

Miaochen Jin

HARVARD UNIVERSITY · PH.D. CANDIDATE
LABORATORY OF PARTICLE PHYSICS AND COSMOLOGY

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Summary

I am a Ph.D. Candidate in Physics at Harvard University, working as a research assistant with Professor Carlos A. Argüelles; I am also a member of the IceCube Collaboration. My current research interests form a heterogeneous subset of neutrino physics. While I am currently focusing on general double-bang search in IceCube, I am also interested in machine learning reconstruction for neutrino telescopes, especially enabling real-time ML data processing by low-power-consuming hardware alternatives. My personal website is [here](#).

Education

Harvard University

Ph.D in Physics

Cambridge, MA

Sep. 2021 – Present

University of Chicago

B.A. in Physics with Honor

Chicago, IL

Oct. 2017 – June 2021

B.S. in Mathematics

Oct. 2017 – June 2021

Minor in Computer Science

Oct. 2017 – June 2021

Awards and Honors

Student Recognition of Teaching

Harvard University

May. 2023

White Prize for Excellence in Teaching

Harvard University

Apr. 2023

Magna Cum Laude

University of Chicago

Jun. 2021

Dean's List

University of Chicago

Jun. 2018, Jun. 2019, and Jun. 2020

Professional Experience

Harvard University

Research Assistant

Cambridge, MA

Sep. 2021 – Present

Research assistant working with Carlos Argüelles at the Laboratory of Particle Physics and Cosmology. Research included IceCube analysis, neutrino oscillations, BSM phenomenology and machine learning for neutrino physics.

High Energy Accelerator Research Organization (KEK)

Research Intern

Tsukuba, Japan

Jul. 2023 – Aug. 2023

Research intern at the KEK QUP Internship Program (QUPIP) working with Professor Volodymyr Takhistov on Neutrino Echo and Boosted Dark Matter

University of Chicago

Research Assistant

Chicago, IL

Feb. 2020 – Dec. 2021

Research assistant working with Professor Carlos Wagner on reconciling cosmological and experimental bounds on sterile neutrino mass as well as developing analytical approximation methods of MSW effect in 3+1 model.

IBM Research

Research Intern

San Jose, CA

Jun. 2019 – Aug. 2019

Research intern working with the machine learning team at IBM research. Contributed to the early stages of development of genetic algorithms on the first large scale FPGA-powered neural computer at IBM Research. The [paper](#) is later highlighted on [VentureBeat](#).

James Frank Institute, University of Chicago

Research Assistant

Chicago, IL

Apr. 2018 – Oct. 2020

Research assistant working with Professor Stuart Rice and Doctor Binhua Lin on simulating ligand-coated gold nanoparticles in solvent. Contributed to the early computations and simulation development. The [article](#) is later published in J. Chem. Phys.

Argonne National Laboratory

Research Intern

Research Intern working with Dr. Balaprakash on hyperparameter auto-tuning for Convolutional Neural Networks.

Lemont, IL

Jun. 2018 – Aug. 2020

Community Involvement and Outreach

Boston Area Chinese Young Physicists Seminar

Founder

Boston, MA

Jul., 2022 - Present

Founded and running a [weekly seminar for mandarin-speaking young physicists in the greater Boston area](#), including researchers and students from Harvard, MIT, Brandeis, Tufts, Boston University, Boston College and Northeastern University. Host regular seminars by the students as well as invited lectures by renowned professors. Our goal is to provide a supportive and collaborative environment for physicists who are native mandarin speakers in the greater Boston area: I believe in the importance of being able to discuss what we love in our own native languages.

Boston/Cambridge Boarding High School Students Spring Camp

Mentor

Cambridge, MA

Mar. 2022

Mentored boarding high school students on a spring break camp, this includes teaching high school level classes, AP curriculum, as well as introducing my own research on an appropriate level for aspiring young scientists.

Mentoring Experience

Harvard University

Research Mentor

Cambridge, MA

Jul. 2021 – Present

Mentor of Tong Zhu, an undergraduate from the University of Science and Technology of China, and a visiting intern associated with the Argüelles-Delgado group at the time of internship. Our project looks at the optimization of IceCube Gen-2 geometry using graph neural networks. Tong presented her work on APS April Meeting 2023. Our paper is now published on [arXiv](#). Tong is now a PhD student at UC Berkeley.

