

Physics Department
Stanford University
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CLARKE A. HARDY

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EDUCATION

Stanford University, Stanford, CA
Ph.D. in Physics Expected 2025

Queen's University, Kingston, Canada
M.Sc. in Physics 2019
B.A.Sc. in Engineering Physics 2018

RESEARCH EXPERIENCE

Graduate Research Assistant, Optically-Levitated Microspheres Lab
Stanford University 2023 – Present

- Developed techniques for in-situ noise & background witnessing to improve sensitivity
- Built analysis framework to test for modifications to Newtonian gravity at short distances

Graduate Research Assistant, nEXO Neutrinoless Double Beta Decay Search
Stanford University 2020 – Present

- Designed, constructed, & characterized a new xenon purifier to mitigate radon backgrounds
- Developed light collection efficiency calibration scheme using an internal ^{127}Xe source
- Built, maintained, & operated two test platforms for nEXO R&D at Stanford

Graduate Research Assistant, LZ Dark Matter Search
SLAC National Accelerator Laboratory 2019 – 2020

- Modelled sensitivity of the LZ detector to leptophilic dark matter

Graduate Research Assistant, PICO Dark Matter Search
Queen's University & SNOLAB 2018 – 2019

- Modelled sensitivity of PICO-40L to $\text{CE}\nu\text{NS}$ and annual modulations in a DM signal
- Assisted with commissioning of the PICO-40L detector at SNOLAB
- Improved PICO-40L image quality by designing, fabricating, & installing a new retroreflector

Undergraduate Research Assistant, PICO Dark Matter Search
Queen's University 2017 – 2018

- Performed ray tracing simulations & reflectivity tests for PICO-40L retroreflector design

Undergraduate Research Assistant, NEWS-G Dark Matter Search
Queen's University Summer 2016

- Developed & tested new calibration schemes using UV laser & external sources
- Designed & implemented slow controls readout electronics & software

HONORS & AWARDS

NSERC Postgraduate Scholarship – Doctoral
National Sciences and Engineering Research Council of Canada 2020

* **Alexander Graham Bell Canada Graduate Scholarship – Doctoral**
National Sciences and Engineering Research Council of Canada 2020

* **Clarendon Scholarship**
University of Oxford 2019

Queen's CAP Prize Examination Award Queen's University	2019
R. Samuel McLaughlin Fellowship Queen's University	2018
First Place, particle physics category Canadian Undergraduate Physics Conference	2017
Ontario Professional Engineers Foundation Scholarship Queen's University	2015
Principal's Scholarship Queen's University	2014
* declined award	

WORKSHOPS

Tri-Institute School on Elementary Particles (TRISEP) Perimeter Institute for Theoretical Physics	June 2023
<ul style="list-style-type: none"> ◦ Workshop spanning two weeks with sessions from invited researchers on the Standard Model, BSM physics, dark sector theory, amplitude techniques, EFT methods for gravity, gravitational wave theory, gravitational wave experiments, collider experiments, particle astrophysics observations, cosmology, and axions 	

TEACHING EXPERIENCE

Co-Instructor , <i>PHY 154: Physics I with Lab</i> , Mount Tamalpais College	Fall 2024
Co-Instructor , <i>Summer Science Circle</i> , Mount Tamalpais College	Summer 2023
Lead Instructor , <i>PHY 154: Physics I with Lab</i> , Mount Tamalpais College	Fall 2022
Co-Instructor , <i>MTH 220: Precalculus I</i> , Mount Tamalpais College	Spring 2022
Teaching Assistant , <i>PH 41: Mechanics</i> , Stanford	Winter 2022
Teaching Assistant , <i>PH 25: Modern Physics</i> , Stanford	Spring 2020
Teaching Assistant , <i>PH 23: Electricity, Magnetism, & Optics</i> , Stanford	Winter 2020
Teaching Assistant , <i>APSC 111: Mechanics</i> , Queen's	Fall 2018

SERVICE & OUTREACH

Volunteer Mentor nEXO Collaboration Mentorship Program	2024 – Present
Volunteer Faculty Mount Tamalpais College	2022 – Present
<ul style="list-style-type: none"> ◦ Served on faculty at a college for the incarcerated population at San Quentin State Prison ◦ Developed & taught multiple courses in physics & math 	
McDonald Institute Ambassador Arthur B. McDonald Canadian Astroparticle Physics Research Institute	2018 – 2019
<ul style="list-style-type: none"> ◦ Hosted school groups & gave tours of the McDonald Institute Visitor Center ◦ Assisted with regular outreach events within the community 	

CONFERENCES & TALKS

- * “In search of Majorana neutrinos and micron-scale interactions,” Nuclear Particle Astrophysics (NPA) Seminar, Yale University, New Haven, CT, April 2025

