

Daine L. Danielson

Department of Physics
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Education

Eckhardt Graduate Scholar and Doctoral Student in **Physics**
The University of Chicago, matriculating Fall 2019


Bachelor of Science in **Computational Physics**

Minor in **Mathematics**

Integrated Studies Honors

Honors Thesis: "Large Reactor-Neutrino Mixing Angle Supports a
Fourier Approach to the Mass Hierarchy Problem."

University of California, Davis; 2017

NSSC Fellow, Nuclear Science and Security Consortium, 2012–2017 

Distinctions

Innovations in Nuclear Technology R&D Award, U.S. Department of Energy, 2019.

Distinguished Student Award, Los Alamos National Laboratory, 2018.

Sigma Pi Sigma lifetime membership.

Research & Experience

Entrepreneurship & Leadership

Cofounder, Chief Architect

Whitekoat, Inc.; 2014–present.

Designed and built generalized medical deep neural network algorithms for diagnostic screening of patient conditions.

As one of three Cofounders (CEO, COO, and Chief Architect), served as the company leader overseeing all mathematical, algorithmic, and technological development.

Lead a team of clinicians, computer scientists, and mathematicians in developing software technology and 24/7 infrastructure for clinical applications.

Lead the design and development of high-security software systems and runtime infrastructures, and operational procedures, capable of maintaining compliance with strict federal regulations pertaining to patient-oriented medical technology.

Lead development of user-friendly graphical interfaces to manage medical machine learning projects, for use by clinicians and medical research staff.

Built a server infrastructure capable of serving overseas and domestic customers with high performance and availability, while automatically scaling provisioned server resources in response to user demand.

Served in a core fundraising capacity, pitching to venture capitalists alongside two Cofounders.

Served in a core hiring capacity, with critical involvement in all personnel decisions.

Served to build a company culture founded on compassion, mutual respect, openness to criticism, diversity, and service.

Theoretical Physics

Post-Baccalaureate Researcher and Distinguished Student with Dr. Anna C. Hayes
Nuclear, Particle, Astrophysics and Cosmology Group;
Theoretical Division; Los Alamos National Laboratory; 2018–present.

Demonstrated the robustness of reactor-based neutrino mass hierarchy experiments against the fine structure of reactor antineutrino spectra. Considered all individual beta decay components, calculated the response of a detector like JUNO, and compared the mass hierarchy and fine structure effects.

Studied the quasi-degenerate transition into a Fermi plasma of deuterium and tritium in fusion conditions using reaction-in-flight neutron activation data from Lawrence Livermore National Laboratory's National Ignition Facility.

Developed a model of brown dwarf density for comparison to the physical conditions in the inertial confinement fusion capsule at the National Ignition Facility.

Reconstructed the neutron beam flux spectrum for the 76-inch cyclotron at Crocker Nuclear Laboratory from measurements made at UC Davis.

Experimental Physics

Neutrino and Nuclear Physics Intern with Prof. Robert C. Svoboda and Prof. Christopher M. Auger
Neutrino and Dark Matter Group; Dept. of Physics; University of California, Davis; 2011–2017.
Subatomic Physics Group; Physics Division; Los Alamos National Laboratory; 2014–2017.

Designed, built, and tested cryogenic in-situ photon detection system for mini-CAPTAIN liquid argon time-projection chamber.

Designed, developed, installed, and maintained photonics data acquisition software and hardware for mini-CAPTAIN.

Performed first laser calibration and laser timing measurement for mini-CAPTAIN.

Diagnosed and mitigated severe wire-plane crosstalk in mini-CAPTAIN.

Designed and built the first data visualization and analysis software package for mini-CAPTAIN.

Calibrated photomultiplier tubes and built a muon detection (veto) system for use in experiments at the UC Davis 76-inch cyclotron at Crocker Nuclear Laboratory.

Designed and built Sens++, a complete reactor antineutrino experiment simulation and analysis software package.

Assisted development of event classification software for the Deep Underground Neutrino Experiment (DUNE) water-Cherenkov far detector design.

Assisted construction and operation of the muon veto prototype for the DUNE water-Cherenkov far detector design.

Assisted design and construction of the photon calibration system for a transportable liquid scintillator detector, for CANDU reactor antineutrino monitoring.

