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Research Positions

- 2024/9 – current  **Postdoctoral Research Fellow**, Department of Physics and Astronomy, University of Oklahoma
- 2024/5 – 2024/9  **Visiting Scholar**, Department of Physics and Astronomy, University of Nebraska-Lincoln
- 2019/9 – 2023/12  **Graduate Research Assistant**, Department of Physics, University of Wisconsin-Madison
- 2014/5 – 2017/5  **Undergraduate Research Assistant**, Department of Physics, University of Illinois at Urbana-Champaign

Education

- 2019/9 – 2023/12  **Ph.D. in Physics, University of Wisconsin-Madison.**
Thesis: *"Naturalness Demands an Answer: The Imperative of Natural SUSY at the HL-LHC"*
Advisor: Vernon D. Barger
- 2017/9 – 2019/9  **Master in Physics, University of Wisconsin-Madison.**
Advisor: Vernon D. Barger
- 2013/9 – 2017/5  **B.S., Physics, University of Illinois at Urbana-Champaign**
Advisor: Benjamin H. Hooberman
-  **B.S., Mathematics, University of Illinois at Urbana-Champaign**

Research Interests

Theoretical Particle physics, Particle Phenomenology, & Cosmology – broadly on physics beyond the Standard Model (BSM) – including 1) Aspects of Electroweak Symmetry Breaking, 2) Flavor & Horizontal Symmetries, 3) Baryogenesis Mechanism & Dark Matter, 4) Supersymmetry under String Landscapes, 5) Axion Physics & the Strong CP Problem, 6) Formal aspects of Quantum Field Theory, as well as the 7) Experimental and observational phenomenology of various BSM extensions.

Publications

Note: Following HEP convention, order of authorship was determined alphabetically.

Preprints

- 1 J. Sheng, T. T. Yanagida, and **K. Zhang**, “WIMP Dark Matter from a Natural Discrete Gauge Symmetry in the Standard Model”, (*under review in JHEP*) (2026), arXiv:2601.15856 [hep-ph].
- 2 **K. Zhang**, “Supersymmetry at High Luminosity LHC”, (2026), arXiv:2601.01066 [hep-ph].

- 3 H. Baer, V. Barger, J. Bolich, D. Sengupta, and **K. Zhang**, “Natural supersymmetry at a muon collider”, (*under review in Phys. Rev. D*) (2025), arXiv:2510.20920 [hep-ph].
- 4 S. P. Adhya et al. (CEPC Study Group), “CEPC Technical Design Report - Reference Detector”, (2025), arXiv:2510.05260 [hep-ex].

Journal Articles

- 5 H. Baer, V. Barger, J. Bolich, D. Sengupta, and **K. Zhang**, “Aspects of the WIMP quality problem and R-parity violation in natural supersymmetry with all axion dark matter”, JCAP **10**, 072 (2025) [DOI](#) 10.1088/1475-7516/2025/10/072, arXiv:2505.09785 [hep-ph].
- 6 H. Baer, V. Barger, J. Bolich, J. Dutta, D. Martinez, S. Salam, D. Sengupta, and **K. Zhang**, “Prospects for supersymmetry at High-Luminosity LHC”, Rev. Mod. Phys. **97**, 045001 (2025) [DOI](#) 10.1103/bzw1-gfs1, arXiv:2502.10879 [hep-ph].
- 7 H. Baer, V. Barger, D. Sengupta, and **K. Zhang**, “All axion dark matter from supersymmetric models”, Phys. Rev. D **111**, L111702 (2025) [DOI](#) 10.1103/1n3m-g69m, arXiv:2502.06955 [hep-ph].
- 8 H. Baer, V. Barger, J. Bolich, and **K. Zhang**, “Implications of Higgs mass for hidden sector SUSY breaking”, Phys. Rev. D **111**, 095019 (2025) [DOI](#) 10.1103/PhysRevD.111.095019, arXiv:2412.15356 [hep-ph].
- 9 P. Huang and **K. Zhang**, “Testable flavored TeV-scale resonant leptogenesis with MeV-GeV dark matter in a neutrinophilic two-Higgs-doublet model”, Phys. Rev. D **111**, 115011 (2025) [DOI](#) 10.1103/b5sk-5f3d, arXiv:2411.18973 [hep-ph].
- 10 H. Baer, V. Barger, and **K. Zhang**, “Living dangerously with decoupled first and second generation scalars: SUSY prospects at the LHC”, Phys. Rev. D **111**, 035033 (2025) [DOI](#) 10.1103/PhysRevD.111.035033, arXiv:2411.13541 [hep-ph].
- 11 H. Baer, V. Barger, and **K. Zhang**, “Decoding the gaugino code, naturally, at high-lumi LHC”, Particles **7**, 927 (2024) [DOI](#) 10.3390/particles7040056, arXiv:2408.02048 [hep-ph].
- 12 H. Baer, V. Barger, and **K. Zhang**, “Stau pairs from natural SUSY at high luminosity LHC”, Phys. Rev. D **110**, 015017 (2024) [DOI](#) 10.1103/PhysRevD.110.015017, arXiv:2403.18991 [hep-ph].
- 13 H. Baer, V. Barger, X. Tata, and **K. Zhang**, “Winos from natural SUSY at the high luminosity LHC”, Phys. Rev. D **109**, 015027 (2024) [DOI](#) 10.1103/PhysRevD.109.015027, arXiv:2310.10829 [hep-ph].
- 14 H. Baer, V. Barger, J. Dutta, D. Sengupta, and **K. Zhang**, “Top squarks from the landscape at high luminosity LHC”, Phys. Rev. D **108**, 075027 (2023) [DOI](#) 10.1103/PhysRevD.108.075027, arXiv:2307.08067 [hep-ph].
- 15 H. Baer, V. Barger, X. Tata, and **K. Zhang**, “Prospects for Charged Higgs Bosons in Natural SUSY Models at the High-Luminosity LHC”, Symmetry **15**, (Selected to be the Journal Cover), 1475 (2023) [DOI](#) 10.3390/sym15081475, arXiv:2306.05207 [hep-ph].
- 16 H. Baer, V. Barger, X. Tata, and **K. Zhang**, “Detecting Heavy Neutral SUSY Higgs Bosons Decaying to Sparticles at the High-Luminosity LHC”, Symmetry **15**, 548 (2023) [DOI](#) 10.3390/sym15020548, arXiv:2212.09198 [hep-ph].
- 17 H. Baer, V. Barger, X. Tata, and **K. Zhang**, “Prospects for Heavy Neutral SUSY HIGGS Scalars in the hMSSM and Natural SUSY at LHC Upgrades”, Symmetry **14**, 2061 (2022) [DOI](#) 10.3390/sym14102061, arXiv:2209.00063 [hep-ph].

