

TANNER TRICKLE

CURRICULUM VITAE

Assistant Professor

University of Illinois Urbana-Champaign

Department of Physics

415 Loomis Laboratory

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Urbana, IL 61801

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Employment

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| 2025 - | Assistant Professor
University of Illinois Urbana-Champaign
Department of Physics
Urbana, IL 61801 |
| 2022 - 2025 | Postdoctoral Research Associate
Fermi National Accelerator Laboratory
Theoretical Physics Division
Batavia, IL 60510 |

Education

- | | |
|-------------|---|
| 2020 - 2022 | Ph.D.
California Institute of Technology
Division of Physics, Astronomy, and Mathematics
<i>Direct Detection of Light Dark Matter with Electrons, Phonons, and Magnons</i>
Advisor: Prof. Kathryn M. Zurek |
| 2017 - 2020 | Ph.D. Student
University of California, Berkeley
Physics Department
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 - **Associate Member**
North American Nanohertz Observatory for Gravitational Waves ([NANOGrav](#))

Grants

2026 - **DOE FY 2025 Continuation of Solicitation for the Office of Science Financial Assistance Program**
High Energy Physics at the University of Illinois Urbana-Champaign
U.S. Department of Energy - High Energy Physics
Co-Principal Investigator
Lead PI: Aida X. El-Khadra, University of Illinois at Urbana-Champaign

2025 - **ACCESS Computing Allocation**
Detailed Sum Rules for Dark Matter Direct Detection
National Science Foundation
Awarded Resources: ACCESS Credits: 200,000 ACCESS Credits (~ 200,000 core-hours)
Principal Investigator

2024 - **Quantum Information Science Enabled Discovery (QuantISED) 2.0**
Quantum Magnonics for Spin-Dependent Beyond the Standard Model Physics
U.S. Department of Energy - High Energy Physics
\$5,000,000 / 4 years
Co-Principal Investigator
Lead PI: Gensheng Wang, Argonne National Laboratory

Mentoring

Postdocs

2026 - **Pankaj Munbodh**
From: University of California Santa Cruz

Graduate Students

2025 - **Connor Stratman**
2025 - **Olivia Bitcon**

Publications

30. **Electronic Direct Detection of Light Dark Matter with Intermediate-Mass Mediators**
C. Stratman, and T. Trickle
[arXiv:2605.11063](#) [[hep-ph](#)]

29. **Infrared Freeze-In of Magnetic Dipole Dark Matter**
A. Berlin, J. H. Chang, and T. Trickle
[arXiv:2512.07927 \[hep-ph\]](#)
28. **A Thermal Relic Encyclopedia: Dark Matter Candidates Coupled to Quarks**
D. Hooper, G. Krnjaic, T. Trickle, and I. R. Wang
[arXiv:2512.03133 \[hep-ph\]](#)
27. **MOSAIC: Magnonic Observations of Spin-dependent Axion-like Interactions**
C. Chang, T. J. Hobbs, D. Jin, Y. Li, M. Lisovenko, V. Novosad, Z. H. Saleem, T. Trickle, and G. Wang
Phys. Rev. D **113** (2026) no. 1, 015016
[arXiv:2504.16160 \[hep-ph\]](#)
26. **Determining spin-dependent light dark matter rates from neutron scattering**
A. Berlin, A. J. Millar, T. Trickle, and K. Zhou
Phys. Rev. D **112** (2025) no. 3, 035021
[arXiv:2504.02927 \[hep-ph\]](#)
25. **Piezoelectric bulk acoustic resonators for dark photon detection**
T. Trickle
Phys. Rev. D **112** (2025) no. 5, 055043
[arXiv:2501.05504 \[hep-ph\]](#)
24. **Listening for new physics with quantum acoustics**
R. Linehan, T. Trickle, C. R. Conner, S. Ghosh, T. Lin, M. Sholapurkar, and A. N. Cleland
Phys. Rev. D **112** (2025) no. 11, 115005
[arXiv:2410.17308 \[hep-ph\]](#)
23. **The non-relativistic effective field theory of dark matter-electron interactions**
G. Krnjaic, D. Rocha, and T. Trickle
JHEP **03** (2025) 165
[arXiv:2407.14598 \[hep-ph\]](#)
22. **Physical signatures of fermion-coupled axion dark matter**
A. Berlin, A. J. Millar, T. Trickle, and K. Zhou
JHEP **05** (2024) 314
[arXiv:2312.11601 \[hep-ph\]](#)
21. **Searching for high-frequency gravitational waves with phonons**
Y. Kahn, J. Schütte-Engel, and T. Trickle

