

# Ethan Silver

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## EDUCATION

### UNIVERSITY OF CALIFORNIA BERKELEY

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

GPA: 4.0/4.0

Expected July 2023

## RESEARCH INTERESTS

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

## RESEARCH EXPERIENCE

**LAWRENCE BERKELEY NATIONAL LAB, PHYSICS DIVISION, STRONG LENSING GROUP**, January 2022 – present  
*Undergraduate Research Apprentice advised by Prof. Xiaosheng Huang (Lead PI: Prof. Saul Perlmutter), and in collaboration with Dr. Adam Bolton. The Strong Lensing Group, a subgroup of The Supernova Cosmology Project, searches for new strong gravitational lenses and strongly lensed supernovae using machine learning techniques.*

- Contributed to the analysis of a strongly lensed multiply-imaged Type Ia supernova (SN Zwicky) by modeling the lens galaxy, source galaxy, and supernova light using GIGA-Lens and LENSTRONOMY; implemented Markov-Chain Monte Carlo methods to estimate probability distributions for each modeled parameter.
- 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 strong lensing 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 sub-galactic 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 TensorFlow and Keras on Google Colab and NERSC (National Energy Research Scientific Computer); optimize performance by testing them on observed HST and JWST lenses/non-lenses.
- Contribute to the testing/use of GIGA-Lens, a novel GPU-accelerated Bayesian 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 SULI internships (and continued during the year) fitting models of galactic cosmic ray (CR) propagation to recent data from Voyager 1, AMS-02 on the Int. Space Station, and other experiments.
- 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 1 and AMS-02.
- Developed an optimization script in Python to quickly and automatically find the optimal parameters that minimize 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 propagation models to compare their performances against these datasets.
- Presented results at the 240<sup>th</sup> meeting of the AAS and the 27<sup>th</sup> European Cosmic Ray Symposium.

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

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

- Participated in instrumentation and data analysis for cosmic microwave background (CMB) experiments.
- 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; tested the electronics for the cryogenics and the readout electronics for the Adiabatic Demagnetization Refrigerator (ADR).

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

*Undergraduate Research Apprentice under the direction of Nate Darling/Dr. Oswald Siegmund*

- Performed testing and characterization of microchannel plate (MCP) photon counting imaging detectors.
- 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.

## UNIVERSITY OF MASSACHUSETTS AMHERST, WILSON CRYOGENIC DEVICES LAB, Summer 2019

*Summer Research Intensive Intern under the direction of Prof. Grant Wilson*

- Worked on the TolTEC project which involved building a large-format camera with 7,000 detectors for the 50-meter Large Millimeter Telescope (LMT) in 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 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.
- Assisted with the closing, cooldown, and opening of the cryogenics; tested electronics in the cryostat.
- Presented work titled [Visualizing and Analyzing Beammaps for AzTEC and TolTEC](#) at a poster session.

## MICHIGAN STATE UNIVERSITY, HSHSP PROGRAM, KE GROUP, Advised by Prof. Xianglin Ke, Summer 2018

- Synthesized the sodium oxides of holmium, dysprosium, and ytterbium, and characterized their structural and magnetic properties using x-ray diffraction and SQUID magnetometry; completed a paper/presentation.

## SUMMER SCIENCE PROGRAM (SSP), ASTROPHYSICS, University of Colorado Boulder, Summer 2017

- Determined the orbit of a near-earth asteroid using 20" optical telescopes and Python for calculations.
- Completed a scientific paper and submitted results to the Minor Planet Center of the IAU.

## UNIVERSITY OF MASSACHUSETTS AMHERST, YAN PHYSICS LAB, Advised by Prof. Jun Yan, Summer 2016

- Prepared and analyzed samples of atomically thin, 2D crystals using an AFM; presented a poster.

## DUKE TIP FIELD STUDIES: ASTRONOMY, PHYSICS, & ASTROBIOLOGY, PARI Observatory, NC, Summer 2016

- Measured the rotation curve of the Andromeda Galaxy using the PARI 12-meter radio telescope.

## UNIVERSITY OF ARIZONA ADVANCED TEEN ASTRONOMY PROGRAM, Kitt Peak Observatory, AZ, Summer 2015

- Participated in a group project finding and classifying supernovae using research-class optical telescopes.

## CONFERENCES

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27<sup>th</sup> European Cosmic Ray Symposium July, 2022

- Talk: [Comparing Propagation Models with Local Cosmic Ray Spectra](#)

240th meeting of the AAS June, 2022

- iPoster: [Comparing Propagation Models with Local Cosmic Ray Spectra](#)

## PUBLICATIONS

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- J.D.R. Pierel, N. Arendse, S. Ertl, X. Huang, L.A. Moustakas, S. Schuldt, A.J. Shajib, Y. Shu, S. Birrer, M. Bronikowski, J. Hjorth, S.H. Suyu, S. Agarwal, A. Agnello, A.S. Bolton, S. Chakrabarti, C. Cold, F. Courbin, J.M. Della Costa, S. Dhawan, M. Engesser, O.D. Fox, C. Gall, S. Gomez, A. Goobar, S.W. Jha, C. Jimenez, J. Johansson, C. Larison, G. Li, R. Marques-Chaves, S. Mao, P.A. Mazzali, I. Perez-Fournon, T. Petrushevska, F. Poidevin, A. Rest, W. Sheu, R. Shirley, **E. Silver**, C. Storfer, L.G. Strolger, T. Treu, R. Wojtak, Y. Zenati, [LensWatch: I. Resolved HST Observations and Constraints on the Strongly-Lensed Type Ia Supernova 2022qmx \("SN Zwicky"\)](#), 2022, arXiv:2211.03772.

## PUBLICATIONS IN PREPARATION

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- E. Silver, E. Orlando, *Comparing Propagation Models with Local Cosmic Ray Spectra*, (to be submitted 01/23).

## 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). Will be taking Machine Learning (CS 189) during the spring semester 2023.

## AWARDS

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

## ASTRONOMY AND ASTROPHYSICS COURSEWORK

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Optical and Infrared Astronomy Lab, Relativistic Astrophysics and Cosmology, Stellar Physics, Intro Astrophysics