Ethan Silver

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EDUCATION

HARVARD UNIVERSITY — Cambridge, MA
Ph.D. in Physics (in progress) — August 2023 - present

UNIVERSITY OF CALIFORNIA BERKELEY — Berkeley, CA
B.A. Physics, B.A. Astrophysics, B.A. Data Science; GPA: 4.0/4.0 (Highest Distinction) — August 2023

RESEARCH INTERESTS

Applications of machine learning to gravitational wave astronomy; transients; black holes; gravitational lensing.

RESEARCH EXPERIENCE

HARVARD ASTRONOMY DEPT, BERGER TIME-DOMAIN RESEARCH GROUP, March 2024 - present
Graduate Research Assistant advised by Prof. Edo Berger, and in collaboration with Dr. Plamen Krastev

- Train neural networks to identify gravitational wave signals from noise and classify them as signals from binary black hole (BBH), binary neutron star (BNS), or neutron star-black hole (NSBH) mergers.
- Train and iterate convolutional neural network (CNN) models on real noise data from LIGO with simulated compact binary coalescence (CBC) signals in each CBC category using the PyCBC package, and train the models to recognize glitches (by injecting glitches from Gravity Spy into the noise in the training data).
- Analyze the performance of the CNN models by calculating their sensitivity to GW signals at different signal to noise ratios (SNR) of the different classes of CBC events.
- Evaluate and optimize the performance of the models on real signals from the Gravitational Wave Transient Catalog (GWTC), performing "blind searches" using time segments stepped through large chunks of LIGO data to test whether the model can still find true GW signals and distinguish them from any false positives.
- Expand the original single-detector model to work with multiple gravitational-wave detectors.

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.

- Simulated images of galaxies strongly lensed by galactic-scale dark matter halos, then trained neural networks on these images 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.
- Used 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.
- Created models of simulated and real strongly lensed galaxies using LENSTRONOMY and GIGA-Lens.
- Trained neural networks using TensorFlow and Keras on Google Colab and NERSC (National Energy Research Scientific Computer); optimized performance by testing them on observed HST and JWST lenses/non-lenses.
- 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.
- Contributed to the testing/use of GIGA-Lens, a novel GPU-accelerated Bayesian strong lens modeling code.

SLAC NATIONAL ACCELERATOR LABORATORY, ASTROPHYSICS DIVISION, June 2021 – January 2024
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.

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.

CONFERENCES

27th 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

- **E. Silver**, E. Orlando, *Testing Cosmic-Ray Propagation Scenarios with AMS-02 and Voyager Data*, 2024, *ApJ, 963 (2), 111* [arXiv:2401.06242].

- 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"), 2023, ApJ, 948 (2), 115 [arXiv:2211.03772].

TECHNICAL SKILLS

- Python (Libraries: Matplotlib, NumPy, Pandas, SciPy, Iminuit), SQL, LabVIEW, MATLAB, C, C++, Java, LaTeX
- Machine Learning/Neural Networks/Deep Learning: TensorFlow, Keras, PyTorch
- Relevant Courses (UC Berkeley): Machine Learning CS 189), Intro to AI (CS 188), Optimization Models (EECS 127), Principles and Techniques of Data Science (Data C100), Foundations of Data Science (Data C8), Data Structures (CS 61B), Structure/Interpretation of Computer Programs (CS 61A), Computational Techniques in Physics (Physics 77), Probability (Stat 134), Linear Algebra (Math 110), Numerical Analysis (Math W128).

TEACHING

- Teaching Fellow for Harvard's Physical Science 12B: Electromagnetism from an Analytic, Numerical, and Experimental Perspective – Fall 2024

AWARDS/HONORS

- Phi Beta Kappa Member (Summer 2023)
- Graduated with Highest Distinction from UC Berkeley (Summer 2023)
- Edward Frank Kraft Award for Freshmen at UC Berkeley (Fall 2019)
- National Merit Scholarship (Spring 2019)

ASTRONOMY AND ASTROPHYSICS COURSEWORK

- Radiative Processes in Astrophysics (Graduate level-Harvard Astron 200)
- Cosmology (Graduate level-Harvard Physics 210)
- Extragalactic Astronomy & Cosmology I (Graduate level-Harvard Astron 202A)
- Optical and Infrared Astronomy Lab (UC Berkeley Astro 120)
- Relativistic Astrophysics and Cosmology (UC Berkeley Astro C161)
- Stellar Physics (UC Berkeley Astro 160)
- Intro to Astrophysics (UC Berkeley Astro 7A and 7B)