

Ethan W. Todd

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Education

University of Michigan

Candidate, Ph.D. Physics

Advisors: Prof. Igor Jovanovic, Prof. James Wells

2025 M.S. Physics
Winter

Ann Arbor, MI

2023 – Present (expected 2026)
Fall Fall

Florida State University

B.S. Physics, Summa Cum Laude

Honors Thesis: Study of Displaced Vertex Tagging with the CMS Experiment

Advisor: Prof. Ted Kolberg

Tallahassee, FL

2020 – 2023
Fall Spring

Emory University

Foundational Coursework

Atlanta, GA

2018 – 2020
Fall Spring

Publications

7. A. R. L. Kavner, **E. Todd**, M. Babicz, et al., "Super-Lindhard Ionization from 254 eV_{nr} Nuclear Recoils in Germanium," *under review*, 2026
6. CMS HGCAL Collaboration, "Leakage Current of High-Fluence Neutron-Irradiated 8" Silicon Sensors for the CMS Endcap Calorimeter Upgrade," *under review*, 2026. [Online]. Available: <https://arxiv.org/abs/2510.17280>
5. V. Fondement, J. Bae, F. Rahman, et al., "Digital Pulse Processing for Mixed-Field Ionizing Radiation Detection in Rare-Event Nuclear Experiments," *Fusion Science and Technology*, 2026, in press
4. V. Fondement, **E. Todd**, and I. Jovanovic, "Updated $^{78m}\text{Br } 2^- \rightarrow 1^+$ Lifetime from Isomeric Decay Cascade in Active Target," *Nuclear Physics A*, 2026. DOI: [10.1016/j.nuclphysa.2026.123485](https://doi.org/10.1016/j.nuclphysa.2026.123485)
3. **E. Todd**, V. Fondement, and I. Jovanovic, "Machine Learning-Enabled Pulse Shape Discrimination in YAP:Ce," *Nuclear Instruments and Methods in Physics Research Section A*, 2026. DOI: [10.1016/j.nima.2026.171883](https://doi.org/10.1016/j.nima.2026.171883)
2. C. Graham, **E. Todd**, C. Wilson, et al., "Light Output-Dependent Integration Gating for Optimized Pulse Shape Discrimination," *Nuclear Instruments and Methods in Physics Research Section A*, 2026. DOI: [10.1016/j.nima.2026.171521](https://doi.org/10.1016/j.nima.2026.171521)
1. K. Yocum, H. Smith, **E. Todd**, et al., "Millimeter/Submillimeter Spectroscopic Detection of Desorbed Ices: A New Technique in Laboratory Astrochemistry," *The Journal of Physical Chemistry A*, 2019. DOI: [10.1021/acs.jpca.9b04587](https://doi.org/10.1021/acs.jpca.9b04587)

Research Experience

Low Energy Physics Group, Argonne National Laboratory

Graduate Research Aide

Lemont, IL

2026 – Present
Summer

Measurement of the $^{37}\text{Cl}(\alpha, n)^{40}\text{K}$ Cross Section

Supervisor: Dr. Daniel Santiago-Gonzalez

- Performed experimental measurements of the $^{37}\text{Cl}(\alpha, n)^{40}\text{K}$ reaction using the Multi-Sampling Ionization Chamber (MUSIC) at the ATLAS accelerator facility at Argonne National Laboratory.
- Developed an event reconstruction algorithm for prior MUSIC data that performs offline time synchronization of four digitizers via analysis of the time structure of the ^{37}Cl beam, and uses CUDA-accelerated time sorting to greatly increase data-processing throughput.
- Currently searching for $^{37}\text{Cl}(\alpha, n)^{40}\text{K}$ reaction events in a newly acquired MUSIC dataset while investigating methods to improve the quality of the prior dataset, including by performing unsupervised classification with ML clustering algorithms.

Applied Nuclear Science Group, University of Michigan
Graduate Student Researcher

Ann Arbor, MI
2024 – Present
Summer

Pulse Shape Discrimination in YAP:Ce via Machine Learning

- Compared α and γ -ray discrimination capabilities of charge comparison/shape indicator to several machine learning methods: random forests, gradient boosting, XGBoost, and multilayer perceptrons.
- Quantified the performance of each method using receiver operating characteristic curves, and demonstrated the substantial advantage of machine learning over traditional methods.
- Applied the XGBoost model to proof-of-concept mixed field radiation environments consisting of ^{241}Am and ^{137}Cs or ^{241}Am and ^{60}Co , and demonstrated that known spectral features of ^{241}Am , ^{137}Cs , and ^{60}Co are correctly classified.

Precision Measurements of $^{72}\text{Ge}(n, \gamma)$ at Thermal Energies

- Utilized the Ohio State Nuclear Reactor Laboratory thermal neutron beam facility to perform new measurements of $^{72}\text{Ge}(n, \gamma)^{73}\text{Ge}$ gamma-ray transition energies with a focus on the 68.75 keV final-state transition.
- Used a **position-sensitive H3D M400 CdZnTe detector** to measure low-energy gamma-ray interactions with event-by-event position sensitivity.
- Developed custom analysis code to select single-scatter events near the detector surface, reducing the Compton background and improving sensitivity in the low-energy region.
- Provided an independent measurement of the 68.75 keV gamma-ray energy in order to verify a separate UZH/PSI gamma-ray measurement and further support the validity of a recent high 254 eV_{nr} germanium ionization-yield result.