2. “Searching for new physics at the micron scale with optically levitated microspheres,” APS April Meeting, Sacramento, CA, April 2024
3. † “Optimizing energy reconstruction for nEXO”, Topics in Astroparticle and Underground Physics (TAUP) 2023, Vienna, Austria, September 2023
4. † “Searching for Neutrinoless Double Beta Decay with nEXO”, TRISEP 2023, Waterloo, Canada, June 2023
5. * “In Search of No Neutrinos: the nEXO Experiment and Detector Calibration”, Two Sigma PhD Symposium, New York, NY, June 2023
6. “Development of a ^{127}Xe calibration source for nEXO,” APS April Meeting, New York City, NY, April 2022
7. “Development of a high-purity zirconium purifier for nEXO,” APS Division of Nuclear Physics Fall Meeting (virtual), MIT, October 2021
8. “Lightmap reconstruction in nEXO with an internal xenon 127 source,” Light Detection In Noble Elements (virtual), UC San Diego, September 2021
9. “New Outreach Initiatives in Canada with the McDonald Institute,” European Physical Society High Energy Physics Conference, Ghent, Belgium, July 2019
10. “Searching for Dark Matter with PICO-40L,” European Physical Society High Energy Physics Conference, Ghent, Belgium, July 2019
11. “Determining the Physics Reach of the PICO Bubble Chamber Dark Matter Detectors,” Canadian Association of Physicists Congress, Burnaby, Canada, June 2019
12. “Improving the Optics of the PICO Bubble Chamber Dark Matter Detector,” Winter Nuclear & Particle Physics Conference, Mont Tremblant, Canada, January 2018
13. “Improving the Optics and Fiducial Volume of the PICO-40L Dark Matter Detector,” Canadian Undergraduate Physics Conference, Ottawa, Canada, October 2017
 - * invited talk
 - † poster presentation

PUBLICATIONS

1. J. Xu [*et al.*, including **C.A. Hardy**] “Electron-ion recombination in composite interactions in liquid xenon,” submitted to Phys. Rev. D (2025) [arXiv:2503.07562]
2. * Gautam Venugopalan, **Clarke A. Hardy** *et al.*, “Search for new interactions at the micron scale with a vector force sensor,” submitted to Phys. Rev. Lett. (2025) [arXiv:2412.13167]
3. S. Hedges [*et al.*, including **C. A. Hardy**], “Supernova electron-neutrino interactions with xenon in the nEXO detector,” Phys. Rev. D 110, 093002 (2024) [arXiv:2405.19419]
4. M. Yvaine [*et al.*, including **C. A. Hardy**], “Overcoming photobleaching in imaging of single barium atoms in a solid xenon matrix,” Phys. Rev. Research 6, 043193 (2024) [arXiv:2407.00285]
5. R.H.M. Tsang [*et al.*, including **C.A. Hardy**], “An integrated online radioassay data storage and analytics tool for nEXO,” Nucl. Instrum. Methods Phys. Res. A 1055, 168477 (2023) [arXiv:arXiv:2304.06180]
6. B. Acharya [*et al.*, including **C. A. Hardy**], “Fundamental Symmetries, Neutrons, and Neutrinos (FSNN): Whitepaper for the 2023 NSAC Long Range Plan,” (2023) [arXiv:2304.03451]
7. C. Adams [*et al.*, including **C.A. Hardy**], “Neutrinoless Double Beta Decay,” White Paper submitted for the Fundamental Symmetries, Neutrons, and Neutrinos Town Meeting (2022) [arXiv:2212.11099]
8. J. Aalbers [*et al.*, including **C.A. Hardy**], “A Next-Generation Liquid Xenon Observatory for Dark Matter and Neutrino Physics,” J. Phys. G: Nucl. Part. Phys. 50, 013001 (2023) [arXiv:2203.02309]

9. G. Gallina [*et al.*, including **C. A. Hardy**], “Performance of novel VUV-sensitive Silicon Photo-Multipliers for nEXO,” *Eur. Phys. J. C* 82, 1125 (2022) [arXiv:2209.07765]
10. * B. G. Lenardo, **C. A. Hardy** *et al.*, “Development of a ^{127}Xe calibration source for nEXO,” *JINST* 17, P07028 (2022) [arXiv:2201.04681]
11. G Adhikari [*et al.*, including **C A Hardy**], “nEXO: Neutrinoless double beta decay search beyond the 10^{28} year half-life sensitivity,” *J. Phys. G: Nucl. Part. Phys.* 49, 015104 (2022) [arXiv:2106.16243]
12. * D.S. Akerib [*et al.*, including **C.A. Hardy**], “Projected sensitivities of the LUX-ZEPLIN (LZ) experiment to new physics via low-energy electron recoils,” *Phys. Rev. D* 104, 092009 (2021) [arXiv:2102.11740]
13. M. Wagenpfeil [*et al.*, including **C. A. Hardy**], “Reflectivity of VUV-sensitive Silicon Photomultipliers in Liquid Xenon,” *JINST* 16, P08002 (2021) [arXiv:2104.07997]
14. M.G. Aartsen [*et al.*, including **C. Hardy**], “Velocity independent constraints on spin-dependent DM-nucleon interactions from IceCube and PICO,” *Eur. Phys. J. C* 80, 819 (2020) [arXiv:1907.12509]
15. C. Amole [*et al.*, including **C. Hardy**], “Data-Driven Modelling of Electron Recoil Nucleation in PICO C_3F_8 Bubble Chambers,” *Phys. Rev. D* 100, 082006 (2019) [arXiv:1905.12522]
16. C. Amole [*et al.*, including **C. Hardy**], “Dark Matter Search Results from the Complete Exposure of the PICO-60 C_3F_8 Bubble Chamber,” *Phys. Rev. D* 100, 022001 (2019) [arXiv:1902.04031]
* paper for which I was a principal author