

Ethan Silver

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EDUCATION

UNIVERSITY OF CALIFORNIA BERKELEY

B.A. Physics, B.A. Astrophysics, Minor in Data Science

GPA: 4.0/4.0

Expected May 2023

RESEARCH INTERESTS

A broad range of topics in observational and computational cosmology and astrophysics including strong gravitational lensing, dark matter, dark matter halos, galaxy formation/evolution, dark energy, and supernovae.

RESEARCH EXPERIENCE

LAWRENCE BERKELEY NATIONAL LAB, COSMOLOGY DIVISION, STRONG LENSING GROUP, January 2022-present

Undergraduate Research Apprentice advised by Prof. Xiaosheng Huang (Lead PI: Prof. Saul Perlmutter)

The Strong Lensing Group of Saul Perlmutter's Supernova Cosmology Project is involved with the search for new strong gravitational lenses and strongly-lensed supernovae using machine learning techniques.

- Simulate images of galaxies strongly lensed by galactic-scale halos, then train neural networks on these images in order to find strong lensing by galactic-scale halos in real HST and JWST observations, with a subsequent goal of extending these techniques to detect lensing effects by sub-galactic halos.
- Use the JAGUAR mock catalog for JWST and VELA cosmological simulations to simulate lensing effects from halos from galactic scale down to the subhalo scale on realistic sources, using different galaxy parameters to accurately simulate large numbers of images of lensing events.
- Create models of simulated and real strongly-lensed galaxies using LENSTRONOMY and GIGA-Lens.
- Train neural networks using machine learning techniques (TensorFlow/Keras) on Google Colab and NERSC (National Energy Research Scientific Computing Center), and optimize their performance by testing them on observed HST and JWST lenses and non-lenses.
- Contribute to the testing and use of GIGA-Lens, a novel GPU-accelerated strong lens modeling code.

SLAC NATIONAL ACCELERATOR LABORATORY, ASTROPHYSICS DIVISION, June 2021 – present

DOE Science Undergraduate Laboratory Intern (SULI program) under the direction of Prof. Elena Orlando

- Completed two 10-week summer internships fitting models of galactic cosmic ray (CR) propagation to recent data, both of which involved completing an abstract and research report, as well as giving a presentation.
- Using the optimization library Minuit2 and GALPROP (code for simulating CR propagation), optimized the CR parameters by comparing predicted spectra to the direct CR measurements by Voyager and AMS-02.
- Process of fitting parameters involved inputting parameters into GALPROP, calculating spectra of CR species from GALPROP output, calculating chi-squared against Voyager and AMS-02, and using Python interface iminuit to calculate new parameters for GALPROP to minimize chi-squared.
- Developed an optimization script to quickly and automatically find the optimal CR parameters that minimized the error with the data, and explored the effects of many different parameters and modeling scenarios to identify the most promising models for understanding CRs, building off of existing CR models to compare their performances against these datasets.
- After the first internship (Summer 2021), continued to work with Prof. Orlando on a research paper which analyzes the impact of various propagation scenarios of CR's based on the latest Voyager and AMS-02 data.
- Presented results at the 240th meeting of the AAS and the 27th European Cosmic Ray Symposium.

LAWRENCE BERKELEY NATIONAL LAB, COSMOLOGY DIVISION, CMB GROUP, January 2020 – May 2021

Undergraduate Research Apprentice under the direction of Dr. Akito Kusaka (Lead PI: Prof. Adrian Lee)

- Participated in research on cosmic microwave background (CMB) observation and instrumentation for current and next-generation CMB experiments such as the Simons Observatory.
- Analyzed and plotted resonator data from the Vector Network Analyzer which involved extracting resonance frequency of the resonator, plotting resonance frequency vs. temp and vs. current, and extracting TLS noise.
- Assisted with sub-K cryogenics, and construction of electronics for instrumentation, including the electronics for cryogenics, and readout electronics for the Adiabatic Demagnetization Refrigerator (ADR).

SPACE SCIENCES LABORATORY AT UC BERKELEY, EXPERIMENTAL ASTROPHYSICS GROUP, Fall Semester 2019

Undergraduate Research Apprentice (through URAP) under the direction of Nate Darling/Dr. Oswald Siegmund

- Performed testing and characterization of microchannel plate (MCP) photon counting imaging detectors for future spaceflight and ground-based applications.
- Trained in clean room procedures, vacuum systems, handling liquid nitrogen, precision cleaning of parts.
- Analyzed and plotted data from the testing, produced summary and comparison presentations of the data.
- Collaborated on a MATLAB project to automate the analysis, plotting, and creation of presentations of data.
- Created a script to automatically analyze background images and calculate intrinsic background rate.

UNIVERSITY OF MASSACHUSETTS AMHERST, WILSON CRYOGENIC DEVICES LAB, Summer 2019, 6 weeks

- Worked on the TolTEC camera project under the direction of Professor Grant Wilson.
- The TolTEC project involved building a large-format camera with 7,000 detectors to be installed on the 50-meter Large Millimeter Telescope (LMT) in Puebla, Mexico, replacing the AzTEC camera with 144 detectors.
- Created Python visualization software with a GUI and a large amount of interactivity to visualize testing images taken by the AzTEC and TolTEC, to improve TolTEC's data processing pipeline.
- Developed a Python class incorporating several interactive tools to compare data from different versions of the data processing software and improve beammap code; improved the speed/efficiency of Python scripts.
- Obtained hands-on experience with the cryogenics systems; assisted with the closing, cooldown, and opening of the cryogenics in the TolTEC cryostat; tested electronic components in the cryostat.
- Assisted in planning, designing, and building a power distribution box for one of TolTEC's electronics racks.
- Tested and shaped windows for TolTEC with a vacuum pump; assisted with testing of Helmholtz coils.
- Presented work titled "Visualizing and Analyzing Beammaps for AzTEC and TolTEC" at a poster session.

CONFERENCE PRESENTATIONS

27 th European Cosmic Ray Symposium	July, 2022
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- Talk: *Comparing Propagation Models with Local Cosmic Ray Spectra*

240th meeting of the AAS	June, 2022
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- iPoster: *Comparing Propagation Models with Local Cosmic Ray Spectra*

PUBLICATIONS (FIRST AUTHOR)

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- (In prep: planned submission 11/2022) Silver, E., Orlando, E., 2022, *On the Comparison of Propagation Models with Local Cosmic Ray Spectra*

AWARDS

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- Dean's Honors List
 - Edward Frank Kraft Award for Freshman (2019-2020)
 - National Merit Scholarship (2019)

COMPUTER SKILLS

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- Python, SQL, LabVIEW, MATLAB, C, C++, Java, LaTeX
 - Libraries: Matplotlib, NumPy, Pandas, SciPy, Iminuit
 - Machine Learning/Neural Networks/Deep Learning: TensorFlow, Keras, PyTorch
 - Relevant Coursework: Optimization Models (EECS 127), Principles and Techniques of Data Science (Data C100), Foundations of Data Science (Data C8), Data Structures (CS 61B), Structure and Interpretation of Computer Programs (CS 61A), Computational Techniques in Physics (Physics 77), Probability (Stat 134), Linear Algebra (Math 110).

ASTRONOMY/ASTROPHYSICS COURSEWORK

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- Relativistic Astrophysics and Cosmology (Astron 161C), Optical and Infrared Astronomy Lab (Astron 120), Stellar Physics (Astron 160), Intro to Astrophysics—two semesters (Astron 7A, 7B)