Applied Physics

Neutrino and Nuclear Physics Intern with Dr. Adam Bernstein

Rare Event Detection Group, Lawrence Livermore National Laboratory, 2013, 2015–2018.

Investigated new experimental and mathematical approaches to the neutrino mass hierarchy problem. Demonstrated applications for AIT-WATCHMAN (water-Cherenkov nonproliferation detector) in measuring the neutrino mass hierarchy at some baselines.

Derived two models, one analytical and one Monte-Carlo, for the inverse beta decay double-vertex distribution in Gadolinium doped liquid scintillator. Characterized sensitivity of a 1 kT Gadolinium doped liquid scintillator detector to detect a clandestine low-power reactor proximal to a known energy reactor.

Young Professionals Nuclear Forum member with Prof. Siegfried S. Hecker

Center for International Security and Cooperation, Stanford University, 2019–present.

Working with international scholars to tackle emerging issues in nuclear security and energy.

Student Researcher with Prof. Barbara J. Neuhauser

Cryogenic Electronics Group, Dept. of Physics and Astronomy, San Francisco State U., 2009–2010. [↗](#)

Developed next-generation tantalum-based and niobium-based superconducting tunnel junctions for X-ray spectroscopy at Lawrence Berkeley National Laboratory.

Repurposed semiconductor industry equipment to perform micron-scale device design, thin-film deposition, photolithography, acid and plasma etching, and cryogenic tests of the superconductive and quantum-tunneling characteristics of thin film devices.

Developed prototype Gadolinium film based portable neutron detectors for the San Francisco Police Department.

Additional Leadership

Cofounder, Organizer

Sacramento Software Developers; 2017–present.

A growing community of startup software developers, with monthly knowledge-sharing and discussion meet-ups.

Publications

Refereed

“First Measurement of the Total Neutron Cross Section on Argon Between 100 and 800 MeV.”

With the CAPTAIN Collaboration.

Physical Review Letters **123**, 042502 (2019), *arXiv:1903.05276 [physics.hep-ex]*, Los Alamos Unlimited Release LA-UR-19-22200 [↗](#)

“Reactor Neutrino Spectral Distortions Play Little Role in Mass Hierarchy Experiments.”

D. L. Danielson, A. C. Hayes, G. T. Garvey.

Physical Review D **99**, 036001 (2019), *arXiv:1808.03276 [physics.hep-ph]*, Los Alamos Unlimited Release LA-UR-18-23776 [↗](#)

“Large Reactor-Neutrino Mixing Angle Supports a Fourier Approach to the Mass Hierarchy Problem.”

Daine L. Danielson.

Explorations: the UC Davis Undergraduate Research Journal 17 (2015). [↗](#)

Honors Thesis; Integrated Studies Honors Program; University of California, Davis (2014).

Submitted

“Directionally Accelerated Detection of an Unknown Second Reactor with GdLS for Mid-Field Non-proliferation Monitoring.”

Daine L. Danielson *et al.* for the AIT-WATCHMAN collaboration

arXiv:1909.05374 [physics.ins-det] (2019), Los Alamos Unlimited Release LA-UR-19-28595 [↗](#)

“Varying Quantum Degeneracy in Plasmas at the National Ignition Facility.”

A.C. Hayes, M. E. Gooden, ..., **D. L. Danielson**, *et al.*

Passed first editorial review, in peer review for publication in Nature Physics (2019).

“Neutron Measurement with the Mini-CAPTAIN Liquid Argon Time Projection Chamber Detector”

C.E. Taylor, ..., **D. L. Danielson**, *et al.*

Submitted to Nuclear Instruments and Methods in Physics Research, Section A (2019).

Proceedings

“Directional Detection of Antineutrinos.”

Daine L. Danielson.

Accepted for publication in Proceedings of the 2018 Workshop on Applied Antineutrino Physics (2018).

Reports

“CAPTAIN Electronics Technical Report.”

Charles Taylor, Richard Van de Water, David Lee, Jacqueline Mirabal-Martinez, Walter Sondheim, Robert Cooper, **Daine Danielson**, and Peter Madigan.

Los Alamos Unlimited Release LA-UR-18-31653 (2018). [↗](#)

“The Long Baseline Neutrino Experiment (LBNE) Water Cherenkov Detector (WCD) Conceptual Design Report (CDR).”

