Miaochen **Jin**

Harvard University · Ph.D. Candidate
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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 hadronic (charm) physics in IceCube, I am also interested in neutrino oscillations as well as fast, low-power machine learning for neutrino telescopes. My personal website is here.

Education

Harvard University — *Cambridge, MA*
Ph.D in Physics — *Sep. 2021 – Present*

University of Chicago — *Chicago, IL*
B.A. in Physics with Honor — *Oct. 2017 – June 2021*
B.S. in Mathematics — *Oct. 2017 – June 2021*
Minor in Computer Science — *Oct. 2017 – June 2021*

Awards and Honors

Gertrude and Maurice Goldhaber Prize — *Harvard University*
Awarded to and recognizing the most outstanding experimental graduate student in the department — *April. 2025*

Student Recognition of Teaching — *Harvard University*
May. 2023

White Prize for Excellence in Teaching — *Harvard University*
For excellence in teaching introductory courses — *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 — *Cambridge, MA*
Research Assistant — *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) — *Tsukuba, Japan*
Research Intern — *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 — *Chicago, IL*
Research Assistant — *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 — *San Jose, CA*
Research Intern — *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 — *Chicago, IL*
Research Assistant — *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 *Lemont, IL*

Research Intern *Jun. 2018 – Aug. 2020*

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

Community Involvement and Outreach

Neutrino Monte Carlo Database *Boston, MA*

Maintainer *Sept, 2024 - present*

Maintain a database of neutrino monte carlos events for multiple neutrino telescopes around the world. we aim to provide an open source community for all neutrino physicist in studying neutrino telescopes.

Boston Area Chinese Young Physicists Seminar *Boston, MA*

Founder *Jul., 2022 - Sept., 2024*

Founded and ran 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 *Cambridge, MA*

Mentor *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 *Cambridge, MA*

Research Mentor *Mar, 2025 – Present*

Mentor of Yaroslav Avletshin, an undergraduate at the collge of Harvard University associated with the Argüelles-Delgado group right now. We plan to study a machine learning approach to the ray tracking problem in neutrino detector, making the most expensive Monte Carlo step of photon propagation efficient and scalable.

Harvard University *Cambridge, MA*

Research Mentor *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 *Cambridge, MA*

Research Mentor *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 *Cambridge, MA*

Research Mentor *Jul. 2023 – Jan. 2024*

Mentor of Emily Hu, a master graduate from Oxford University and a visting 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 *Cambridge, MA*

Polaris Program Mentor *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 *Cambridge, MA*

Student Co-Mentor *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 *Cambridge, MA*

Teaching Fellow *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 *Cambridge, MA*

Teaching Fellow *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 *Chicago, IL*

Course Assistant *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 *Cambridge, MA*

The NSF AI Institute for Artificial Intelligence and Fundamental Interactions (IAIFI) Journal Club *Oct. 2023*

Hunting for Beyond the Standard Model physics with Neutrino Telescopes *Tsukuba, Ibaraki, Japan*

High Energy Accelerator Research Organization Theory Center Seminar *Aug. 2023*

Conferences, Workshops, and Schools

TeVPA 2024 *Chicago, IL*

Gave talk on TPU acceleration of real-time event processing in neutrino telescopes *Aug. 2024*

Neutrino 2024 *Milan, Lombardy, Italy*

Presented poster on searching for charmed-hadron-induced double-cascade events in neutrino telescopes *June. 2024*

High Energy Accelerator Research Organization QUP Week *Tsukuba, Ibaraki, Japan*

Presented poster on probing sterile neutrino global fits with quantum decoherence and neutrino invisible decays *Aug. 2023*

International Cosmic Ray Conference (ICRC) 2023 *Nagoya, Aichi, Japan*

Presented poster on low power neutrino telescope event reconstruction on Tensor Processing Units *July. 2023*