Harvard University

Research Mentor

Cambridge, MA

Sep. 2023 – Feb. 2024

Mentor of Santiago Giner, a senior undergraduate student of Harvard College and research assistant in the Argüelles-Delgado group at the time of internship. Our project focuses on improving the sensitivity to neutrino mass ordering using atmospheric neutrino oscillation data by incorporating inelasticity reconstruction. Our work is published on [Phys. Rev. D](#). Santi is now a PhD student at UC Berkeley

Harvard University

Research Mentor

Cambridge, MA

Jul. 2023 – Jan. 2024

Mentor of Emily Hu, a master graduate from Oxford University and a visiting intern associated with the Argüelles-Delgado group. Our project focuses on the detection of double bang events and specifically finding double peak waveforms using graph neural networks.

Harvard University

Polaris Program Mentor

Cambridge, MA

Sep. 2021 – Aug. 2023

Polaris Program mentor of Nika Imamberdieva, a first year undergraduate of Harvard College. The Polaris Program matches graduate students with undergraduate students to provide general help and advice on physics career, course work, and any other related question the undergraduate students might have.

Harvard University

Student Co-Mentor

Cambridge, MA

Jul. 2021 – Jun. 2023

Co-Mentor of (with Ibrahim Safa) Savanna Coffel, a first-year undergraduate associated with the Argüelles-Delgado group. Our project looks at the identification and categorization of double-bang events caused by high energy tau neutrinos in IceCube using machine learning methods

Teaching Experience

Physics Department, Harvard University

Teaching Fellow

Cambridge, MA

Jan. 2023 – May. 2023

Served as teaching fellow to a introductory course in electromagnetism primarily for non-physics majors. Main work includes hosting helprooms, teaching review sessions, and other administrative work.

Physics Department, Harvard University

Teaching Fellow

Cambridge, MA

Sep. 2022 – Dec. 2022

Served as teaching fellow to the renowned undergraduate course Mechanics and Special Relativity, very challenging introductory course available to Harvard undergraduates. Includes teaching sections, drafting problem sets and exams, and hosting office hours.

Department of Mathematics, University of Chicago

Course Assistant

Chicago, IL

Oct. 2018 – April. 2020

Served as course assistant to first-year and second-year level math courses including Calculus, Introduction to Proofs in Analysis and Mathematical Methods for Physical Sciences. Hosted office hours and graded student homework

Invited Talks and Seminars

Two Watts is All You Need: Enabling In-Detector Real-Time Machine Learning for Neutrino Telescopes Via Edge Computing

The NSF AI Institute for Artificial Intelligence and Fundamental Interactions (IAIFI) Journal Club

Cambridge, MA

Oct. 2023

Hunting for Beyond the Standard Model physics with Neutrino Telescopes

High Energy Accelerator Research Organization Theory Center Seminar

Tsukuba, Ibaraki, Japan

Aug. 2023

Conferences, Workshops, and Schools

TeVPA 2024

Gave talk on TPU acceleration of real-time event processing in neutrino telescopes

Chicago, IL

Aug. 2024

Neutrino 2024

Presented poster on searching for charmed-hadron-induced double-cascade events in neutrino telescopes

Milan, Lombardy, Italy

June. 2024

High Energy Accelerator Research Organization QUP Week

Presented poster on probing sterile neutrino global fits with quantum decoherence and neutrino invisible decays

Tsukuba, Ibaraki, Japan

Aug. 2023

International Cosmic Ray Conference (ICRC) 2023

Presented poster on low power neutrino telescope event reconstruction on Tensor Processing Units

Nagoya, Aichi, Japan

July. 2023

APS April Meeting 2023

Gave a talk on improving neutrino telescope muon track reconstruction by identifying PMT muon-dynode pre-pulse signatures

