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John Hardin

Education

2012–2018 **Ph. D.**, *Massachusetts Institute of Technology*.
Cambridge, MA
Physics
Adviser: Michael Williams

2008–2012 **B.S.**, *University of North Carolina - Chapel Hill*.
Physics, Mathematics
Adviser: Hugon Karwowski

Employment

2021–current **Postdoctoral Researcher**, *Massachusetts Institute of Technology*.
IceCube
Adviser: Janet Conrad

2019–2021 **IceCube Winterover Experiments Operator and Station Science Lead**, *IceCube Collaboration*.
Amundsen-Scott South Pole Station

2018–2019 **Postdoctoral Researcher (interim)**, *Massachusetts Institute of Technology*.
KamLAND-Zen
Adviser: Lindley Winslow

Teaching

Fall 2017 Graduate Intro Nuclear/Particle *Teaching Assistant*

Spring 2016 Graduate Nuclear Physics *Teaching Assistant*

Summer 2014 HSSP
Taught an Intro Physics Summer Program to Highschoolers over 6 weeks

Collaboration Leadership

Coordinator Columbia-Harvard-MIT Global Fits Group

Analysis Coordinator IceCube Matter Enhanced Oscillations With Steriles (MEOWS) Group

Honors And Awards

2014 Jefferson Science Associates/Jefferson Laboratory Graduate Fellowship

2013 Jefferson Science Associates/Jefferson Laboratory Graduate Fellowship

2012 Frank Fellow - MIT First Year Fellowship

Research Activities

Postdoctoral Research

- Coordinating and coding for Short Baseline Sterile Neutrino Global Fits efforts.
- Examining the underlying statistic of the global fits models.
- Analyzing MEOWS data for other BSM signals.
- Overseeing graduate students developing machine learning techniques for use on IceCube.
- Organized KamLAND-Zen Software from Tohoku University for use on other systems and clusters. Unified the install of the analysis chain. Extended the analysis chain for usability and transparency for local analyzers.
- Oversaw graduate students developing machine learning techniques for use on KamLAND-Zen.

Graduate Research

- Developed FastDIRC: a package to track photons through a DIRC based Cerenkov PID system O(10000) faster than Geant4. Cerenkov photons are traced through the DIRC by leveraging the rectangular geometry to convert repeated reflection into a single ray trace. This allows a KDE approach to reconstruction which improves angular resolution by 20% and is applicable to many DIRC geometries. FastDIRC was used to validate and improve the GlueX DIRC design resulting in a threefold cost savings on the readout box construction.
- Measured the wavelength-dependent reflectivitity of a variety of mirror surfaces for use in the DIRC readout. Used a similar setup to measure the transmission of optical cookies for coupling PMTs to the readout box.
- Developed a monitoring system for transport of the DIRC across the country. Video, accelerometry, and pressure data were collected on the transport and trasmitted to a chase car where it was monitored. Set up the network infrastructure for communication with the monitoring system.
- Maintained the GlueX software locally for interface with the CMS Tier 2 grid at MIT.
- Used a binary decision tree to compare expected particle identification (PID) performance of several proposed PID subdetectors.

Colloquia, Seminars, and Talks at Scientific Conferences

Presentations

Nov 2023 "(Upcoming) Provisional title: Warmspot in IceCube"
University of Michigan Seminar

Oct 2023 "(Upcoming) Sterile Neutrino Global Fits: 3+1 and Beyond?"
Brookhaven Forum 2023

Sep 2023 "Neutrino Flavored Ice"
Colloquium at Tufts University

Aug 2023 "Sterile Neutrino Fits: 3+1 and Beyond?"
WIPAC Student Seminar

Jun 2023 "The MEOWS 3+1 Sterile Result"
WIPAC Seminar

Apr 2023 "IceCube MEOWS Working Group Update"
APS April Meeting

Jan 2023 "The Future of Neutrino Physics is Bright"
Colloquium at Northeastern University

Nov 2022 "Sterile Neutrino Short Basline Fits in 2022"
Laboratory for Nuclear Sciences Seminar at MIT

Oct 2022 "Preference for Damping Effects in the Global Fits"
Northwestern University Seminar

Oct 2021 "IceCube at the South Pole"
APS DNP Undergraduate Physics Seminar

May 2021 "Wintering at the Pole"
Laboratory for Nuclear Sciences Seminar at MIT

May 2019 "KamLAND-Zen Status and Future Plans"
Conference on Science at the Sanford Underground Research Facility 2019 - Invited

Oct 2017 "The GlueX DIRC Detector"
APS Division of Nuclear Physics - at the GlueX mini-symposia

Oct 2016 "Leptophobic Boson Searches"
APS Division of Nuclear Physics - at the GlueX mini-symposia

Posters

Jun 2022 "Current Progress on Sterile Neutrino Global Fits in 2022"
2022 International Conference on Neutrino Physics and Astrophysics

Aug 2016 "A DIRC Detector for GlueX"
Gordon Photonuclear Reactions Conference

Jun 2016 "A DIRC Detector for GlueX"
Jefferson Laboratory User's Group Meeting

Nov 2015 "A Focusing DIRC Detector for GlueX"
European Research Conference on Electromagnetic Interactions with Nucleons and Nuclei