- Phys. Rev. D* **109** (2024) no. 9, 096023
[arXiv:2311.17147 \[hep-ph\]](#)
20. **Effective field theory for dark matter absorption on single phonons**
A. Mitridate, K. Pardo, T. Trickle, and K. M. Zurek
Phys. Rev. D **109** (2024) no. 1, 015010
[arXiv:2308.06314 \[hep-ph\]](#)
 19. **The NANOGrav 15 yr Data Set: Search for Signals from New Physics**
NANOGrav Collaboration, A. Afzal et al.
Astrophys. J. Lett. **951** (2023) no. 1, L11
[arXiv:2306.16219 \[astro-ph.HE\]](#)
 18. **Absorption of Axion Dark Matter in a Magnetized Medium**
A. Berlin, and T. Trickle
Phys. Rev. Lett. **132** (2024) no. 18, 181801
[arXiv:2305.05681 \[hep-ph\]](#)
 17. **Absorption of vector dark matter beyond kinetic mixing**
G. Krnjaic, and T. Trickle
Phys. Rev. D **108** (2023) no. 1, 015024
[arXiv:2303.11344 \[hep-ph\]](#)
 16. **Extended calculation of electronic excitations for direct detection of dark matter**
T. Trickle
Phys. Rev. D **107** (2023) no. 3, 035035
[arXiv:2210.14917 \[hep-ph\]](#)
 15. **Constraining fundamental constant variations from ultralight dark matter with pulsar timing arrays**
D. E. Kaplan, A. Mitridate, and T. Trickle
Phys. Rev. D **106** (2022) no. 3, 035032
[arXiv:2205.06817 \[hep-ph\]](#)
 14. **Dark matter direct detection in materials with spin-orbit coupling**
H. Chen, A. Mitridate, T. Trickle, Z. Zhang, M. Bernardi, and K. M. Zurek
Phys. Rev. D **106** (2022) no. 1, 015024
[arXiv:2202.11716 \[hep-ph\]](#)
 13. **Radiative semileptonic $\bar{B}$ decays**
M. Papucci, T. Trickle, and M. B. Wise
JHEP **02** (2022) 043
[arXiv:2110.13154 \[hep-ph\]](#)
 12. **Dark matter absorption via electronic excitations**
A. Mitridate, T. Trickle, Z. Zhang, and K. M. Zurek

- JHEP* **09** (2021) 123
[arXiv:2106.12586 \[hep-ph\]](#)
11. **Extended calculation of dark matter-electron scattering in crystal targets**
 S. M. Griffin, K. Inzani, T. Trickle, Z. Zhang, and K. M. Zurek
Phys. Rev. D **104** (2021) no. 9, 095015
[arXiv:2105.05253 \[hep-ph\]](#)
 10. **Bayesian Forecasts for Dark Matter Substructure Searches with Mock Pulsar Timing Data**
 V. S. H. Lee, S. R. Taylor, T. Trickle, and K. M. Zurek
JCAP **08** (2021) 025
[arXiv:2104.05717 \[astro-ph.CO\]](#)
 9. **Directional detectability of dark matter with single phonon excitations: Target comparison**
 A. Coskuner, T. Trickle, Z. Zhang, and K. M. Zurek
Phys. Rev. D **105** (2022) no. 1, 015010
[arXiv:2102.09567 \[hep-ph\]](#)
 8. **Probing Small-Scale Power Spectra with Pulsar Timing Arrays**
 V. S. H. Lee, A. Mitridate, T. Trickle, and K. M. Zurek
JHEP **06** (2021) 028
[arXiv:2012.09857 \[astro-ph.CO\]](#)
 7. **Effective field theory of dark matter direct detection with collective excitations**
 T. Trickle, Z. Zhang, and K. M. Zurek
Phys. Rev. D **105** (2022) no. 1, 015001
[arXiv:2009.13534 \[hep-ph\]](#)
 6. **Detectability of Axion Dark Matter with Phonon Polaritons and Magnons**
 A. Mitridate, T. Trickle, Z. Zhang, and K. M. Zurek
Phys. Rev. D **102** (2020) no. 9, 095005
[arXiv:2005.10256 \[hep-ph\]](#)
 5. **Observability of Dark Matter Substructure with Pulsar Timing Correlations**
 H. Ramani, T. Trickle, and K. M. Zurek
JCAP **12** (2020) 033
[arXiv:2005.03030 \[astro-ph.CO\]](#)
 4. **Multichannel direct detection of light dark matter: Target comparison**
 S. M. Griffin, K. Inzani, T. Trickle, Z. Zhang, and K. M. Zurek
Phys. Rev. D **101** (2020) no. 5, 055004
[arXiv:1910.10716 \[hep-ph\]](#)