(Virtual) Minneapolis, MN, USA

Apr. 2023

IAIFI Summer School and Workshop 2022

Cambridge, MA

Aug. 2022

Neutrino 2022

Presented poster on the idea and performance of an original implementation of Deep Hierarchical Neural Network compatible to tensor processing units for the purpose of accelerating IceCube event reconstruction

(Virtual) Seoul, Korea

Jun. 2022

APS April Meeting 2022

Gave a talk on preliminary results on a combined fit of neutrino oscillation parameters with IceCube and SuperK

New York, NY, USA

Apr. 2022

AstroDark 2021

Presented poster on an analytic approximation method to long baseline neutrino oscillation probability in a model for light sterile neutrinos

Vritual

Dec. 2021

IBM Summer Symposium 2019

Gave talk on the results of training a genetic algorithm "Deep Neuro-Evolution" on IBM FPGA-powered computer

San Jose, CA, USA

Jul. 2019

Chicago Area Undergraduate Research Symposium 2019

Presented poster on the effect of solvent on mechanical properties of ligand coated Au nanoparticles

Chicago, IL, USA

Apr. 2019

Summer Argonne Student Symposium 2018

Presented results on benchmarking hyperparameter optimization for convolutional neural networks

Lemont, IL, USA

Aug. 2018

Selected Publications and Proceedings

My Orchid is [0000-0003-0487-5559](https://orcid.org/0000-0003-0487-5559). For a full list of publications, please visit my [Inspire profile](#). The following are selected works to which I made significant and essential contributions.

Two Watts is All You Need: Enabling In-Detector Real-Time Machine Learning for Neutrino Telescopes Via Edge Computing

Miaochen Jin, Yushi Hu, Carlos A. Argüelles

J. Cosmol. Astropart. Phys.

[arXiv](#)

Comparison of Geometrical Layouts for Next-Generation Large-volume Cherenkov Neutrino Telescopes

Tong Zhu, Miaochen Jin, Carlos A. Argüelles

[arXiv](#)

Boosting Neutrino Mass Ordering Sensitivity with Inelasticity for Atmospheric Neutrino Oscillation Measurement

Santiago Giner Olavarrieta, Miaochen Jin, C. A. Argüelles, P. Fernández, I. Martínez-Soler

Phys. Rev. D

[arXiv](#)

Measuring Oscillations with A Million Atmospheric Neutrinos

C. A. Argüelles, P. Fernández, I. Martínez-Soler, M. Jin

Phys. Rev. X

[arXiv](#)

New Clues About Light Sterile Neutrinos: Preference for Models with Damping Effects in Global Fits

J.M. Hardin, I Martínez-Soler, A. Diaz, M. Jin, M.W. Kamp, C.A. Argüelles, J.M. Conrad, M.H. Shaevitz

J. High Energy Phys.

[arXiv](#)

Selected Slides and Posters

Two Watts Is All You Need

TeV Particle Astrophysics 2024

[Slides](#)

Aug. 2024

Charmed-Hadron-Induced Double Cascades in Neutrino Telescopes

Neutrino 2024

[Slides](#)

June. 2024

Two Watts is All You Need: Enabling In-Detector Real-Time Machine Learning for Neutrino Telescopes Via Edge Computing

The NSF AI Institute for Artificial Intelligence and Fundamental Interactions Journal Club

[Slides](#)

Oct. 2023

Low Power Real-Time Event Reconstruction for Water(Ice) Cherenkov Neutrino Telescopes

International Cosmic Ray Conference 2023

[Poster](#)

Aug. 2023

Improving Neutrino Telescope Track Reconstruction with PMT Muon Pre-Pulse

APS April Meeting 2023

[Slides](#)

Apr. 2023

Accelerating IceCube Neutrino Event Reconstruction on Tensor Processing Units

Neutrino 2022

[Poster](#)

Aug. 2022

Hunting for the Neutrino Oscillation Parameters with One Million Neutrinos in SK and IceCube

APS April Meeting 2022

Long Baseline Oscillation Probability Approximation in a Model for Light Sterile Neutrinos

AstroDark 2021

[Slides, Video](#)

[Apr. 2022](#)

[Poster](#)

[Dec. 2021](#)