Talks for Students

Jun 2023 "Basic Statistics"
IceCube Summer School

Jun 2022 "Basic Statistics"
IceCube Summer School

Mar 2022 "IceCube at the South Pole"
University of Wisconsin-Madison Physics Guest Lecture

Feb 2022 "IceCube at the South Pole"
IceCube After School Lecture

Nov 2021 "IceCube at the South Pole"
University of Wisconsin-Madison Physics Guest Lecture

Oct 2021 "IceCube at the South Pole"
University of North Carolina Chapel Hill Physics Guest Lecture

Mar 2021 "Life at the Pole"
Student Seminar at MIT

Outreach

Jul 2023 Talk for local school-aged children at Grandparents University

Apr 2023 Physics Science Fair volunteer at University of Wisconsin-Madison

Dec 2022 Quoted in BBC Sky at Night

Oct 2022 Science Days at UW-Madison

Jul 2022 Talk for local school-aged children at Grandparents University

Jul 2022 Davis-Bachall Fellows Talk

Apr 2022 Physics Science Fair volunteer at University of Wisconsin-Madison

Jan 2022 IceCube booth on the frozen lake

Outreach from the South Pole

Oct 2020 Narrated and helped shoot "South Pole Tour", a video on working for IceCube at the South Pole

Jul 2020 Astrophysics talk at the MOBSTER-1 Virtual Conference

Jul 2020 Live call to a school in Takayama, Gifu Japan

Jun 2020 Live Q&A with a school group in Tennessee

Jun 2020 Astronomy on Tap for The University of Edinburgh's School of Physics & Astronomy

Jun 2020 Shout-out at SciAccess 2020: The Virtual Science Accessibility Conference organized by Ohio State University

May 2020 Physics Magazine Letter to the Editor about life at the Pole

Apr-Jun 2020 Six public webcasts including a "Kids' Edition" with Jargie the Science Girl

Mar 2020 Quoted in Nature News about life at the Pole

References

Primary References

Janet Conrad Postdoctoral Adviser
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Lindley Winslow
Postdoctoral Adviser
Professor, MIT
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Jim Madsen
IceCube Experiment Co-collaborator
Executive Director, WIPAC
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Secondary References

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Cambridge, MA 02139
(617) 253-4816

Michael Shaevitz
Global Fits Co-collaborator
Professor, Columbia
mhs4@columbia.edu
538 West 120th Street
722 Pupin Mail Code 5220
New York, NY 10027
(212) 854-3305

John Hardin, Publications

Selected Publications

Thesis

The GlueX DIRC Detector and Searching for Leptophobic Bosons at GlueX
Supervisor: Michael Williams https://dspace.mit.edu/handle/1721.1/119104

Publications for which I am a principal co-author:

J.M. Hardin *Wilks's Theorem, Global Fits, and Neutrino Oscillations* Submitted to European Journal of Physics Sep 2023 arxiv:2211.06347

J.M. Hardin, I. Martinez-Soler, A. Diaz, M. Jin, N.W. Kamp, C.A. Argüelles, J.M. Conrad, M.H. Shaevitz, *New Clues About Light Sterile Neutrinos: Preference for Models with Damping Effects in Global Fits* Sep 2023 arxiv:2211.02610, J. High Energ. Phys. 2023, 58 (2023)

A. Ali et. al. *The GLUEX DIRC program* Apr 2020 arxiv:2002.07990, Journal of Instrumentation 15 (2020) no. 4, C04054

J. Hardin, M. Williams. *FastDIRC: A Fast Monte Carlo and Reconstruction Algorithm for DIRC Detectors* Aug 2016 arxiv:1608.01180, Journal of Instrumentation 11 (2016) no. 10, P10007

J. Stevens et. al. *The GlueX DIRC project* Jul 2016 arxiv:1606.05645, Journal of Instrumentation 11 (2016) no. 07 C07010

B. Guegan, J. Hardin, J. Stevens, M. Williams. *Model Selection for Amplitude Analysis* May 2015 arxiv:1505.05133, Journal of Instrumentation 10 (2015) no. 9 P09002

Publications from my Working Group

R. Abbasi *et al.* [IceCube], *Search for Unstable Sterile Neutrinos with the IceCube Neutrino Observatory*, arXiv:2204.00612 Phys. Rev. Lett. **129**, no.15, 15 (2022)

R. Abbasi *et al.* [IceCube], *Strong Constraints on Neutrino Nonstandard Interactions from TeV-Scale ν_u Disappearance at IceCube*, arXiv:2201.03566 Phys. Rev. Lett. **129**, no.1, 1 (2022)

R. Abbasi *et al.* [IceCube], *Searching for Decoherence from Quantum Gravity at the IceCube South Pole Neutrino Observatory*, arXiv:2308.00105

Full Publication List

A full list of publications, including IceCube Collaboration Papers, can be found here: https://inspirehep.net/authors/1829624