Alina Lynn Kochocki
Curriculum Vitae (July, 2024)

CONTACT INFORMATION

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RESEARCH INTERESTS

- Cosmic-ray acceleration and neutrino production in astrophysical jets.
- Atmospheric neutrinos and the modeling of hadronic interactions.
- Machine learning applications in particle physics and astrophysics.
- The optimization and construction of future neutrino observatories.

EDUCATION

Michigan State University *September 2021 - June 2026*
Doctor of Philosophy in Physics (intended)

University of California, Los Angeles *September 2017 - March 2021*
Bachelor of Science in Physics. GPA: 3.893
Magna Cum Laude, Highest Departmental Honors

RESEARCH EXPERIENCE

University Distinguished Fellow *August 2021 - present*
Advised by Nathan Whitehorn, Michigan State University.

- Pursuing robust multiwavelength tracers of extragalactic and galactic neutrino activity.
- Developing a next generation analysis of the diffuse neutrino spectrum.
- Modernizing IceCube's most physical, likelihood-based reconstruction algorithm with generative inference.
- Overseeing optical and environmental testing of the IceCube Upgrade mDOM optical module (MSU lot).
- Forecasted IceCube-Gen2 diffuse sensitivity with track and cascade-like event selections. Involvement was a continuation of detector performance studies completed at UCLA.

Undergraduate Research Scholar *August 2020 - August 2021*
Advised by Alexander Kusenko, University of California, Los Angeles.

- Developed an analysis to test the presence of an exotic, heavy dark matter candidate particle with IceCube data. Project was funded by the UCLA Undergraduate Research Center (UCLA-URC).
- Completed a search for IceCube emission correlated with AGN and starburst galaxy populations, assuming secondary neutrino production from intermediate cosmic-ray interactions with extragalactic background light. Work was jointly advised by Nathan Whitehorn.

Undergraduate Research Scholar *August 2019 - August 2020*
Advised by Rene Ong, University of California, Los Angeles.

- Carried out a study of 14 VERITAS (Very Energetic Radiation Imaging Telescope Array System) candidate pulsar wind nebulae. Performed radiative modeling of their associated spectral energy distributions and numerical simulation of dynamical evolution. Funded by UCLA-URC.

Undergraduate Research Fellow *December 2018 - August 2019*
Advised by Rene Ong, University of California, Los Angeles.

- Analysis and periodicity study of ten years of HESS J0632+057 VERITAS observations, a compact object of unknown nature in orbit with a Be-class star.
- Preliminary analysis of PSR J2032+4127.

Undergraduate Research Assistant   *December 2018 - August 2020*
Advised by Rene Ong, University of California, Los Angeles.

- Study of multiple revisions to the custom SiPM-preamplifier to be used onboard GAPS (General Anti-Particle Spectrometer) time-of-flight system.

- Designed, and debugged a new lab testing bed to automate the testing of 400+ preamplifier/SiPM (silicon photomultiplier) components. Machined custom parts. Wrote procedures for tests and produced the necessary analysis pipeline.

Summer Undergraduate Research Student   *December 2018 - August 2019*
Advised by Rene Ong, University of California, Los Angeles.

- Tested gain linearity of S13360 series SiPMs with custom preamplifier boards for GAPS. Produced original analysis scripts to identify and address varying sources of unexpected noise, greatly improving single photoelectron resolution, gain calculations, and general understanding of the device. A write-up of these results was shared with the device's principle engineers (Hamamatsu).

TECHNICAL SKILLS

Programming Languages: C, C++, Python, Bash, Perl.
High-Level Languages: Mathematica, SOLIDWORKS.
Relevant Software: XGBoost, TensorFlow, Pythia, Geant4, ROOT, Arduino, SCPI.
Analysis Packages: IceTray, VEGAS.
Distributed Computing: TORQUE, Sun Grid Engine, Slurm, HTCondor.
Communication: GitHub, LaTeX, Overleaf, Wiki markup, Microsoft Office, Google Apps.
Backend/Frontend Development: JAVA, HTML, CSS.

