

Xing Liu (刘行)

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I am undergraduate at UC Berkeley with an interest in the phenomenological aspects of nuclear, stellar, and cosmological physics. I intend to graduate in three years and pursue a PhD in physics.

EDUCATION

B.A. Physics with Honors + B.A. Pure Mathematics, UC Berkeley. *August 2023 – (May 2026)*
GPA: 3.933; Physics GPA: 3.975; Physics GRE: 980.
Arcadia High School, California. *August 2019 – June 2023*

PAPERS

A Continuous Galactic Line Source of Axions: The Remarkable Case of ^{23}Na . (arXiv:2505.03038)
Wick Haxton, Xing Liu, Annie McCutcheon, Anupam Ray. Published in *Physical Review Letters*.
The Production and Resonant Absorption of Axions by ^{23}Na . (In preparation)
Wick Haxton, Xing Liu, Anupam Ray.
Dark Matter Capture in White Dwarfs: The EFT Bridge to Direct Detection. (In preparation)
Wick Haxton, Xing Liu, Anupam Ray, Evan Rule.

RESEARCH & ENGINEERING

Stellar axion phenomenology with Prof. Wick Haxton, Berkeley N3AS. *Summer 2024 →*
Applying nuclear and stellar astrophysics towards the search for axion dark matter.
Dark matter effective theory with Dr. Evan Rule, Berkeley N3AS. *Summer 2025 →*
Simulating the consequences of dark-matter-mediated inelastic nuclear transitions.
Fast radio burst cosmology with Dr. Calvin Leung, CHIME:FRB. *Summer 2024 →*
Studying galaxy feedback using cosmological simulations of fast radio bursts propagation.
Atmospheric science with Prof. David Romps, Berkeley Climate Physics Group. *Summer 2025 →*
Simulating and deriving analytical models for the advection of soot in windy urban fires.
Machine learning in cosmology with Cooper Jacobus, Berkeley ULAB. *Spring 2024*
Developed a proof-of-concept super-resolution model for the IllustrisTNG cosmological simulation.
Software for observational cosmology with Dr. Anthony Kremin, LBL. *Spring 2024*
Wrote data transfer tools and code wrappers to make DESI data and code accessible to the public.
FTC 15303 robotics team with Simon Pei, Arcadia High School. *Fall 2019 – Summer 2023*
Drivetrain design using CAD, 3D printing, and machining; Autonomous navigation by visual odometry.

SKILLS

Data analysis and machine learning. Experienced in making numerical simulation, analysis, and visualization with Python (NumPy, SciPy, AstroPy, OpenCV). Also experienced in symbolic analysis with Mathematica. Have implemented convolutional neural networks (CNNs) with PyTorch. Familiar with C, C++, Fortran, MatLab, WebGL/ThreeJS, and OpenGL.
Systems administration. Uses Ubuntu Linux. Experienced with shell-scripting, git/GitHub, and other command-line tools, as well as Google Cloud, Firebase, S3, and EC2 for cloud computing.

databases, hosting, and APIs. Former web developer for the Berkeley Society of Physics Students.

CAD and electrical engineering. Experienced with OnShape CAD. Familiar with Arduinos and basic breadboard circuitry.

TEACHING

Beginner's Guide to the Universe, Berkeley Dept. of Astronomy. *Spring & Fall 2025*

A 2-unit course where we teach a qualitative introduction to modern physics and astronomy to new freshman and transfer students. We also hold discussions on the history and philosophy of physics.

Tutor and grader, Berkeley Dept. of Physics. *Spring 2024 – Spring 2025*

I tutored and graded assignments for students in lower-division physics courses. I also held exam review sessions (audience of 160), gave Mathematica tutorials (audience of 30), and mentored two undergraduates on quantum field theory.

K–12 outreach, Berkeley Society of Physics Students. *Fall 2023 – Spring 2025*

Traveled a dozen times to schools across the Bay Area to teach science lessons and answer cute questions about black holes. Wrote and taught introductory relativity, cosmology, programming, calculus, and differential equations lessons for high-schoolers.

TALKS

Can axions escape stars and supernovae? (Poster symposium, Berkeley N3AS) *Dec 2025*

The nuclear astrophysics of dark matter searches (Berkeley Society of Physics Students) *Sep 2025*

A continuous line of galactic axions (Nuclear astrophysics session, APS April Meeting) *Mar 2025*

Line axion production in AGB stars (Nuclear astrophysics seminar, Berkeley N3AS) *Mar 2025*

Introduction to the Higgs mechanism (Berkeley Physics Directed Reading Program) *Dec 2024*

Gravitational lensing theory (Berkeley Society of Physics Students) *Oct 2024*

Enabling public access to DESI via AWS and Docker (DESI data group meeting, LBL) *May 2024*

Machine learning for cosmological simulations (Poster symposium, Berkeley ULAB) *May 2024*

TERM PAPERS

Signal dispersion in coaxial cables *Physics 5BL*

Building a Fabry–Pérot inteferometer *Physics 5CL*

Why is gauge theory useful in particle physics? (Manim animation) *Physics 24*

Modeling autowaves in nonlinear media with coupled chaotic circuits *Physics 111A*

Topological defects in cosmology *Physics 198*

An introduction to gravitational memory *Physics 231*

SIDE PROJECTS

Starherd, independent work (xingyzt.net/starherd) *Summer 2023 →*

An interactive website for teaching stellar evolution, built in JS/WebGL.

Polarizar, FTC Robotics (github.com/flyorboom/polarizar) (demo) *Fall 2022 – Spring 2023*

A real-time computer vision algorithm for autonomous navigation, built in Python/OpenCV.

Map.ahs.app, App Dev Team (github.com/ahsappdevteam/voxmap) (demo) *Fall 2021 – Fall 2022*

An interactive, raymarched 3D map of Arcadia High School, supporting location tags and featuring real-time raymarched rendering, built in C/C++/JS/WebGL.