

Tristan A. Eggenberger

Curriculum Vitae

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Interests

(in no particular order)

- Cosmology and astrophysics, especially topics in early universe cosmology such as inflation, the CMB, reionization, structure formation, and the expansion history of the universe.
- Particle physics, particularly gauge theories, hierarchy problems, and BSM physics, especially the nature of dark matter and dark energy.
- High performance scientific computing, mathematical modelling, and machine learning.
- Pure mathematics and mathematical physics, especially abstract algebra, topology, differential geometry, and their applications to physics.

Education

- **B.Sc. Pure Mathematics & Physics** (2023 - Present)
The University of New Mexico
GPA: 3.96 (Fall 2023 - Spring 2026)
- **High School Diploma** (2019 - 2023)
Sandia High School, Albuquerque, New Mexico
GPA: 4.01

Work & Internships

- **Undergraduate Research Assistant** (August 2024 - Present)
University of New Mexico, Department of Physics and Astronomy
Barron Experimental Cosmology Group
Advisor: Dr. Darcy R. Barron
Duties: Data analysis, development of software and hardware tools for data readout from cryostats. Development of hardware and software for monitoring the radio frequency interference environments at CMB telescope sites, notably SignalHound 3 at the South Pole Telescope and SCOUT at the CLASS telescope.
- **QU-REACH** (May - August 2024)
University of New Mexico,
Department of Physics & Astronomy and Center for High Technology Materials
Advisor: Dr. Darcy R. Barron
Project Title: "Low-Temperature Electronics for Experimental Cosmology"

Publications & Posters

Conference Proceedings

Low Temperature Detectors (2025)

Santa Fe, New Mexico

Wilber Dominguez, Darcy R. Barron, Zeeshan Ahmed, Amy N. Bender, Sandra Diez, Malcolm Durkin, Tristan A. Eggenberger, Gunther Haller, Shawn W. Henderson, Katherine Hewey et al. "Thermal and Electrical Properties of Prototype Readout Components for CMB-S4." IEEE Transactions on Applied Superconductivity 2026, DOI: 10.1109/TASC.2026.3682450 (contributing author)

Posters

APS Four Corners (2025)

Greeley, Colorado

- * Tristan A. Eggenberger and Darcy R. Barron "cryopy: A high-level python package for analyzing the temperature response from cryostats." (presenting author)
- * Sydney Holt, Tristan A. Eggenberger, Darcy R. Barron "It's a Bird, it's a Plane, it's Radio Frequency Interference: Signalhound Characterizing Observatory Unwanted Transmissions." (contributing author)

Skills

- **Programming**

Professional Experience with C99, Python (3.9+) and the scientific python ecosystem (NumPy, SciPy, Pandas, matplotlib) along with machine learning in Python using scikit-learn and PyTorch. Familiar with C11, C23, experience with parallel computing in C via OpenMP.

- **Operating Systems and System Administration**

Professional Experience with Ubuntu and other Debian-based Linux distributions including Linux Mint, Raspberry Pi OS and Pop!_OS. Very familiar with Arch and Arch-based linux distributions including Manjaro and EndeavourOS. Familiar with RHEL-based distributions such as Fedora.

Experienced in creating, deploying and managing networks for managing scientific equipment and data acquisition.

Experienced with Windows 7, 10, and 11.

- **Languages**

Fluent in English. (native speaker)

B2 certificates in German for speaking, reading, and writing. (Goethe-Institut, 2025)

Professional Organizations

- American Physical Society (APS)
- Secretary of the UNM Chapter of the Society of Physics Students (SPS)

Extracurricular Experiences

- 2026 NRAO CosmicAI Summer School (June - July 2026)

As a participant in the inaugural CosmicAI Summer School, I learned about the application of machine learning techniques to astronomy and astrophysics research using scikit-learn and PyTorch. Over the course of the program I became acquainted with simple supervised models (regression models, decision trees and random forest classifiers), unsupervised models (PCA, K-means clustering, GMMs, and DBSCAN), and neural networks, from multi-layer perceptrons to convolutional neural networks. I applied my knowledge during workshops to develop (among other things) a random forest classifier for identifying lensed-AGN candidates in Vera C. Rubin Observatory data and a convolutional neural network to identify the morphologies of galaxies from the Sloan Digital Sky Survey.

- 2025 NRAO CosmicAI Virtual Winter School (December 2025)

Successfully participated in the 2025 CosmicAI Winter School, furthering my statistics and data analysis skills with python and packages in the scientific python ecosystem (numpy, pandas, matplotlib, astropy) in preparation for the 2026 CosmicAI Summer School.

- 2025 UNM German Summer School (June - July 2025)

Successfully participated in the 2025 UNM German Summer School. During the program, I completed 7 upper division German credits, and in July I took the B2 Goethe Prüfung and passed 3 out of the 4 sections (Lesen, Sprechen, Schreiben).

- 2025 NASA SpaceApps Challenge (October 2025)

My friends and I took part in the 2025 NASA SpaceApps Challenge, where over the course of 2 days we made a webapp with the goal of modelling various asteroid impact scenarios, allowing users to tweak asteroid orbital parameters, and visualize the consequences of asteroid impacts. (link)

- 2024 NASA SpaceApps Challenge (October 2024)

In the 2024 NASA SpaceApps Challenge, my friends and I created a tool for visualizing the night skies of exoplanets by building up a 3D map of exoplanets and stars using the Open Exoplanet Database and Hipparcos catalog. We also enabled users to create their own star charts. (link)

- Rubik's Cube solving robot (May 2024 - January 2025)

My friends and I over the course of 6 months built a Rubik's Cube solving robot from scratch powered by a Raspberry Pi 1B+, along with developing our own high performance cube solver in C. (link)

Awards

- University of New Mexico Dean's List Spring/Fall 2024, Spring/Fall 2025, and Spring 2026.
- 1st place in Oral Presentations at UNM Physics Day 2026 for my talk on *Characterizing Trends in Radio Frequency Interference at CMB Observatory Sites*.
- 3rd place at the 33rd annual New Mexico Super Computing Challenge for *SINGS: A Simple Interactive N-body Gravitation Simulator* (2023)
- Sandia High School Best Math Student (2023).