Berkeley, CA
(510)-610-3663
cjacobus@berkeley.edu

Cooper Jacobus

LinkedIn ⧉

Academic Interests: Cosmology, Computational Physics, Philosophy of Physics, Machine Intelligence, Science Communication.

EDUCATION

University of California, Berkeley

BA, Astrophysics and Mathematical Logic — GPA: 3.92/4.0 **Fall 2021 — Spring 2025**

RESEARCH EXPERIENCE

Student Researcher **Fall 2021 — Present**

Lawrence Berkeley National Lab - Computational Cosmology Center (LBNL - C^3) Berkeley, CA

Employing machine learning to develop powerful and accurate surrogate cosmological hydrodynamic simulations. Generating models of the large-scale structure of the universe which are orders of magnitude larger and computationally cheaper than traditional simulations. Simulated potential future ground-based observing runs of the Cosmic Microwave Background (CMB). Examined cross-correlations between the CMB and the distribution of galaxies in the local universe.

Visiting Scientist **Summer 2024**

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

Developing novel neural network architectures to perform GPU-accelerated, backwards-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

Operating telescopes at Lick and Palomar Observatories and validating supernovae and other transient candidates with Zwicky Transient Facility at Palomar. Collaborating with graduate students in the group on supernova 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. This work verified predictions about the 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, complex assemblies of the synchrotron's new power system and radiation shielding. Used computer simulations to validate my designs.

Intern **Spring — Summer 2019**

Integrated Dynamic Electron Solutions (IDES) 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 in professional labs worldwide. Performed computational research on electron deflection patterns in MATLAB.

AWARDS & HONORS

2024 Goldwater Scholar **($7.5k)**; UC Berkeley Outstanding Student Instructor Award **($1k)**
2023 NASA Astronaut Scholar **($15k)**
2022 UC Berkeley Dean's List
2021 UC Berkeley Leadership Award **($10k)**; FIRST Robotics Regional Medalist
2020 National Merit Scholar Finalist; International Physics Olympiad Finalist; California Math League Finalist

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.

Science Communicator   **Fall 2019 — Spring 2021**
Chabot Space and Science Center   Oakland, CA

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

Teacher's Assistant   **Fall 2018 — Spring 2020**
The Athenian School   Danville, CA

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

Publications

Jacobus, C. Harrington, P. Lukic, Z. Lyα 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, MJ. 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

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

Jacobus, C. Harrington, P. Lukic, Z. Lyα field estimation with Convolutional Neural Networks. **Oral Presentation** at: *Future Science with CMB x LSS* ⧉ Kyoto, Japan (Apr 2023)

Jacobus, C. Modeling 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)