

**CONTACT
INFORMATION**

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**GRADUATE
RESEARCH
INTERESTS**

- Likelihood-based analyses and exploratory studies of real and simulated instrument data. Emphasis on establishing model sensitivity for faint signals.
- The incorporation and development of novel machine-learning techniques for improved analysis performance.
- Modeling the environments and multimessenger emission of astrophysical sources. Different particle species' dynamic evolution and interactions are described with time-dependent transport equations. Fits are performed with Markov chain Monte Carlo sampling.
- Modeling atmospheric cosmic-rays, instrument response, and other complex physical processes representing systematic uncertainties relevant to high-energy neutrino astronomy.

EDUCATION

Michigan State University *September 2021 - January 2026*
Doctor of Philosophy in Physics (intended). GPA: 3.888

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

**SELECTED
PUBLICATIONS**

- (*In prep*) The IceCube Collaboration. 2025 "Timing Resolution of the IceCube Upgrade mDOM".
- (*In prep*) Alina Kochocki, Sam Hori, Emma Kun. 2025 "Delayed Gamma-ray and Radio Flaring Activity in a Selection of Fermi LAT AGN".
- (*In prep*) Alina Kochocki and Xavier Rodrigues. 2025 "Leptohadronic Modeling of the Gamma-ray Flare and Delayed Radio Flare from TXS 0506+056".
- (*In prep*) Alina Kochocki and Xavier Rodrigues. 2025 "A Leptonic Jet Model for Delayed Radio Flares in Neutrino Blazars".
- (*In prep*) The IceCube Collaboration. 2025 "A Time-Dependent Search for Neutrino Emission from Flaring X-ray Binaries".
- (*Submitted to PoS*) Kochocki et al. for the IceCube Collaboration. 2025 "A Search for Astrophysical Neutrinos from Flaring X-ray Binaries with IceCube".
- (*Submitted to ApJ*) The IceCube Collaboration and Atacama Cosmology Telescope. 2024 "A Search for Millimeter-Bright Blazars as Astrophysical Neutrino Sources".
- 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

- International Cosmic Ray Conference (Geneva, Switzerland) – July 2025. Talk on, “A Search for Astrophysical Neutrinos from Flaring X-ray Binaries with IceCube.”
- **(Invited)** Northwestern CIERA Theory Seminar (Evanston, USA) – April 2025. Spoke on, “Neutrino Production in the Disk-Jet System.”
- **(Invited)** UCLA TEPAPP Seminar (Los Angeles, USA) – March 2025. Spoke on, “From Radio to Neutrino: Clues from the Inner-Hundred Parsecs.”
- American Physical Society Global Physics Summit (Anaheim, USA) – March 2025. Spoke on, “Making Sense of Neutrino Bright Blazars.”
- **(Invited)** PACIFIC (Moorea, French Polynesia) – August 2024. Spoke on, “Flaring Signatures of IceCube Blazar AGN.”
- **(Invited)** Turbulence in Astrophysical Environments (Santa Barbara, USA) – February 2024. Talk on, “A Multimessenger View of Acceleration in AGN Cores.”
- Turbulence in the Universe (Santa Barbara, USA) – February 2024. Poster on, “Neutrino Production in Turbulent 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
National Science Foundation GRFP – Honorable Mention	April 2022
University Distinguished Fellowship, Michigan State University	August 2021
College of Natural Science Fellowship, Michigan State University	August 2021
Recruiting Fellowship, Michigan State University	August 2021
USRA Distinguished Undergraduate Award – Honorable Mention	August 2020
Undergraduate Research Scholar, UCLA URC	August 2020
Honors Summer Research Stipend Award, UCLA College Honors	June 2020
Undergraduate Research Scholar, UCLA URC	August 2019
Frederick R. Waingrow Peterson Publishing Company Scholarship	April 2019
Undergraduate Research Fellow, UCLA URC	December 2018
Invited Member of UCLA College Honors Program	April 2017

RESEARCH

EXPERIENCE

University Distinguished Fellow	August 2021 - present
Advised by Nathan Whitehorn, Michigan State University.	
• Exploring the spatial origin of neutrino and gamma-ray blazar AGN flares with a combination of multiwavelength data (Fermi-LAT, RATAN-600) and VLBI morphological observations (MOJAVE) for a population of over 100 blazar jets. A temporal correlation is performed. The analysis will test the impact of gamma-ray absorption on plasma potentially loaded into the jet at distances within the photon-dense broad line region. The analysis will also quantify the prevalence of ‘gamma-radio-delayed’ flares, in which increased radio activity follows a gamma-ray flaring state, likely linked to particle loading at the jet base.	

