

**Research Interests:** Theoretical Cosmology, Computational Physics, Inflation, Large Scale Structure, Philosophy of Physics.

## EDUCATION

### University of California, Berkeley

BA, Astrophysics and Logic — GPA: 3.9/4.0

Aug 2021 — May 2025

## RESEARCH EXPERIENCE

### Student Researcher

National Energy Research Scientific Computing Center (NERSC)

April 2022 — Present

Berkeley, CA

Employing machine learning to develop powerful and accurate surrogate cosmological hydrodynamic simulations. Using our technique, researchers can generate models of the large-scale structure of the universe, which are orders of magnitude computationally cheaper than traditional simulations.

### Lab Affiliate

Lawrence Berkeley National Lab - Computational Cosmology Center (C<sup>3</sup>)

Aug 2021 — Present

Berkeley, CA

Using super-computing techniques to simulate potential future ground-based observing runs of the Cosmic Microwave Background (CMB). Examining cross-correlations between the CMB and the distribution of galaxies in the local universe. Developed publicly available software [↗](#) that simulates progress towards the CMB-S4 science goals over time and presented cost analysis to the NSF.

### Undergraduate Researcher

UC Berkeley Dept. of Astronomy

Jan 2022 — Present

Berkeley, CA

Operating telescopes at Lick and Palomar Observatories and validating supernovae and other transient candidates with Zwicky Transient Facility at Palomar. Collaborating with grad students in the group on supernova photometry analysis.

### Research Assistant

Princeton Plasma Physics Laboratory (PPPL)

Jun 2021 — Dec 2021

Remote

Developed machine learning techniques capable of automatically analyzing magneto-hydrodynamic instabilities and the emergence and dynamics of edge-localized filamentary structures inside tokamak h-mode plasmas. This work verified predictions about the behavior of turbulence inside tokamaks, which were previously entirely theoretical, as described in our original paper [↗](#).

### Lab Affiliate

Lawrence Berkeley National Lab - Advanced Light Source (ALS)

Mar 2020 — May 2020

Berkeley, CA

Prototyped large-scale, intricate assemblies of the synchrotron's new power system and shielding. Used computer simulations to validate my designs.

### Intern

Integrated Dynamic Electron Solutions

Mar 2019 — Jul 2019

Pleasanton, CA

Spent several months away from high school to design specialty parts for electron microscopes. Produced several optical mechanisms that have been successfully implemented at labs in Berkeley, Tel Aviv, and Tokyo. Performed computational research on electron deflection patterns in MATLAB.

## AWARDS & HONORS

2022 UC Berkeley Dean's List

2021 UC Berkeley Alumni Scholar; FIRST Robotics Regional Medalist

2020 National Merit Scholar Finalist; International Physics Olympiad Finalist; California Math League Finalist

## TECHNICAL SKILLS

### Tools

Python, Java, MATLAB, Linux, Pytorch, Tensorflow, Solidworks, LaTeX, Photoshop

### Techniques

Machine Learning, Signal Processing, High-Performance Computing, Observational Astronomy, Lasers

## TEACHING EXPERIENCE

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### Student Instructor

*UC Berkeley Dept. of Astronomy*

**Aug 2022 — Present**

Berkeley, CA

Held 20 hours/week of supplementary lectures, labs, and study halls each week and operated telescopes for class viewings. Guided undergrads through their introduction to Astrophysics.

### Science Communicator

*Chabot Space and Science Center*

**Oct 2019 — Feb 2021**

Oakland, CA

Engaged the public with kid-friendly, interactive demonstrations and accessible lectures on astronomy.

### Teacher's Assistant

*The Athenian School*

**Sep 2018 — Jun 2020**

Danville, CA

Assisted students with Physics and Chemistry during weekly office hours and graded their assignments .

## VOLUNTEER WORK

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### Astronomy “Climate” Advisor

*UC Berkeley Dept. of Astronomy*

**Aug 2022 — Present**

Berkeley, CA

One of two undergrads recommended by our peers to serve on the department’s advisory committee [↗](#) , which addresses interpersonal and civil concerns within Berkeley’s astronomy community.

### Alumni Mentor

*The Summer Science Program*

**Jun 2022 — Present**

Remote

Mentor for current and recent students in the SSP community [↗](#) on college admissions and undergraduate research.