3. **Multi-Channel Direct Detection of Light Dark Matter: Theoretical Framework**
T. Trickle, Z. Zhang, K. M. Zurek, K. Inzani, and S. M. Griffin
JHEP **03** (2020) 036
[arXiv:1910.08092 \[hep-ph\]](#)
2. **Detecting Light Dark Matter with Magnons**
T. Trickle, Z. Zhang, and K. M. Zurek
Phys. Rev. Lett. **124** (2020) no. 20, 201801
[arXiv:1905.13744 \[hep-ph\]](#)
1. **Pulsar Timing Probes of Primordial Black Holes and Subhalos**
J. A. Dror, H. Ramani, T. Trickle, and K. M. Zurek
Phys. Rev. D **100** (2019) no. 2, 023003
[arXiv:1901.04490 \[astro-ph.CO\]](#)

Reports and White Papers

4. **PTArcade**
A. Mitridate, D. Wright, R. von Eckardstein, T. Schröder, J. Nay, K. Olum, K. Schmitz, and T. Trickle
[arXiv:2306.16377 \[hep-ph\]](#)
3. **Direct Detection of Light Dark Matter with Electrons, Phonons, and Magnons**
T. Trickle
Ph.D. thesis, California Institute of Technology, 2022, [10.7907/n4j3-1b24](#)
2. **Snowmass2021 Cosmic Frontier: The landscape of low-threshold dark matter direct detection in the next decade**
R. Essig et al.
[arXiv:2203.08297 \[hep-ph\]](#)
1. **Snowmass white paper: Light dark matter direct detection at the interface with condensed matter physics**
A. Mitridate, T. Trickle, Z. Zhang, K. M. Zurek
Phys. Dark Univ. **40** (2023) 101221
[arXiv:2203.07492 \[hep-ph\]](#)

Seminars

May 2026 High Energy Physics Seminar
Argonne National Laboratory
The Search for Light Dark Matter

Nov. 2025	Particle Physics Seminar Perimeter Institute <i>Light Magnetic Dipole-Coupled Dark Matter</i>
Apr. 2025	Particle Astrophysics and Cosmology Meeting Around NYC (PACMAN) Flatiron Institute <i>Listening For New Physics With Bulk Acoustic Resonators</i>
Apr. 2025	Sydney CPPC Seminar <i>Direct Detection With Magnons</i>
Apr. 2025	Particle Theory Seminar University of Chicago <i>Direct Detection With Magnons</i>
Feb. 2025	High Energy Physics Seminar University of Illinois, Urbana-Champaign <i>Tabletop to Telescope: Unraveling the Mystery of Dark Matter</i>
Sep. 2024	High Energy Physics Seminar University of Illinois, Urbana-Champaign <i>The Non-Relativistic Effective Field Theory of Dark Matter-Electron Interactions</i>
Sep. 2024	Particle Physics Seminar Notre Dame University <i>The Non-Relativistic Effective Field Theory of Dark Matter-Electron Interactions</i>
Apr. 2024	Particle Theory Seminar Harvard University <i>New Ways To Search For Axion Dark Matter</i>
Apr. 2024	Nuclear Seminar University of Kentucky <i>New Ways To Search For Axion Dark Matter</i>
Feb. 2024	Theory Seminar University of Wisconsin, Madison <i>Tabletop to Telescope: Unraveling The Mystery of Dark Matter</i>
Dec. 2023	High Energy Theory Brown Bag Seminar University of Michigan <i>Searching for High Frequency Gravitational Waves with Phonons</i>
Nov. 2023	High Energy and Astrophysics (HEAP) Seminar University of Utah <i>Searching for High Frequency Gravitational Waves with Phonons</i>