In Preparation

- 18 H. Baer, V. Barger, and **K. Zhang**, “pMSSM versus Complete Models and the Excellent Prospects for Top-squark Discovery at HL-LHC”, (2026), arXiv:2602.xxxxx [hep-ph].
- 19 **K. Zhang**, “Baryon Asymmetry, Relic Abundance, Neutrino Mass in One Shot”, (2026), arXiv:2602.xxxxx [hep-ph].
- 20 P. Huang and **K. Zhang**, “Experimental Phenomenology of the Neutrinophilic Type-I Two-Higgs-Doublet Model with TeV-Scale Flavored Leptogenesis”, (2026), arXiv:2604.xxxxx [hep-ph].
- 21 **K. Zhang**, “The Implication of Electroweak Symmetry Restoration and Radiation Amplitude Zeros on Probing Extended Higgs Sectors”, (2026), arXiv:26xx.xxxxx [hep-ph].

Thesis

- 22 **K. Zhang**, “Naturalness demands an answer: the imperative of natural SUSY at the HL-LHC”, PhD thesis (Wisconsin U., Madison, 2023).

Talks & Oral Presentations

Note: † are invited talks.

- 📖 *"WIMP Dark Matter from a Natural Discrete Gauge Symmetry in the Standard Model"*, HEP Journal Club, Kavli IPMU, Japan, Jan 2026.
- 📖 *"Axion Quality Problem, WIMP Quality Problem, and R-parity Violation in Supersymmetry"*, Axion in Japan, Kavli IPMU, Japan, Nov 2025.
- 📖 *"Baryon Asymmetry, Relic Abundance, and Neutrino Mass in One Shot"*, 2nd International Conference on the Physics of the Two Infinities, University of Tokyo, Japan, Nov 2025.
- 📖 *"Baryon Asymmetry, Relic Abundance, and Neutrino Mass in One Shot"†*, High Energy Physics Seminar, University of Pittsburgh, US, Nov 2025.
- 📖 *"Axion quality problem, WIMP quality problem, and R-parity violation in natural supersymmetry"*, 28th International Conference on Particle Physics & Cosmology (COSMO-25), Carnegie Mellon University, US, Oct 2025.
- 📖 *"SUSY prospects at the HL-LHC"†*, 32nd International Symposium on Lepton Photon Interactions at High Energies (Lepton-Photon 2025), University of Wisconsin-Madison, US, Aug 2025.
- 📖 *"Axion quality problem, WIMP quality problem, and R-parity violation in natural supersymmetry"*, 32nd International Conference on Supersymmetry and Unification of Fundamental Interactions (SUSY 2025), University of Santa Cruz, US, Aug 2025.
- 📖 *"Flavored Leptogenesis with MeV–GeV Dark Matter"*,

32nd International Conference on Supersymmetry and Unification of Fundamental Interactions (SUSY 2025), University of Santa Cruz, US, Aug 2025.

