

# Jeff Schueler Ph.D. (He/Him)

jschueler1@unm.edu | Seattle, WA | (425) 736-8516

[Personal website](#) | [GitHub](#) | [INSPIRE HEP](#) | [UNM contact](#)

## Appointments and Education

<b>Postdoctoral Scholar</b> University of New Mexico, Albuquerque, NM	<b>April 2023 – Present</b>
<b>Ph.D: Physics</b> University of Hawai'i, Honolulu, HI	<b>2015 – 2022</b>
<i>Dissertation: From neutrons to dark matter: Directional recoil detection and utilization of deep learning for gaseous time projection chambers</i>	
<b>MSc: Adolescent Education–Physics</b> Pace University, New York, NY	<b>2013 – 2015</b>
<b>Physics Fellow</b> New York City Teaching Fellows, New York, NY	<b>2013 – 2015</b>
<b>BSc: Physics (Honors) &amp; Mathematics</b> University of Washington, Seattle, WA	<b>2009 – 2013</b>

## Research Experience

**University of New Mexico**, Albuquerque, NM (Remote) **2023 – Present**

**Postdoctoral Scholar (PI: Dinesh Loomba):** Analysis coordinator 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
  - Led and published a [collaboration-wide paper](#) and gave six invited seminars on this topic
  - **Credited as the inspiration for the candidate selection algorithm used in the MARVEL experiment's [discovery of the Migdal effect](#)**
- Created Object-Aware Segmentation of ImagesS ([OASIS](#)) – A new segmentation regression framework improving overlapping object separation in scientific image data
- Standardized the production of collaboration-wide data products that unify all subdetectors

**University of Hawai'i at Mānoa**, Honolulu, HI **2017 – 2022**

**Research Assistant (PI: Sven Vahsen):** Designed systems of gas time projection chambers (TPCs) that characterize beam-induced neutron backgrounds at the SuperKEKB  $e^+e^-$  collider for the Belle II experiment.

- Commissioned two generations of TPC systems that are still in use as of 2026
- Published an analysis that discovered beam-induced neutron hotspots that have since been shielded to protect the Belle II detector
- 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 a 4D spatial-charge detector simulator that reduced both memory consumption and computation time ~10-fold compared to our previously used software
- Wrote custom ResNets and loss functions that led to the first real-data demonstration of statistically significant 3D vector reconstructions of sub-20 keV 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

Dustin Edgeman (University of New Mexico; Graduate Student) **2024 – Present**

Wesley Thompson (University of New Mexico; Graduate Student) **2024 – Present**

Stephanie Paiva-Flynn (University of New Mexico, Imperial College London) **2024 – Present**

**Undergraduate Honors Thesis (publication in prep):** [Deep learning-based keypoint detection for electron recoil vertex identification and trajectory reconstruction](#)

Elizabeth Tilly (University of New Mexico; Graduate Student) **2023 – Present**

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)

### 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)

## Selected Publications

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

1. **J. Schueler**, et. al. (MIGDAL Collaboration), *Overlap-aware segmentation for topological reconstruction of obscured objects* (Submitted) (**2025**) DOI: [10.48550/arXiv.2510.06194](https://doi.org/10.48550/arXiv.2510.06194)
2. **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](https://doi.org/10.1103/PhysRevD.111.072004)
3. **J. Schueler**, et. al., *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](https://doi.org/10.1016/j.nima.2022.167291)
4. 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](https://doi.org/10.1016/j.nima.2022.167168)
5. **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](https://doi.org/10.48550/arXiv.2206.10822)
6. P. M. Lewis, M. T. Hedges, I. Jaegle, **J. Schueler**, T. N. Thorpe, S. E. Vahsen, *Primary track recovery in high-definition gas time projection chambers*, Eur.Phys.J.C 82 (**2022**) 4, 324 DOI: [10.1140/epjc/s10052-022-10283-3](https://doi.org/10.1140/epjc/s10052-022-10283-3)
7. 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](https://doi.org/10.1016/j.nima.2021.166066)
8. 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](https://doi.org/10.1016/j.nima.2023.168550)
9. 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](https://doi.org/10.1016/j.nima.2019.06.037)

## Publications in preparation

Below are works I am authoring or substantially contributing to that will be submitted soon:

10. MIGDAL Collaboration (**Co-corresponding author**), *Performance of the Optical Time Projection Chamber of the MIGDAL Experiment (Final stages of collaboration review)*
11. MIGDAL Collaboration (including **J. Schueler**), *Search for the Migdal Effect in Neutron Scattering on Fluorine and Carbon*
12. D. Edgeman et. al. (including **J. Schueler**) *Optical effects in Gas Electron Multipliers (Final stages of collaboration review)*
13. E. Tilly, C. McCabe et. al. (including **J. Schueler**) *Limits on Directional Sensitivity to the Migdal Effect in a Gas TPC*
14. **J. Schueler**, S.E. Vahsen, M. Ghrear, *First observation of the head/tail effect in sub-20 keV nuclear recoils*

### Invited Talks/Workshops

- UCSD HEP Seminar (upcoming) Spring 2026
- [Brown Virtual AI Winter School 2026](#) 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

- [9th International CYGNUS Workshop on Directional Recoil Detection](#) Feb. 25th 2026  
(Upcoming; on behalf of the MIGDAL collaboration)
- [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

1. **OASIS** – Overlap-Aware Segmentation of ImageS is a new segmentation-regression framework designed to separate overlapping objects in scientific image data. The cross-disciplinary software introduces a novel loss function designed to weight regions of pixel-overlap during training. In our newly submitted paper, we demonstrate that overlap region-specific loss function weights significantly improve the reconstruction of heavily overlapping tracks in the MIGDAL detector. [GitHub](#)
2. **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](https://doi.org/10.5281/zenodo.12628436)
3. **MIGDAL\_simulator** – Full-detector simulation of the MIGDAL experiment’s TPC. Includes tools for simulating primary tracks, drifting and diffusing them in a gas mixture, amplification with any number of GEMs, and digitization. [GitHub](#) | [Documentation](#)
4. **objectKeyPointLabelStudio** – [LabelStudio](#) plugin for object-keypoint detection with automated ML-assisted labeling integration. [GitHub](#)