Nov. 2023	Stanford Institute for Theoretical Physics Seminar <i>Searching for High Frequency Gravitational Waves with Phonons</i>
Mar. 2023	Quantum Science Center Fermi National Accelerator Laboratory <i>Dark Matter - Phonon Interactions in Sapphire</i>
Feb. 2023	Particle Theory Seminar Fermi National Accelerator Laboratory <i>New Ideas in Direct Detection of Light Dark Matter with Electrons</i>
Jan. 2023	Kavli Institute for Cosmological Physics Seminar University of Chicago <i>New Ideas in Direct Detection of Light Dark Matter with Electrons</i>
Dec. 2022	Nuclear Seminar University of Kentucky <i>Searching for Ultralight Dark Matter with Pulsar Timing Arrays</i>
Apr. 2022	NANOGrav Working Group <i>Constraints on Ultralight Dark Matter from Mass Fluctuations in Pulsar Timing Arrays</i>
Nov. 2021	BSM Pandemic - Delta Lecture Series <i>Multi-Channel Searches For Light Dark Matter</i>
Oct. 2021	SuperCDMS Science Group <i>First Principles Calculations of Dark Matter-Electron/Phonon Excitation Rates</i>
Oct. 2021	High Energy Phenomenology Seminar University of Illinois Urbana-Champaign <i>Searching for Dark Matter Subhalos with Pulsar Timing Arrays</i>
Jun. 2021	QuantISED Group Lawrence Berkeley National Laboratory <i>Extended Calculation of Dark Matter-Electron Scattering in Crystal Targets</i>
Apr. 2021	NANOGrav Working Group <i>Pulsar Timing Array Signals from Dark Matter Subhalos</i>
Jan. 2020	4D Seminar University of California, Berkeley <i>Multi-Channel Direct Detection of Light Dark Matter</i>
Dec. 2019	Particle Theory Group California Institute of Technology <i>Multi-Channel Direct Detection of Light Dark Matter</i>

Workshops and Conferences

Organizer

Dec. 2025 The Great Lakes Beyond-Standard-Model Workshop
University of Chicago

Participant

Mar. 2026 Fill the Gap: Signatures of Electronic Excitations in Dark Matter and Neutrino
Direct Detection Experiments
Munich Institute for Astro-, Particle, and BioPhysics
New Horizons in Electron-Coupled Dark Matter: Models and Detection

Jul. 2025 10th Physics and Astrophysics at the eXtreme Workshop and 3rd Cosmic Ex-
plorer Symposium
University of Illinois Urbana-Champaign
Invited Panelist Member
Dark Matter Searches

Jun. 2025 15th Conference on the Intersections of Particle and Nuclear Physics (CIPANP
2025)
University of Wisconsin Madison
The Search For Light Dark Matter

Jun. 2025 Current Trends in Particle Theory V
University of Illinois Chicago
The Search For Light Dark Matter

May 2025 The 10th LCTP Spring Symposium: Hunting for Particle Dark Matter
University of Michigan
Direct Detection With Magnons

Mar. 2025 APS Global Summit 2025
Invited Speaker
New Ways To Search For Axion Dark Matter

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 <i>Constraining Fundamental Constant Variations from Ultralight Dark Matter with Pulsar Timing Arrays</i>
Jul. 2021	APS Division of Particles and Fields 2021 <i>Dark Matter Absorption via Electronic Excitations</i>
May 2021	Phenomenology 2021 Symposium (PHENO) <i>Improved Calculation of Dark Matter-Electron Scattering in Semiconductors</i>

Awards

2022	Robert F. Christy Prize for Outstanding Doctoral Thesis in Theoretical Physics California Institute of Technology
2021	John S. Stemple Memorial Prize California Institute of Technology

Honors

2026	Collins Scholar Academy for Excellence in Engineering Education The Grainger College of Engineering University of Illinois Urbana-Champaign
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Teaching

Lecturer

Spring 2026	PHYS 213: University Physics: Thermal Physics Head Lecturer Sections A1, A2, A3 (<i>Service-In-Excess</i>)
Spring 2026	PHYS 214: University Physics: Quantum Physics Sections A2, A3

Graduate Student Teaching Assistant

Spring 2022	Relativistic Quantum Field Theory, Phys 205b California Institute of Technology
Spring 2021	Relativistic Quantum Field Theory, Phys 205b California Institute of Technology
Summer 2018	Introduction to Mathematical Physics, Physics 89 University of California, Berkeley

Spring 2018 Physics for Scientists and Engineers, Physics 7A
University of California, Berkeley

Fall 2017 Physics for Scientists and Engineers, Physics 7A
University of California, Berkeley

Departmental Service

Preliminary Exam Committee

Member

2025 Haoran Sun

Fall 2025 High Energy Physics Seminar Coordinator

Oct. 2025 PHYS 596: Graduate Physics Orientation
Presentation
The Search For Dark Matter

Professional Service

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

Outreach

Feb. 2026 Astronomy on Tap
University of Illinois Urbana-Champaign
Dark Matter

Jan. 2026 Loomis Confessions
University of Illinois Urbana-Champaign

Dec. 2024 Saturday Morning Physics Panel
Fermi National Accelerator Laboratory

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