APS April Meeting 2023 *(Virtual) Minneapolis, MN, USA*

Gave a talk on improving neutrino telescope muon track reconstruction by identifying PMT muon-dynode pre-pulse signatures *Apr. 2023*

IAIFI Summer School and Workshop 2022 *Cambridge, MA*

Aug. 2022

Neutrino 2022 — *(Virtual) Seoul, Korea*
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 — *Jun. 2022*

APS April Meeting 2022 — *New York, NY, USA*
Gave a talk on preliminary results on a combined fit of neutrino oscillation parameters with IceCube and SuperK — *Apr. 2022*

AstroDark 2021 — *Vritual*
Presented poster on an analytic approximation method to long baseline neutrino oscillation probability in a model for light sterile neutrinos — *Dec. 2021*

IBM Summer Symposium 2019 — *San Jose, CA, USA*
Gave talk on the results of training a genetic algorithm "Deep Neuro-Evolution" on IBM FPGA-powered computer — *Jul. 2019*

Chicago Area Undergraduate Research Symposium 2019 — *Chicago, IL, USA*
Presented poster on the effect of solvent on mechanical properties of ligand coated Au nanoparticles — *Apr. 2019*

Summer Argonne Student Symposium 2018 — *Lemont, IL, USA*
Presented results on benchmarking hyperparameter optimization for convolutional neural networks — *Aug. 2018*

Selected Publications and Proceedings

My Orchid is 0000-0003-0487-559. 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 — *J. Cosmol. Astropart. Phys.*
Miaochen Jin, Yushi Hu, Carlos A. Argüelles — *arXiv*

Comparison of Geometrical Layouts for Next-Generation Large-volume Cherenkov Neutrino Telescopes — *J. Instrumentation*
Tong Zhu, **Miaochen Jin**, Carlos A. Argüelles — *arXiv*

Boosting Neutrino Mass Ordering Sensitivity with Inelasticity for Atmospheric Neutrino Oscillation Measurement — *Phys. Rev. D*
Santiago Giner Olavarrieta, **Miaochen Jin**, C. A. Argüelles, P. Fernández, I. Martínez-Soler — *arXiv*

Measuring Oscillations with A Million Atmospheric Neutrinos — *Phys. Rev. X*
C. A. Argüelles, P. Fernández, I. Martínez-Soler, **M. Jin** — *arXiv*

New Clues About Light Sterile Neutrinos: Preference for Models with Damping Effects in Global Fits — *J. High Energy Phys.*
J.M. Hardin, I Martinez-Soler, A. Diaz, **M. Jin**, M.W. Kamp, C.A. Argüelles, J.M. Conrad, M.H. Shaevitz — *arXiv*

Selected Slides and Posters

Two Watts Is All You Need — *Slides*
TeV Particle Astrophysics 2024 — *Aug. 2024*

Charmed-Hadron-Induced Double Cascades in Neutrino Telescopes — *Slides*
Neutrino 2024 — *June. 2024*

Two Watts is All You Need: Enabling In-Detector Real-Time Machine Learning for Neutrino Telescopes Via Edge Computing — *Slides*
The NSF AI Institute for Artificial Intelligence and Fundamental Interactions Journal Club — *Oct. 2023*

Low Power Real-Time Event Reconstruction for Water(Ice) Cherenkov Neutrino Telescopes *Poster*
International Cosmic Ray Conference 2023 *Aug. 2023*

Improving Neutrino Telescope Track Reconstruction with PMT Muon Pre-Pulse *Slides*
APS April Meeting 2023 *Apr. 2023*

Accelerating IceCube Neutrino Event Reconstruction on Tensor Processing Units *Poster*
Neutrino 2022 *Aug. 2022*

Hunting for the Neutrino Oscillation Parameters with One Million Neutrinos in SK and IceCube *Slides, Video*
APS April Meeting 2022 *Apr. 2022*

Long Baseline Oscillation Probability Approximation in a Model for Light Sterile Neutrinos *Poster*
AstroDark 2021 *Dec. 2021*