Jeff Schueler Ph.D. (He/Him)

jschueler1@unm.edu | Seattle, WA | (425) 736-8516
Personal website | GitHub | INSPIRE HEP | UNM contact

Appointments and Education

Postdoctoral fellow **April 2023 – Present**
Department of Physics & Astronomy, University of New Mexico, Albuquerque, NM

University of Hawai'i, Honolulu, HI **2015 – 2022**
Ph.D in Physics
Dissertation: *From neutrons to dark matter: Directional recoil detection and utilization of deep learning for gaseous time projection chambers*

Pace University, New York, NY **2013 – 2015**
M.S.in Adolescent Education: Physics (2015)

Physics fellow (high school teaching fellowship) **June 2013 – Aug. 2015**
New York City Teaching Fellows, New York, NY

University of Washington, Seattle, WA **2009 – 2013**
B.S. Physics (Honors) & Mathematics

Research Experience

University of New Mexico, Albuquerque, NM (Remote) **2023 – Present**
Postdoctoral Scholar (PI: Dinesh Loomba): Principal analyst for the MIGDAL experiment – a neutron scattering rare event search experiment looking for the Migdal effect, which is an atomic physics phenomenon relevant for light dark matter searches.

- Conceived of, developed, and maintain migYOLO, a deep learning-based object detection pipeline that now is the experiment's core search tool in their CMOS camera readout
  - Automates end-to-end Migdal effect searches in real time (>120 fps)
  - Operates alongside data acquisition digesting up to 40TB of images daily
  - First application of real-data ML training for a rare event search
  - Real-time detector performance monitoring with an integrated GUI
  - Led and published a collaboration-wide paper and gave six invited seminars on this topic
- Lead the production of collaboration-wide data products that unify all subdetectors
- Co-advising two students in machine learning event reconstruction techniques

University of Hawai'i at Mānoa, Honolulu, HI **2017 – 2022**
Research Assistant (PI: Sven Vahsen): Specialized in applying computer vision techniques to improve directional recoil detection in gas TPCs.

- Commissioned two generations of systems of TPCs at the SuperKEKB e^+e^- collider experiment in Tsukuba, Japan. These detectors measure beam-induced neutron backgrounds for the Belle II experiment and are still in use as of 2025.

- Led the design, development, construction, documentation, and implementation of these systems, including remote operation, data collection, data processing, and analyses that are featured in more than five journal publications.
- Developed and maintained real-time GUI displays monitoring over 50 quantities of interest for over a dozen Belle II subsystems. These displays are still used by shifters daily.
- Developed an efficient 4D spatial-charge detector simulator that reduced both memory consumption and computation time ~10-fold compared to our previously used software
- Wrote and trained custom ResNets on millions of simulated 4D event images, applied them to real data and demonstrated, for the first time, statistically significant vector head/tail recognition in sub-20 keV_{ee} nuclear recoil tracks
- Invited to present this work as an Early Career plenary speaker in the Coordinating Panel for Advanced Detectors (CPAD) 2022 workshop.

University of Washington – Seattle, WA **June 2012 – June 2013**
Undergraduate Research Assistant (PI: Thompson (Toby) Burnett): Performed statistical analyses supporting research efforts for the Fermi Gamma-ray Space Telescope.

Advising and Mentoring Experience

Wesley Thompson (University of New Mexico; Graduate Student) **2024 – Present**
Project title: *Directional reconstruction and characterization of diffusion of protons and alphas in the MIGDAL detector*

Stephanie Paiva-Flynn (University of New Mexico, now Imperial College London) **2024 – Present**
Honors Thesis: *Deep learning-based keypoint detection for electron recoil vertex identification and trajectory reconstruction*

Hima Bindhu Korandla (University of Hawaii; Graduate Student) **2021 – 2022**

Teaching Experience

University of Hawai'i at Mānoa – Honolulu, HI **2015 – 2017 and Fall 2019**
Graduate Teaching Assistant: Taught a total of nine introductory physics lab sessions, three introductory physics recitation sessions, and four senior-level quantum mechanics recitation sessions.
- Elected as Head TA
- Awarded the departmental Outstanding TA prize
- Led the piloting of recitation sessions for undergraduate quantum mechanics and introductory classical mechanics; both of which are current components of these courses
- Twice nominated for the university-wide TA award

Maspeth High School – New York, NY **Sept. 2013 – June 2015**
Founding Physics Teacher: Public high school physics teacher at an open enrollment school.

- Developed the school's physics and AP physics curriculum.
- Wrote over 30 letters of recommendation, many for first generation college applicants.
- Mentored several groups of students who participated in the New York City Science Fair.

Awards

H. Keith and Sue Ernst ARCS Award and Scholarship (2021)
University of Hawaii Department of Physics Outstanding TA prize (2016)
Head Physics TA (2016)

Selected Publications

A complete list of my publications and contributions can be found at my INSPIRE HEP page, which includes over 100 works affiliated with the Belle/Belle II collaborations. Below are publications I substantially contributed to:

1. **J. Schueler**, et. al. (MIGDAL Collaboration), *Transforming a rare event search into a not-so-rare event search in real-time with deep learning-based object detection* Phys. Rev. D 111, 072004 (2025) DOI: 10.1103/PhysRevD.111.072004

2. **J. Schueler**, S.E Vahsen, P.M Lewis, M. Hedges, D. Liventsev, F. Meier, H. Nakayama, A. Natochii, T.N Thorpe, *Application of recoil-imaging time projection chambers to directional neutron background measurements in the SuperKEKB accelerator tunnel*, Nucl. Instrum. Methods Phys. Res., Sect. A 1040 (2022) 167291. DOI:10.1016/j.nima.2022.167291

