion Dark Matter*
Feb. 2024	Theory Seminar University of Wisconsin, Madison *Tabletop to Telescope: Unraveling The Mystery of Dark Matter*
Dec. 2023	High Energy Theory Brown Bag Seminar University of Michigan *Searching for High Frequency Gravitational Waves with Phonons*
Nov. 2023	High Energy and Astrophysics (HEAP) Seminar University of Utah *Searching for High Frequency Gravitational Waves with Phonons*
Nov. 2023	Stanford Institute for Theoretical Physics Seminar *Searching for High Frequency Gravitational Waves with Phonons*
Mar. 2023	Quantum Science Center Presentation Fermi National Accelerator Laboratory *Dark Matter - Phonon Interactions in Sapphire*
Feb. 2023	Particle Theory Seminar Fermi National Accelerator Laboratory *New Ideas in Direct Detection of Light Dark Matter with Electrons*
Jan. 2023	Kavli Institute for Cosmological Physics Seminar University of Chicago *New Ideas in Direct Detection of Light Dark Matter with Electrons*
Dec. 2022	Nuclear Seminar University of Kentucky *Searching for Ultralight Dark Matter with Pulsar Timing Arrays*
Apr. 2022	NANOGrav Working Group, Presentation *Constraints on Ultralight Dark Matter from Mass Fluctuations in Pulsar Timing Arrays*
Nov. 2021	BSM Pandemic - Delta Lecture Series *Multi-Channel Searches For Light Dark Matter*
Oct. 2021	SuperCDMS Science Presentation *First Principles Calculations of Dark Matter-Electron/Phonon Excitation Rates*
Oct. 2021	High Energy Phenomenology Seminar University of Illinois Urbana-Champaign *Searching for Dark Matter Subhalos with Pulsar Timing Arrays*
Jun. 2021	QuantISED Group, Presentation Lawrence Berkeley National Laboratory *Extended Calculation of Dark Matter-Electron Scattering in Crystal Targets*

Apr. 2021	NANOGrav Working Group, Presentation *Pulsar Timing Array Signals from Dark Matter Subhalos*
Jan. 2020	4D Seminar University of California, Berkeley *Multi-Channel Direct Detection of Light Dark Matter*
Dec. 2019	Particle Theory Group, Presentation California Institute of Technology *Multi-Channel Direct Detection of Light Dark Matter*

Workshops and Conferences

Nov. 2024	Chicago-Area Phenomenology Symposium University of Illinois, Urbana-Champaign *Listening For New Physics With Quantum Acoustics*
Oct. 2024	Dark Interactions 2024 Simon Fraser University *Theory of Direct Detection For The Next Generation*
Aug. 2023	Pulsar Timing Arrays: A Star-Way To New Physics Mainz Institute of Theoretical Physics
Apr. 2023	PACC IQ Initiative: Axion, Fundamental and Synthetic University of Pittsburgh *Detecting Axion Dark Matter with Phonons and Magnons*
Jun. 2022	Physics of This Universe Johns Hopkins University *Constraining Fundamental Constant Variations from Ultralight Dark Matter with Pulsar Timing Arrays*
Jul. 2021	APS Division of Particles and Fields 2021 *Dark Matter Absorption via Electronic Excitations*
May 2021	Phenomenology 2021 Symposium (PHENO) *Improved Calculation of Dark Matter-Electron Scattering in Semiconductors*

Awards

2022	**Robert F. Christy Prize for Outstanding Doctoral Thesis in Theoretical Physics** Awarded to a student who has produced an outstanding thesis in theoretical physics.
2021	**John S. Stemple Memorial Prize** For outstanding progress in research and excellent performance on the oral candidacy exam.

Teaching Experience

Jan. 2022 - Mar. 2022	**Teaching Assistant** Relativistic Quantum Field Theory, Phys 205b California Institute of Technology
Jan. 2021 - Mar. 2021	**Teaching Assistant** Relativistic Quantum Field Theory, Phys 205b California Institute of Technology
Jun. 2018 - Aug. 2018	**Graduate Student Instructor** Introduction to Mathematical Physics, Physics 89 University of California, Berkeley
Aug. 2017 - Jun. 2018	**Graduate Student Instructor** Physics for Scientists and Engineers, Physics 7A University of California, Berkeley

Outreach

Dec. 2024	Saturday Morning Physics Panel Fermi National Accelerator Laboratory

Service to Profession

2020 -	**Journal Referee** Physical Review D Physical Review Letters Journal of High Energy Physics