- 📖 *"Flavored TeV-scale Resonant Leptogenesis with MeV–GeV Dark Matter"*,
Phenomenology 2025 Symposium, University of Pittsburgh, US, May 2025.
- 📖 *"Flavored Resonant Leptogenesis in a Type-I Two Higgs Doublet Model"*,
Particle Physics on the Plains 2024, University of Kansas, US, Nov 2024.
- 📖 *"Top squarks from the landscape at high luminosity LHC"*,
The 31st International Conference on Supersymmetry and Unification of Fundamental Interactions (SUSY 2024), IFT, Madrid, Spain, June 2024.
- 📖 *"Winos from natural SUSY at the high luminosity LHC"*,
APS Division of Particles & Fields (DPF) Meeting – Phenomenology 2024 Joint Symposium, University of Pittsburgh, US, May 2024.
- 📖 *"Implications of Naturalness for Heavy SUSY Particle Discovery at the HL-LHC Era"[†]*,
High Energy Physics Seminar, University of Oklahoma, US, Oct 2023.
- 📖 *"Prospects of Heavy Higgs scalar in the natural SUSY at LHC upgrades"*,
Brookhaven Forum 2023 Advancing Searches for New Physics, Brookhaven National Lab, US, Oct 2023.
- 📖 *"Heavy Higgs scalar in the natural SUSY at LHC upgrades"*,
The 30th International Conference on Supersymmetry and Unification of Fundamental Interactions (SUSY 2023), University of Southampton, Southampton, UK, July 2023.
- 📖 *"Prospects of Heavy Higgs scalar in the natural SUSY at LHC upgrades"*,
Phenomenology 2023 Symposium, University of Pittsburgh, US, May 2023.
- 📖 *"Top p_T Reweighting in ATLAS"*,
ATLAS SUSY Strong Production with 2 Leptons Meeting, ATLAS, CERN, Oct 2016.



Professional Service

- 📖 *Organizing Committee Member*
33rd International Conference on Supersymmetry and Unification of Fundamental Interactions (SUSY 2026)
- 📖 *Invited Lecturer*
Pre-SUSY School 2026 – lecture series: "Supersymmetry phenomenology"
- 📖 *Weekly Seminar Convener*
HEP group, University of Oklahoma





Other Academic Visiting & Workshops & Schools Attended

- March 2026  *Invited Visiting Scholar*,
Perimeter Institute, Ontario, Canada.
- January 2026  *IAS Program on Fundamental Physics (FP 2026)*,
HKUST, Hong Kong, China.
- December 2025  *Dark matter and black holes Workshop*,
Kavli IPMU, Japan.
- November 2025  *Particle Physics on the Plains 2025*,
University of Kansas, US.
- August 2025  *Pre-SUSY School 2025*,
University of California – Santa Cruz, US.
- July 2025  *53rd SLAC summer institute (SSI 2025)*,
SLAC, US.
- June 2025  *Phenomenology Before and After the Standard Model*,
University of Wisconsin-Madison, US.
- August 2019  *12th International Neutrino Summer School at Fermilab*,
Fermilab, US.



Other Academic Contributions

-  **Solutions Manual** for “*Quantum Field Theory and the Standard Model*” by Matthew D. Schwartz
 - First 19 chapters + appendices; complete solutions with detailed steps for all exercises.
 - Used as a reference when mentoring graduate students.
 - Available online at personal webpage.
-  **Solutions Manual** for “*Cosmology*” by Daniel Baumann
 - First 3 chapters + appendices; complete solutions with detailed steps for all exercises.
 - Used as a reference when mentoring graduate students.
 - Available online at personal webpage.

Technical Skills

- Programming Languages  C++, C, Fortran, Java, Matlab, Mathematica, Python.
- Machine Learning Frameworks  PyTorch, TensorFlow.
- Machine Learning Algorithms  Convolutional neural network, Decision tree, Random forest, LSTM.
- Physics Analysis Packages  Delphes, Fastjet, Flavio, Isajet, MadGraph, Prospino, Pythia, Root, SOFTSUSY, SusHi, zHDMC

Teachings & Grading

-  PHYS 832 – “Advanced Quantum Mechanics II (Graduate-level QFT II)”: *Grader*, SP23
-  PHYS 831 – “Advanced Quantum Mechanics I (Graduate-level QFT I)”: *Grader*, FA23

- PHYS 721 – "Theoretical Physics-Electrodynamics (Graduate-level)": *Grader*, FA23
- PHYS 531 – "Introduction to Quantum Mechanics I (Graduate-level)": *Grader*, SP19
- PHYS 449 – "Atomic and Quantum Physics II": *Grader*, SP20
- PHYS 415 – "Thermal Physics": *Grader*, SP22
- PHYS 406 – "Special Topics in Physics (Intro to General Relativity & Cosmology)": *Grader*, FA19
- PHYS 308 – "Lab-Electromagnetic Fields and Optics": *Teaching assistant*, SP18
- PHYS 307 – "Lab-Mechanics & Modern Physics": *Teaching assistant*, FA17, FA18, SP19
- PHYS 115 – "Energy": *Teaching assistant*, FA19, FA23
- PHYS 109 – "Physics in the Arts": *Teaching assistant*, SP20, FA20, SP21, FA21, SP23

Past Experimental Collaborations

2014/5 – 2017/5  **ATLAS Collaboration**, *Undergraduate Researcher*.