

Academic Interests: Physical Cosmology, Computational Physics, Machine Intelligence, Mathematical Logic, Science Communication.

EDUCATION

University of California, Berkeley

BA, Astrophysics and Mathematical Logic — GPA: 3.91/4.0

Fall 2021 — Spring 2025

RESEARCH EXPERIENCE

Student Researcher

Fall 2021 — Present

Lawrence Berkeley National Lab - Computational Cosmology Center (LBNL - C³)

Berkeley, CA

Developing powerful and accurate surrogate cosmological hydrodynamic simulations based on novel machine-learning methods. Generating data-driven, error-controlled models of the large-scale structure of the universe which are orders of magnitude more computationally efficient than traditional simulations. Produced the largest ever simulated map of the Lyman- α forest.

Visiting Scientist

Summer 2024

Kavli Institute for the Physics and Mathematics of the Universe (IPMU)

Tokyo, Japan

Developed novel neural network architectures to perform GPU-accelerated, backward-differentiable fluid simulation in arbitrary, deformable coordinate systems for broad applications including cosmology and plasma physics.

Undergraduate Researcher

Spring 2022 — Spring 2024

UC Berkeley Dept. of Astronomy

Berkeley, CA

Operated telescopes at Lick and Palomar Observatories to gather data and examined supernovae and other transient candidates with the Zwicky Transient Facility. Collaborated with graduate students in the group on transient photometry analysis.

Research Assistant

Summer — Fall 2021

Princeton Plasma Physics Laboratory (PPPL)

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. Verified predictions about the complex, quasi-periodic behavior of turbulence inside tokamaks which were previously entirely theoretical.

Lab Affiliate

Spring — Summer 2020

Lawrence Berkeley National Lab - Advanced Light Source (LBNL - ALS)

Berkeley, CA


Prototyped large-scale assemblies for the synchrotron's new, upgraded power system and radiation shielding. Used computational radiation transport simulations to validate and adjust my designs.

Intern

Spring — Summer 2019

Integrated Dynamic Electron Solutions (IDES)

Pleasanton, CA

Designed and manufactured specialty parts for precision electron microscopes . Produced several optical mechanisms that have been successfully implemented in professional labs worldwide. Performed computational research on electron deflection patterns.

TEACHING EXPERIENCE

(Head) Student Instructor

Fall 2022, Fall 2023, Fall 2024

UC Berkeley Dept. of Astronomy

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 astronomy and cosmology (Astron C10). Promoted to Head Student Instructor in 2024 to manage the curriculum and logistics of the entire 1000-student class and lecture in Berkeley's largest auditorium.

Science Communicator

Fall 2019 — Spring 2021

The Chabot Space and Science Center

Oakland, CA

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

AWARDS & HONORS

2024 Goldwater Scholar (**\$7.5k**); NASA Astronaut Scholar (**\$15k**); UC Berkeley Outstanding Student Instructor (**\$1k**)
2023 NASA Astronaut Scholar (**\$15k**)
2022 UC Berkeley Dean's List
2021 UC Berkeley Leadership Award (**\$10k**); FIRST Robotics Regional Medalist

PUBLICATIONS

Jacobus, C. Chabanier, S. Harrington, P. Emberson, J. Lukic, Z. Habib, S. Gigaparsec-Scale Hydrodynamic Volume Reconstructed with Deep Learning. Submitted to *The Astrophysical Journal* [↗](#) (2024)

Jacobus, C. Thiele, L. Harrington, P. Liu, J. Lukic, Z. Enhancing Cosmological Simulations with Efficient and Interpretable Machine Learning in the Gabor Wavelet Basis. *NeurIPS: Machine Learning and the Physical Sciences* [↗](#) (2024)

Alvarado, E. Bostow, K. Patra, K. **Jacobus, C.** Baer-Way R. Jennings C. Pichay N. et al. Searching for tidal orbital decay in hot Jupiters. *Monthly Notices of the Royal Astronomical Society* [↗](#) (2024)

Jacobus, C. Harrington, P. Lukic, Z. Ly α field estimation with Convolutional Neural Networks. *The Astrophysical Journal* [↗](#) (2023)

Risin, S. **Jacobus, C.** Altunin, I. Brink, T. Patra, K. Zheng, W. Yang, Y. Pichay, N. Fitzgerald, M. Boyce, G. Boyce, P. Filippenko, A. Optical Observations of the Type Ia Supernova 2022hrs. *Research Notes of the AAS* [↗](#) (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. Choi, M.J. Kube, R. Machine-learning enabled analysis of ELM filament dynamics in KSTAR. *Pre-print* [↗](#) (2022)

PRESENTATIONS

Enhancing Cosmological Simulations with Efficient and Interpretable Machine Learning in the Gabor Wavelet Basis.
Poster at: *NeurIPS: Machine Learning and the Physical Sciences* [↗](#) Vancouver, Canada (Dec 2024)

Cosmology, Complexity, Computation.
Public Lecture at: *Berkeley Student Seminars* [↗](#) Berkeley, CA (Nov 2024)

Modeling the Large-Scale Structure of the Universe with Deep Learning.
Contributed Talk at: *Science Understanding through Data Science Conference* [↗](#) Pasadena, CA (Aug 2024)

Enhancing Cosmological Simulations with Machine Learning in the Wavelet Basis.
Poster at: *IAIFI Summer Workshop* [↗](#) Cambridge, MA (Aug 2024)

Reconstructing the Large-Scale Structure of the Universe with Deep Learning.
Oral Presentation at: *Kavli IPMU Seminar*. Kashiwa, Japan (Jun 2024)

Modeling the Large-Scale Structure of the Universe with Deep Learning.
Oral Presentation at: *Berkeley Compass Lectures in Physics* [↗](#) Berkeley, CA (Oct 2023)

Lyman- α field estimation with Convolutional Neural Networks.
Oral Presentation at: *Future Science with CMB x LSS* [↗](#) Kyoto, Japan (Apr 2023)

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

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)

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

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

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