Physics Department Stanford University Stanford, CA 94305

CLARKE A. HARDY

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2019

Education

Stanford University , Stanford, CA Ph.D. in Physics	Expected 2025
Queen's University, Kingston, Canada M.Sc. in Physics B.A.Sc. in Engineering Physics	2019 2018
Research Experience	
 Graduate Research Assistant, Optically-Levitated Microspheres Lab Stanford University Developed techniques for in-situ noise & background witnessing to improve sensitivity Built analysis framework to test for modifications to Newtonian gravity at short distance 	2023 – Present
 Graduate Research Assistant, nEXO Neutrinoless Double Beta Decay Search Stanford University Designed, constructed, & characterized a new xenon purifier to mitigate radon backgrou Developed light collection efficiency calibration scheme using an internal ¹²⁷Xe source Built, maintained, & operated two test platforms for nEXO R&D at Stanford 	2020 – Present inds
 Graduate Research Assistant, LZ Dark Matter Search SLAC National Accelerator Laboratory o Modelled sensitivity of the LZ detector to leptophilic dark matter 	2019 - 2020
 Graduate Research Assistant, PICO Dark Matter Search Queen's University & SNOLAB o Modelled sensitivity of PICO-40L to CEνNS and annual modulations in a DM signal o Assisted with commissioning of the PICO-40L detector at SNOLAB o Improved PICO-40L image quality by designing, fabricating, & installing a new retroref 	2018 – 2019 lector
 Undergraduate Research Assistant, PICO Dark Matter Search Queen's University Performed ray tracing simulations & reflectivity tests for PICO-40L retroreflector design 	2017 - 2018
 Undergraduate Research Assistant, NEWS-G Dark Matter Search Queen's University Developed & tested new calibration schemes using UV laser & external sources Designed & implemented slow controls readout electronics & software 	Summer 2016
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 * Glassian Galache Lit 	2020

* Clarendon Scholarship

University of Oxford

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 * declined award	2014

WORKSHOPS

Tri-Institute School on Elementary Particles (TRISEP)

Perimeter Institute for Theoretical Physics

• 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, PHY 154: Physics I with Lab, Mount Tamalpais College Co-Instructor, Summer Science Circle, Mount Tamalpais College Lead Instructor, PHY 154: Physics I with Lab, Mount Tamalpais College Co-Instructor, MTH 220: Precalculus I, Mount Tamalpais College Teaching Assistant, PH 41: Mechanics, Stanford Teaching Assistant, PH 25: Modern Physics, Stanford Teaching Assistant, PH 23: Electricity, Magnetism, & Optics, Stanford Teaching Assistant, APSC 111: Mechanics, Queen's 	Fall 2024 Summer 2023 Fall 2022 Spring 2022 Winter 2022 Spring 2020 Winter 2020 Fall 2018
Service & Outreach	
Volunteer Mentor nEXO Collaboration Mentorship Program	2024 – Present
 Volunteer Faculty Mount Tamalpais College Served on faculty at a college for the incarcerated population at San Quentin State Pris Developed & taught multiple courses in physics & math 	2022 – Present on
 McDonald Institute Ambassador Arthur B. McDonald Canadian Astroparticle Physics Research Institute o Hosted school groups & gave tours of the McDonald Institute Visitor Center o Assisted with regular outreach events within the community 	2018 - 2019

Conferences & Talks

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

June 2023

- 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 ¹²⁷Xe 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
- "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
- "Improving the Optics of the PICO Bubble Chamber Dark Matter Detector," Winter Nuclear & Particle Physics Conference, Mont Tremblant, Canada, January 2018
- "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. A. Anker [*et al.*, including **C.A. Hardy**] "Ultra-sensitive radon assay using an electrostatic chamber in a recirculating system," submitted to NIM A (2025) [arXiv:2504.15464]
- 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]
- 3. * 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]
- 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]
- 5. 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]
- 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]
- 7. 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]
- 8. 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]

- 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]
- 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]
- * B. G. Lenardo, C. A. Hardy et al., "Development of a ¹²⁷Xe calibration source for nEXO," JINST 17, P07028 (2022) [arXiv:2201.04681]
- G Adhikari [*et al.*, including C A Hardy], "nEXO: Neutrinoless double beta decay search beyond the 10²⁸ year half-life sensitivity," J. Phys. G: Nucl. Part. Phys. 49, 015104 (2022) [arXiv:2106.16243]
- * 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]
- M. Wagenpfeil [*et al.*, including C. A. Hardy], "Reflectivity of VUV-sensitive Silicon Photomultipliers in Liquid Xenon," JINST 16, P08002 (2021) [arXiv:2104.07997]
- 15. 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]
- C. Amole [*et al.*, including C. Hardy], "Data-Driven Modelling of Electron Recoil Nucleation in PICO C₃F₈ Bubble Chambers," Phys. Rev. D 100, 082006 (2019) [arXiv:1905.12522]
- C. Amole [et al., including C. Hardy], "Dark Matter Search Results from the Complete Exposure of the PICO-60 C₃F₈ Bubble Chamber," Phys. Rev. D 100, 022001 (2019) [arXiv:1902.04031]
 - * paper for which I was a principal author