3. Z. J. Liptak A. Paladino, L. Santelj, **J. Schueler**, S. Stefkova, H. Tanigawa, N. Tsuzuki, et al., *Measurements of beam backgrounds in SuperKEKB Phase 2*, Nucl. Instrum. Methods Phys. Res., Sect. A 1040 (2022) 167168. DOI: 10.1016/j.nima.2022.167168

4. **J. Schueler**, M. Ghrear, S.E. Vahsen, P. Sadowski, C. Deaconu, *Deep learning for improved keV-scale recoil identification in high resolution gas time projection chambers* (2022). DOI: 10.48550/arXiv.2206.10822

5. P. M. Lewis, M. T. Hedges, I. Jaegle, **J. Schueler**, T. N. Thorpe, S. E. Vahsen, *Primary track recovery in high-definition gas ti*me projection chambers, Eur.Phys.J.C 82 (2022) 4, 324 DOI: 10.1140/epjc/s10052-022-10283-3

6. M.T. Hedges, S.E. Vahsen, I. Jaegle, P.M. Lewis, H. Nakayama, **J. Schueler,** T.N. Thorpe *First 3D vector tracking of helium recoils for fast neutron measurements at SuperKEKB,* Nucl.Instrum.Meth.A 1026 (2022) 166066 DOI: 10.1016/j.nima.2021.166066

7. A. Natochii et. al. (including **J. Schueler**) *Measured and projected beam backgrounds in the Belle II experiment at the SuperKEKB collider,* Nucl.Instrum.Meth.A 1055 (2023) 168550, DOI: 10.1016/j.nima.2023.168550

8. I. Jaegle, P. M. Lewis, M. Garcia-Sciveres, M. T. Hedges, T. Hemperek, J. Janssen, Q. Ji, D.-L. Pohl, S. Ross, **J. Schueler**, I. Seong, T. N. Thorpe, S. E. Vahsen, *Compact, directional neutron detectors capable of high-resolution nuclear recoil imaging,* Nucl.Instrum.Meth.A 945 (2019) 162296, DOI: 10.1016/j.nima.2019.06.037

Publications in preparation

9. **J. Schueler, et. al.** (MIGDAL Collaboration), *Energy-aware segmentation for topological reconstruction of obscured objects* [Internal collaboration review as of Sept. 2025]

10. MIGDAL Collaboration et. al. (including **J. Schueler**), *Performance of the Optical Time Projection Chamber of the MIGDAL Experiment*

11. D. Edgeman et. al. (including **J. Schueler**) *Optical effects in Gas Electron Multipliers*

12. **J. Schueler**, S.E. Vahsen, M. Ghrear, *First observation of the head/tail effect in sub-20 keV nuclear recoils*

Invited Talks/Workshops

Talk titles and links to slides are included in cases where a link to the event is not provided.

- **Brown Virtual AI Winter School 2026 (upcoming)** Jan. 8th, 2026
- **University of Washington: CENPA Seminar** March 20th, 2025
- **University of New Mexico: NUPAC Seminar** Sept. 24th, 2024
- **Berkeley Institute for Data Science Seminar** Sept. 17th, 2024
- **Stanford/SLAC: FPD Seminar** Sept. 12th, 2024
- **LUX-ZEPLIN UK/Europe/Australia meeting** June 20th, 2024
  Title: *A deep learning-based object detection pipeline for real-time Migdal effect searches on CMOS camera data from the MIGDAL experiment*
- **Los Alamos National Lab: Particle Physics Seminar** Nov. 15th, 2023
  Title: *Deep Learning for Improved Analyses of High Resolution Gaseous TPC Data*
- **CPAD Workshop 2022 (Early Career Plenary)** Nov. 30th, 2022
- **2020 Hawaii US Belle II Summer School** July 7th, 2020
  Title: Measurement of Neutron Backgrounds with Time Projection Chambers
- **2019 BNL US Belle II Summer School** July 31st, 2019
  Title: Beam Induced Backgrounds at SuperKEKB

Other Presentations

- **8th International Conference on Micro Pattern Gaseous Detectors** Oct. 14th, 2024
  (Presented on behalf of the MIGDAL collaboration)
- **APS April Meeting 2024** Apr. 4th, 2024

- **CPAD Workshop 2023** Nov. 9th, 2023
- **APS April Meeting 2021** Apr. 17th, 2021
- **APS April Meeting 2019** Apr. 15th, 2019

Selected Maintained Software

migYOLO – Companion software for the MIGDAL collaboration's PRD paper *Transforming a rare event search into a not-so-rare event search in real-time with deep learning-based object detection.* The software is self-contained and includes all tools discussed in the paper.
GitHub | Documentation | doi.org/10.5281/zenodo.12628436

MIGDAL_simulator – Fast TPC full-detector simulation. Includes tools for simulating primary tracks, drifting and diffusing them in a gas mixture, amplification with any number of GEMs, and digitization. Also includes rudimentary GPU support.
GitHub | Documentation

objectKeyPointLabelStudio - General framework to automatically generate XML code that enables an object-keypoint detection data labeling interface in LabelStudio. This software includes a custom YOLOv8-pose model I pre-trained to demonstrate ML-assisted labeling with LabelStudio. This software is built to be flexible and can be adapted to object-keypoint detection workflows outside of physics.
GitHub

Outreach, professional development, and other service

- Physics Department Graduate Student Organization (GSO) Representative (2016-2017)
- University of Hawaii Physics Day volunteer (2015-2016)
- ISEE Teaching Professional Development Program participant (2015)
- New York City Science Fair judge (2014)
- Saturday Physics Prep volunteer for NYC public high school students (2013-2014)