With the DUNE Collaboration (f.k.a. LBNE).

arXiv:1204.2295 [physics.ins-det] (2012). [↗](#)

Research Proposals

“Study of Neutron Interactions in a Liquid Argon Time Projection Chamber.”

E. Guardincerri, D. Cline, R. Svoboda, **D. Danielson**, *et al.*

Los Alamos Neutron Science Center Proposal NS-2016-7313-A (2016). [↗](#)

“CAPTAIN-MINER ν A: Neutrino-Argon Scattering in a Medium-Energy Neutrino Beam.”

With the CAPTAIN-MINER ν A Collaboration.

Los Alamos Unlimited Release LA-UR-15-28458, Fermilab Proposal 1061 (2015). [↗](#)

In Preparation

“Design and Characterization of a Fast Neutron Beam Facility at the Crocker Nuclear Laboratory 76-inch Isochronous Cyclotron.”

C. Grant, N. Walsh, A. Manalaysay, E. Pantic, R. Svoboda, K. Bilton, **D. Danielson** (2018).

Contributed

“An Investigation of the $^{40}\text{Ar}(n,p)^{40}\text{Cl}$ Reaction Cross-Section below 50 MeV at Crocker Nuclear Laboratory.”

Nicholas Ian Walsh.

Dissertation, Ph.D. Physics, University of California at Davis (2016). [↗](#)

“Development of Tantalum-Based Superconducting Tunnel Junction Detectors for X-Ray Absorption Spectroscopy.”

Faustin Carter.

Master’s Thesis, M.S. Physics, San Francisco State University (2009). [↗](#)

Awards

Poster Award, 2nd place; 12th International Neutrino Summer School; Fermilab, 2019

Awarded for “Resolving the Neutrino Mass Ordering, Despite Nuclear Structure”.

DOE Innovations in Nuclear Technology R&D Award; U.S. Department of Energy, Office of Nuclear Energy, Office of Nuclear Technology R&D, 2019.

Awarded for my research on neutrino-based, directionally accelerated reactor-monitoring technologies for nuclear nonproliferation. [↗](#)

Distinguished Student Award; Los Alamos National Laboratory, 2018.

Awarded from two distinct nominations—one from Theoretical Division, one from Physics Division—for theoretical results in neutrino and nuclear phenomenology of neutrino mass hierarchy measurements, and for experimental work in measuring the total neutron cross section on liquid argon.

Chancellor’s Award for Excellence in Undergraduate Research, Honorable Mention; UC Davis, 2017.

Nominated by faculty from Boston University, University of Pennsylvania, and UC Davis for overall contributions in experimental neutrino physics.

Gold United States President’s Volunteer Service Award, 2016.

For volunteer service in medicine.

Gold UC Davis Community Service Award, 2016.

For volunteer service in medicine.

UC Davis Freshman Scholar, 2011.

Class of 2010 English Writing Award; St. Ignatius College Preparatory, 2010.

Awarded to the top graduating student in English writing.

National Merit Scholarship Program Letter of Commendation, 2010.

Advanced Placement Scholar with Distinction Award, 2010.

Grants and Fellowships

International travel funding from the American Physical Society, 2019.

For an invited talk at the Canadian-American-Mexican Graduate Student Physics Conference in Sudbury, Ontario, Canada.

Eckhardt Graduate Scholarship, The University of Chicago, 2019.

The premier fellowship program of the Physical Sciences Division of the University of Chicago.

NSSC Fellow, Nuclear Science and Security Consortium, 2012–2017.

Research in neutrino physics fully funded by the Nuclear Science and Security Consortium.

Award funding offered by Conference Experience for Undergraduates, 2014.

For investigations into the sensitivity of the WATCHMAN detector to address the Neutrino Mass Hierarchy Problem.

Award funding from Conference Experience for Undergraduates, 2013.

For investigations into new techniques for solving the Neutrino Mass Hierarchy Problem.

James & Leta Fulmor Scholarship; UC Davis, 2010.

Hubert H. Wakeham Scholarship; UC Davis, 2010.

Honors

Sigma Pi Sigma physics honor society lifetime membership; American Institute of Physics, 2014–present. [↗](#)

For academic achievement in Physics.

UC Davis Integrated Studies Honors Program, 2010–2017.

