Curriculum Vitae

Hannah Richards

Pronouns: she or they
hannah.willow.richards@gmail.com
(937) 546-5860

Employment

April 2020—Present

Position: Machine Learning Engineer
Where: *confidential*
Contributions: *confidential*

January 2017—December 2019

Position: Learning Assistant
Where: Department of Physics and Astronomy, University of Alabama
Contributions:

- I worked as an undergraduate teaching assistant in introductory physics courses from the spring of my freshman year until my senior year.
- I assisted with labs, proctored exams, and sometimes presented extra credit problems for the classes.

Education

August 2016—May 2020

Degree: Bachelor of Science in Physics
Where: University of Alabama, Tuscaloosa, AL
GPA: 4.0 of 4.0
Minors in Linguistics and Mathematics
Special programs:

- Randall Research Scholars Program, f.k.a. Computer–Based Honors Program
- Honors College

Research

February 2017—August 2019

Project: Signal–Background Discrimination in EXO–200
Where: University of Alabama, Tuscaloosa, AL
Advisor: Igor Ostrovskiy
Contributions:

- I trained convolutional neural networks (CNNs) for recognizing neutrinoless double beta decay signals against background events. I found that they performed better than conventional methods, such as binary decision trees, in my preliminary results.
- I administered two Linux GPU computing servers. My duties included managing user accounts, data, hardware, and software on these systems.

- I worked on statistically interpreting an event-by-event classifier (e.g., a CNN) to calculate the sensitivity of the method and confidence intervals.
- I gained experience working with photomultiplier tubes and digitizers for a muon detection project.

May 2019—July 2019

Project: Neutrino Physics Research Experience for Undergraduates (REU)
Where: Duke University, Durham, NC
Advisor: Kate Scholberg
Contributions:

- I searched for candidates for neutrino detector materials based on their charged–current interaction energy thresholds.
- I found two isotopes, ^{181}Ta and ^{160}Gd, that have desirable properties. I ran preliminary calculations for interaction cross sections and event rates, greenlighting further study.

May 2018—August 2018

Project: Experimental Nuclear Structure REU
Where: Vanderbilt University, Nashville, TN
Advisor: Joseph Hamilton
Contributions:

- Using double and triple coincidence counting, I measured the frequency at which ^{252}Cf spontaneously fissions into certain isotopes. I performed these measurements for two separate element pairs, tellurium–palladium and strontium–neodymium.
- I tabulated my results into yields matrices, finding that the most common number of neutrons evaporated during these decays was 3 or 4, with immeasurably small yields at about 6+ neutrons. This is evidence that a previously studied case, that of barium–molybdenum, is unique since it has an unusually high probability of evaporating between 7 and 10 neutrons.

Publications

- Brooks M. Musangu et al. "Anomalous neutron yields confirmed for Ba-Mo and newly observed for Ce-Zr from spontaneous fission of ^{252}Cf". In: *Phys. Rev. C* 101 (3 Mar. 2020), p. 034610. DOI: 10.1103/PhysRevC.101.034610. URL: https://link.aps.org/doi/10.1103/PhysRevC.101.034610
- Sébastien Delaquis et al. "Deep neural networks for energy and position reconstruction in EXO-200". In: *Journal of Instrumentation* 13.08 (Aug. 2018), P08023. DOI: 10.1088/1748-0221/13/08/p08023. URL: https://iopscience.iop.org/article/10.1088/1748-0221/13/08/P08023

Presentations

- T. H. Richards and Kate Scholberg. "Finding a Material with a Low Energy Threshold for Charged–Current Neutrino Interactions". In: *86th Annual Meeting of the Southeastern Section of the American Physical Society (SESAPS)*. vol. 64. 19. Nov. 2019. URL: https://meetings.aps.org/Meeting/SES19/Session/D04.18
- T. H. Richards and Kate Scholberg. "Finding a Material with a Low Energy Threshold for Charged–Current Neutrino Interactions". In: *2019 Fall Meeting of the APS Division of Nuclear Physics*. Vol. 64. 12. Oct. 2019. URL: http://meetings.aps.org/Meeting/DNP19/Session/HA.117
- T. H. Richards. "Signal–Background Discrimination in EXO–200 with Deep Learning". In: *APS April Meeting 2019*. Vol. 64. 12. Apr. 2019. URL: https://meetings.aps.org/Meeting/APR19/Session/L10.8
- T. H. Richards et al. "Determining Yields of Fragment Pairs from the Spontaneous Fission of Californium–252". In: *5th Joint Meeting of the APS Division of Nuclear Physics and the Physical Society of Japan*. Vol. 63. 12. Oct. 2018. URL: http://meetings.aps.org/link/BAPS.2018.HAW.HA.74

Technical experience

Hardware

PMTs, digitizers, breadboarding

Software

TensorFlow/Keras, PyTorch, Linux shell, Python, LaTeX, C/C++, ROOT, Fortran

Winner of UA's Large Hadron Collider Machine Learning Hackathon (2019)

Honors and awards

- Goldwater Scholarship (2019)
- Outstanding First Year Physics Student (2017)
- Computer–Based Honors Program Fellowship (2016)
- University of Alabama Presidential Scholarship (2016)