### Student Mentor

*FIRST Lego League*

**Oct 2018 — Jun 2020**

Oakland, CA

Volunteered as a coach and resource for elementary and middle school students during their first encounter with robotics and computer programming.

## EXTRACURRICULAR ACTIVITIES

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### Student Researcher

*The Summer Science Program*

**Jun 2020 — Aug 2020**

Remote

Participated in a competitive and highly intensive research-study program [↗](#) in observational astronomy, orbital mechanics, and computational research. Performed observations and gathered data on the orbit of a near-earth asteroid and developed a program capable of calculating its orbit from observations. Presented our findings in a brief paper [↗](#) , which are now used in the official asteroid database [↗](#) .

### Team Captain

*FIRST Robotics Team 852*

**Nov 2017 — Apr 2021**

Danville, CA

Served first as mechanism design lead, then CAD integration lead, and finally as Team Captain. Designed and Fabricated a competitive robot and managed and mentored a team of 60 students.

### Co-Founder & Board Member

*STEM Gender Equity Coalition*

**Jan 2018 — Apr 2021**

Oakland, CA

Raised money and launched a series of talks, panels, and fairs showcasing Women in Science and Technology [↗](#) .

### Founder & Captain

*High-School Math Olympiad*

**Oct 2017 — Apr 2021**

Danville, CA

Founded and led High School’s Math Olympiad team.

## EXTERNAL COURSEWORK

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Princeton University	Introduction to Plasma Physics	P	2021
California Institute of Technology	Computational Astronomy	P	2020
Massachusetts Institute of Technology	Rocketry & Orbital Mechanics	A+	2019
UC Berkeley Academic Talent Development Program	Physics & Astronomy	A	2017-2019
Johns Hopkins Center for Talented Youth	Geometry→Calculus	A+	2016-2018
UC Berkeley Math Circles	Mathematics	A-	2012-2018

## PUBLICATIONS

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**Jacobus, C.** Harrington, P. Lukic, Z. Ly $\alpha$  field estimation with Convolutional Neural Networks. *In Prep* (2023)

Risin, S. **Jacobus, C.** Altunin, I. Patra, K. Multiwavelength Observations of Type 1a Supernova 2022hrs. *In Prep* (2023)

**Jacobus, C.** Harrington, P. Lukic, Z. Closing the resolution gap in Lyman alpha simulations with deep learning. *NeurIPS: Machine Learning and the Physical Sciences* [↗](#) (2022)

**Jacobus, C.** Kube, R. Machine-Learning enabled analysis of ELM filament dynamics in KSTAR. *Pre-print* [↗](#) (2022)

Abazajian, K. **et al.** Snowmass 2021 CMB-S4 White Paper. *Pre-print* [↗](#) (2022)

## PRESENTATIONS

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**Jacobus, C.** Harrington, P. Lukic, Z. Ly $\alpha$  field estimation with Convolutional Neural Networks. **Oral Presentation** at: *Future Science with CMB x LSS* [↗](#) Kyoto, Japan (Apr 2023)

**Jacobus, C.** Modelling the Large Scale Structure of the Universe with Convolutional Neural Networks. **Oral Presentation** at: *Berkeley Physics Seminars* [↗](#) Berkeley, CA (Feb 2023)

**Jacobus, C.** Harrington, P. Lukic, Z. Closing the resolution gap in Lyman alpha simulations with deep learning. **Poster** at: *NeurIPS: Machine Learning and the Physical Sciences* [↗](#) New Orleans, LA (Dec 2022)

**Jacobus, C.** Harrington, P. Lukic, Z. Closing the resolution gap in Lyman alpha simulations with deep learning. **Oral Presentation** at: *Berkeley Center for Cosmological Physics Colloquium* [↗](#) Berkeley, CA (Nov 2022)

**Jacobus, C.** Kube, R. Machine-Learning enabled analysis of ELM filament dynamics in KSTAR. **Poster** at: *APS Division of Plasma Physics Annual Meeting* [↗](#) Pittsburgh, PA (Nov 2021)

**Jacobus, C.** Kube, R. Machine Learning enabled detection of ELM-Precursors in KSTAR ECEI data. **Oral Presentation** at: *PPPL Summer Closing Talks* [↗](#) Online (Aug 2021)