SELECTED PUBLICATIONS

- Alina Kochocki for the IceCube-Gen2 Collaboration. 2023 "Forecasted Sensitivity of IceCube-Gen2 to the Astrophysical Diffuse Spectrum". *PoS*, ECRS, 100

- Alina Kochocki, Volodymyr Takhistov, Alexander Kusenko and Nathan Whitehorn. 2021 "Contribution of Secondary Neutrinos from Line-of-Sight Cosmic Ray Interactions to the IceCube Diffuse Astrophysical Flux". *ApJ*, 914, p.91

TALKS AND PRESENTATIONS

- Turbulence in Astrophysical Environments (Santa Barbara, USA) – February 2024. Invited talk on, "A Multimessenger View of Acceleration in AGN Cores."

- TeV Particle Astrophysics (Napoli, Italy) – September 2023. Contributed talk on, "Investigating Millimeter-Bright AGN as Astrophysical Neutrino Sources."

- 27th European Cosmic Ray Symposium (Nijmegen, the Netherlands) - July 2022. Oral presentation on the "Forecasted Sensitivity of IceCube-Gen2 to the Astrophysical Diffuse Spectrum."

- 237th Meeting of the American Astronomical Society - January 2021. Spoke on "Reevaluating Possible Explanations for the IceCube Diffuse Spectrum in Context of New Constraints on the Neutrino Flux from AGN and Starburst Galaxy Populations."

- UCLA Undergraduate Research Virtual Showcase - May 2020. Gave an oral presentation, "Modeling the Acceleration Mechanisms Powering the Twelve Pulsar Wind Nebulae Observed by VERITAS."

- UCLA Undergraduate Research Poster Fair - May 2019. Presented poster, "A New Periodicity and Spectral Analysis of Binary Gamma Ray Source HESS J0632+057 with VERITAS."

AWARDS AND HONORS

Michigan State University STEM Ambassador, STEMAP	February 2023
University Distinguished Fellowship, Michigan State University	August 2021
Recruiting Fellowship, Michigan State University	August 2021
USRA Distinguished Undergraduate Award - Honorable Mention	August 2020
Honors Summer Research Stipend Award, UCLA College Honors	June 2020
Frederick R. Waingrow Peterson Publishing Company Scholarship	April 2019
Invited Member of UCLA College Honors Program	April 2017

OUTREACH AND SERVICE

MSU PGO President *July 2024 - present*
President of the MSU Physics Graduate Organization.

Graduate Colloquium Committee Representative *July 2023 - present*
Organized and hosted student-postdoctoral lunches with visiting colloquium speakers. Worked with local colloquium committee to improve graduate and departmental colloquium attendance.

HEP Social Organization *July 2023 - present*
Hosted socials and happy hours for the high-energy physics group at MSU.

Outreach Activity, "Academic Research and Community with IceCube" *January 2023*
Developed an outreach event for high school students at St. Catherine of Siena Academy (Wixom, MI) interested in physics, astronomy and computer science. Presented on my own work with IceCube, entering science and academia, and led a guided discussion with small groups to consider the lifestyle of a researcher, bridging potential misconceptions held about STEM education and careers.

STEM Ambassador Program *September 2022 - February 2023*
Accepted into the 2022 cohort of the NSF-supported STEM Ambassador Program (STEMAP). Attended a set of regular workshops to learn best practices for outreach and in building community trust in science. Developed and carried out a novel outreach activity.

UCLA Exploring Your Universe (EYU) Science Fair *November 2018, 2020*
Presenter at UCLA's Exploring Your Universe fair. Helped manage organization of the 2020 cosmology and astroparticle physics virtual booth. Explored aspects of astroparticle physics experimentation and detection with participants of all ages and backgrounds.

Head Telescope Operator, UCLA Public Viewing Nights *September 2017 - February 2019*
Organized weekly shows, presented scientific background to large audiences, and mentored new club members.

TEACHING EXPERIENCE

Elementary Particle Physics Laboratory *September 2020 - December 2020*
A cosmic-ray detector is simulated and built from a photomultiplier tube and scintillator. Contributed to development of the virtual course syllabus structure and content. Responsible for creation and oversight of the simulation component of this course; produced a cookbook for the construction of optical physics simulations catered towards students with minimal background in experimental particle physics. Produced original Python analysis and Geant4 simulation tutorials presented in class.