Invitational university honors program for overall academic achievement, completed with an Honor's Thesis in neutrino physics research, four years of Integrated Studies Honors courses, and one year of residence in honors dormitories (Miller Hall).

UC Davis Dean's Honors List, Fall 2010, Winter 2011, Spring 2011, Winter 2013.

Golden Key International Honour Society, 2012–present.

National Society of Collegiate Scholars, 2011–present.

California Scholarship Federation Life Membership, 2010–present.

Invited Talks

Physics

“Detecting a Hidden Nuclear Reactor with Antineutrinos for Mid-Field Nonproliferation Monitoring.”
Canadian-American-Mexican Graduate Student Physics Conference.
Laurentian University; Sudbury, Ontario, Canada; July, 2019. [↗](#)

“Directional Detection of Antineutrinos.”
Applied Antineutrino Physics 2018.
Lawrence Livermore National Laboratory; Livermore, California; October, 2018. [↗](#)

Career

“Physics Mentality – Open Mind Opens Doors”
UC Davis Alumni Physics Careers Seminar.
Department of Physics; University of California, Davis; Davis, California; 2015.

Talks

Physics

“Reactor Neutrino Spectral Distortions Play Little Role in Mass Hierarchy Experiments”
APS April Meeting 2019; Bulletin of the American Physical Society 64, 3 (2019).
Denver, Colorado; 2019. [↗](#)

“Determining the Neutrino Mass Hierarchy, Despite Nuclear Structure.”
2018 T Division Lightning Talks.
Theoretical Division, Los Alamos National Laboratory; Los Alamos, New Mexico; August, 2018. [↗](#)

“Distinguishing Two Reactors using Directional Methods.”
WATCHMAN Collaboration Meeting – August, 2016.
Lawrence Livermore National Laboratory; Livermore, California; 2016.

“Time Projection Chamber / Photon Detection System DAQ Synchronization.”
CAPTAIN Collaboration Meeting – July, 2016.
Santa Fe, New Mexico; 2016.

“Neutrino Detector Design for Directional Mid-Field Nuclear Nonproliferation.”
UC Davis 27th Annual Undergraduate Research, Scholarship & Creative Activities Conference.
University of California, Davis; Davis, California; April, 2016. [↗](#)

“mini-CAPTAIN Photon Detection System Summary.”
CAPTAIN Collaboration Meeting – November, 2015.
Santa Fe, New Mexico; 2015.

“Diagnosing and Mitigating Electronic Noise in the Mini-CAPTAIN Liquid-Argon Time Projection Chamber.”
UC Davis 26th Annual Undergraduate Research, Scholarship & Creative Activities Conference.
University of California, Davis; Davis, California; May, 2015.
CAPTAIN Collaboration Meeting – July, 2016.
Santa Fe, New Mexico, 2016. [↗](#)

“Building the mini-CAPTAIN Photon Detection System.”
CAPTAIN Collaboration Meeting – February, 2015.
Santa Fe, New Mexico; 2015.

“mini-CAPTAIN Photon Detection System Status.”
CAPTAIN Collaboration Meeting – November, 2014.
University of California, Los Angeles; Los Angeles, California; 2014.

“Noise in the Liquid-Nitrogen Filled mini-CAPTAIN Time Projection Chamber.”
CAPTAIN Collaboration Meeting – July, 2014.
Santa Fe, New Mexico; 2014.

“Viability of a Fourier Approach to the Neutrino Mass Hierarchy Problem in WATCHMAN.”
UC Davis 25th Annual Undergraduate Research, Scholarship & Creative Activities Conference.
University of California, Davis; Davis, California; 2014. [↗](#)

“Determining the Hierarchy of Neutrino Masses Using Fourier Analysis and Matched-Filter Signal Processing.”
UC Davis 24th Annual Undergraduate Research, Scholarship & Creative Activities Conference.
University of California, Davis; Davis, California; 2013. [↗](#)

Workshops

Physics

12th International Neutrino Summer School.
Fermi National Accelerator Laboratory (Fermilab), August 2019.

U.S. Delegate and Poster Judge at Canadian-American-Mexican Graduate Student Physics Conference.
Laurentian University, Sudbury, Ontario, Canada, July 2019.

Fifth Young Professionals Nuclear Forum.
Stanford University, May 2019.