- Developed a novel, time-evolving, leptonic jet model to explain the multi-year delayed radio flares (from initial, heightened gamma-ray activity) observed from the two most prominent, neutrino-bright blazars, TXS 0506+056 and PKS 1424+240. Model tracks the evolution of material initially loaded at the jet base (gamma-ray flare) and eventual shock or interaction with an additional electron plasma at ~ 20 pc-scales (subsequent radio flare). Extension to a lepto-hadronic jet model can provide a successful explanation and spatial origin for radio, gamma-ray and neutrino observations. The evolution of these particle species is described with a time-dependent set of transport equations.
- Searching for neutrino emission from X-ray microquasars through time-dependent correlations with their soft and hard X-ray and gamma-ray activity (MAXI, Swift, Fermi-LAT). Analysis probes both likely jet activity and stages of accretion disk hysteresis.
- Performed a correlation between a first catalog of millimeter-wavelength blazar light curves from the Atacama Cosmology Telescope and IceCube data. Unabsorbed millimeter-wavelength emission is expected to well-trace particle loading at the jet base. Made substantial contributions to internal, collaboration-shared analysis code.
- Developed a new analysis to utilize the morphology of conventional and prompt atmospheric neutrino interactions within a study of the all-sky IceCube diffuse flux. The unique, coincident radiative deposition of both the cosmic-ray muon bundle and cascade-like neutrino interaction is used to improve sensitivity to the atmospheric neutrino spectrum. A gradient boosted decision tree was developed and trained for data classification.
- Modernizing IceCube's most physical, likelihood-based event reconstruction algorithm with reference through generative inference. Neutrinos and cosmic rays interacting within the IceCube detector deposit radiative topologies related to particle specie, position, direction and energy. Modeling these expected radiative depositions in one cubic-kilometer of anisotropic South Pole ice requires simplified representation. The natural compression of a neural network or decoder provides an optimal solution relative to table-based storage (https://github.com/akochocki/egen_lite).
- Oversaw commissioning of the IceCube Upgrade mDOM optical module (MSU production lot) optical and environmental testing – 1M USD in sensor hardware. Leading first studies of sensor timing resolution. Advised a group of eight undergraduate researchers.
- Forecasted IceCube-Gen2 diffuse sensitivity with track and cascade-like event selections. A gradient boosted decision tree was trained for event classification. 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, Boost.**High(er)-Level Software:** Mathematica, SOLIDWORKS.**Relevant Software:** XGBoost, TensorFlow, Pythia, Geant4, ROOT, Arduino, SCPI.**Analysis Packages:** IceTray (high-energy neutrino and cosmic-ray data processing), VEGAS (IACT gamma-ray data processing), Fermitools (gamma-ray data processing).**Distributed Computing:** TORQUE, Sun Grid Engine, Slurm, HTCondor.**Computing Experience:** Extensive CPU and GPU-facilitated simulation and model training. Efficient parallelization of tasks over resources.**Communication:** GitHub, LaTeX, Overleaf, Wiki Markup, Microsoft Office, Google Apps.**Backend/Frontend Development:** JAVA, HTML, CSS.**SERVICE****IceCube Neutrino-Sources Technical Lead***March 2024 - present*

Technical lead for the IceCube Collaboration Neutrino-Sources (astrophysics) working group. Oversee software reviews for analyses, provide assistance with software, likelihood implementation, data and computing resources.

MSU Physics Graduate Organization President*July 2024 - July 2025*

President of the MSU Physics Graduate Organization. Involvement in departmental advisory. Supported student-organized services and representatives. Assisted departmental leadership in communicating effectively with the student body during periods of funding instability and policy changes. Provided students with resources during periods of instability. Led survey to understand student needs and experiences.

Graduate Colloquium Committee Representative*July 2023 - October 2024*

Organized and hosted student-postdoctoral lunches with visiting colloquium speakers. Worked with local colloquium committee to improve departmental colloquium experience and attendance.

HEP Social Organization*July 2023 - December 2024*

Hosted socials and happy hours for the high-energy physics group at MSU.

OUTREACH**Astronomy on Tap, "IceCube and Astrophysical Neutrinos"***July 2024*

Invited to speak on IceCube and neutrino astrophysics for a public audience in East Lansing, Michigan.

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. Assessed activity efficacy with IRB-approved survey.

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 audiences, and mentored 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.

**SELECTED
GRADUATE
COURSEWORK****Modeling Environmental and Social Systems****ISAPP 2023: Neutrino Physics, Astrophysics and Cosmology (Varenna, Italy)****Extragalactic Astrophysics****Radiative Astrophysics****Special Topics in High-Energy Physics – Collider Phenomenology****Quantum Field Theory****LANGUAGES****English** – Native**Spanish** – Limited working proficiency (five years of classroom study)**German** – Elementary proficiency (one year of classroom study – studying for B1 level, summer 2025)