CMS Group, Florida State University
Undergraduate Student Researcher

Tallahassee, FL
2021 – 2023
Fall Summer

Search for BSM Long-lived Particles

Advisor: Prof. Ted Kolberg

- Utilized deep neural network machine learning to search for beyond the Standard Model long-lived particles in data from the CMS Experiment.
- Trained ML models on Monte Carlo data with varying signal (mass, lifetime) and background (t , b physics) to verify their ability to identify displaced vertices independently of the particular physics.
- Investigated the most effective parameters of ML models and verified physics-based expectations.

Silicon Sensor Quality Control

Advisor: Prof. Rachel Yohay

- Conducted process quality control (PQC) testing for the CMS High Granularity Calorimeter (HGCAL) to monitor the quality and stability of the silicon sensor production process.
- Analyzed and presented PQC results to the CMS HGCAL sensor testing group.
- Helped create and implement a standardized testing procedure at FSU.

WW Astrochemistry Group, Emory University
Undergraduate Student Researcher

Atlanta, GA
2018 – 2020
Fall Fall

Advisor: Prof. Susanna Widicus Weaver

- Performed millimeter/submillimeter spectroscopic measurements of desorbed astrophysical ice analogs.
- Conducted proof-of-concept millimeter/submillimeter spectroscopic measurements of H_2O and D_2O binding energy, sublimation enthalpy, and sublimation entropy.

Teaching Experience

University of Michigan
Lead Graduate Student Instructor

Ann Arbor, MI
2025 – 2026
Fall Winter

- Oversee 30 graduate student instructors teaching general physics laboratories with a total enrollment of 1800 undergraduate students.
- Edit and maintain the laboratory manuals and Jupyter notebook worksheets used in the course.
- Manage the course information and organization via Canvas.
- Arbitrate student and graduate student instructor concerns.

University of Michigan
Graduate Student Instructor

Ann Arbor, MI
2023–2025
Fall Spring

- 2025 Spring Physics 251, Fundamental Physics for the Life Sciences II Lab
- 2024 Fall Physics 121, Physics for Architects Lab
- 2023 – 2024 Fall Winter Physics 241, General Physics II Lab

Florida State University
Physics Learning Assistant

Tallahassee, FL
2022
Spring

PHY 2049C, General Physics B

Emory University
Laboratory Teaching Assistant

Atlanta, GA
2019
Fall

CHEM 150L, Structure and Properties Lab

Honors and Awards

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| 2026 <small>Winter</small> : Marcellus L. Wiedenbeck Teaching Award | <i>Awarded for exemplifying outstanding teaching abilities.</i> |
| 2026 <small>Winter</small> : Rackham Outstanding Graduate Student Instructor Award | <i>Awarded for demonstrating extraordinary dedication and excellence as a teacher.</i> |
| 2023 <small>Spring</small> : Phi Beta Kappa Society | |
| 2023 <small>Spring</small> : Joseph Lanutti Undergraduate Research Award | <i>Awarded for third place in the FSU physics departmental poster presentation contest.</i> |
| 2022 <small>Fall</small> : Evelyn and John Baugh Research Presentation Scholarship | <i>Awarded to travel and present research at SESAPS.</i> |
| 2022 <small>Spring</small> : Anna Runyan Undergraduate Endowment | <i>Awarded for outstanding academic success in physics.</i> |

Grants

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| 2025 <small>Fall</small> : NSUF Rapid Turnaround Experiment Grant | <i>Awarded to conduct precision measurements of Ge gamma-ray cascades at the Ohio State University Nuclear Reactor Laboratory.</i> |
| 2025 <small>Fall</small> : Rackham Graduate Student Research Grant | <i>Awarded to conduct research at the Paul Scherrer Institute on the ionization yield of high-purity germanium detectors.</i> |

Skills

Programming: C++, Python, Nix, CUDA

Software:	Nuclear Measurements:	ROOT, Geant4, CoMPASS, wavedump, LISE⁺⁺ , SRIM
	Machine Learning:	Scikit-learn, XGBoost, TensorFlow
	Artificial Intelligence:	Local deployment of open-source LLMs as agents via llama.cpp
	Version Control:	Git, Nix Flakes
	Build Systems:	Nix , Make, CMake
	Scientific Presentation:	L^AT_EX /Beamer

Hardware: CAEN digitizers, soldering, electronic testing equipment, *e.g.*, oscilloscopes

Presentations

5. **E. Todd**, V. Fondement, and I. Jovanovic, *Machine Learning-Enabled Pulse Shape Discrimination in Fast Inorganic Scintillators*, ANL PSE Student Lunch Talk Summer Series, Lemont, IL, 2026
4. **E. Todd**, V. Fondement, and I. Jovanovic, *Particle Identification in Fast Inorganic Scintillators via Machine Learning*, Fall Meeting of the Eastern Great Lakes Section of the American Physical Society, Ypsilanti, MI, 2025
3. **E. Todd** and I. Jovanovic, *Investigation of Anomalously High Ionization Produced by Low Energy Nuclear Recoils in Germanium (poster)*, DOE NNSA Office of Defense Nuclear Nonproliferation R&D University Program Review, Gainesville, FL, 2025
2. **E. Todd**, A. A. Kadhim, N. Bower, et al., *Process Quality Control for HGCal at Florida State University (poster)*, 89th Annual Meeting of the Southeastern Section of the American Physical Society, Oxford, MS, 2022
1. **E. Todd**, K. Yocum, P. Gerakines, et al., *A Novel Use of Rotational Spectroscopy for Studying Characteristics of Desorbed Interstellar Ice Analogs (poster)*, Emory SURE 2019 Symposium, Atlanta, GA, 2019