Mentor at Nuclear Innovation Bootcamp.
University of California, Berkeley, 2018.

Santa Fe Summer Workshop in Particle Physics.
Los Alamos National Laboratory. Santa Fe, New Mexico, 2018.

Expert Reference at Nuclear Innovation Bootcamp.

University of California, Berkeley, 2017. [↗](#)

Mentor at Nuclear Innovation Bootcamp.

Nuclear Innovation Alliance, US Department of Energy. UC Berkeley, 2016. [↗](#)

Workshop on the Application of Open Source Tools for Nuclear Nonproliferation Research.

Nuclear Science and Security Consortium. UC Berkeley, 2015.

School of Nukes.

Nuclear Science and Security Consortium. Los Alamos National Laboratory, 2014.

Summer School in Nuclear Analytical Techniques.

Nuclear Science and Security Consortium. UC Davis, 2012, 2013

Long-Baseline Neutrino Experiment (LBNE) Water-Cherenkov Reconstruction Workshop.

Fermi National Accelerator Laboratory (Fermilab). Batavia, Illinois, 2011.

Expositions

Artificial Intelligence

Whitecoat, Inc.

Impact Global Ventures Summit 2018.

Sacramento Kings Stadium; Sacramento, California; 2016.

Whitecoat, Inc.

Impact Global Ventures Summit 2016.

Sacramento Kings Stadium; Sacramento, California; 2016.

Posters

Physics

“Resolving the Neutrino Mass Ordering, Despite Nuclear Structure.”

12th International Neutrino Summer School.

Fermi National Accelerator Laboratory (Fermilab); Batavia, Illinois; 2019.

“Solving the Neutrino Mass Hierarchy Problem, Despite Nuclear Structure.”

34th Annual New Mexico Symposium.

National Radio Astronomy Observatory Science Operations Center; Socorro, New Mexico; November, 2018. [↗](#)

Los Alamos National Laboratory 75th Anniversary Student Symposium.

Los Alamos National Laboratory; Los Alamos, New Mexico; August, 2018.

“Investigation of the Sensitivity of WATCHMAN to Measure the Neutrino Mass Hierarchy.”

Los Alamos National Laboratory; Los Alamos, New Mexico; 2014.

University & Industry Technical Interchange Review Meeting.

Walnut Creek, California; June, 2014;

“Determining the Hierarchy of Neutrino Masses Using Discrete Fourier Analysis.”

2013 Fall Meeting of the APS Division of Nuclear Physics.

Newport News, Virginia; October, 2013. [↗](#)

Medicine

“Dare to Prevent STDs Globally.”
37th Annual Fulbright Conference.
Washington, DC; 2014.

“Bridging the Gap Between Food and Medicine with Technology.”
37th Annual Fulbright Conference.
Washington, DC; 2014.

Skills & Certifications

Radiation laboratory experience and training.
Los Alamos National Lab. Certified Radiological Worker II & UC Davis Certified.

Class 4 laser laboratory experience and training.
Los Alamos National Lab. Certified.

Clean room laboratory experience and training.
UC Berkeley Certified.

Room-temperature / cryogenic photonics development and characterization proficiency.

Data acquisition hardware and software development proficiency.

Superconductor / semiconductor microfabrication experience.

Contributor to multiple open source software projects.

Machine learning algorithm design proficiency, including deep neural network proficiency.
Keras and TensorFlow machine learning proficiency.

C, C++, and Python 2 and 3 fluency (including NumPy).

Fortran proficiency.

Mathematica, SageMath proficiency.

CERN ROOT proficiency (C++/Cling/CINT/PyROOT).

RAT-PAC detector simulation and analysis proficiency.

Docker software containerization proficiency.

Amazon Web Services and on-site server administration proficiency.

HTTP Representational State Transfer (REST) API design and development fluency.

SQL and NoSQL database design and object mapping proficiency.

Unified Modeling Language proficiency.

Puppet configuration management proficiency.

Linux/macOS/Windows operating system proficiency.

Classically trained pianist and composer. [🔗](#)

Invited soloist in Jackson Hall at Robert and Margrit Mondavi Center for the Performing Arts.

References

Prof. Robert C. Svoboda

Professor and Past Chair
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Dr. Anna C. Hayes

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Prof. Gerald T. Garvey

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<http://danielson.pro/cv>