Ravjit (Rav) Kaur

ravkaur20.github.io | ravkaur@ucsc.edu

Education

University of California, Santa Cruz — Santa Cruz, CA
PhD Student in Astronomy and Astrophysics; Advisor: Prof. Ryan Foley

University of California, Berkeley — Berkeley, CA
BA in Astrophysics with Honors; BA in Music — *May 2024*

Research Interests

I am interested in transients, kilonovae, afterglows, multimessenger astrophysics, gravitational waves, compact objects, the Hubble tension, and prospects for future gravitational wave observations and events.

Publications

1. **Kaur, Ravjit**, Brendan O'Connor, Antonella Palmese, & Keerthi Kunnumkai. (2024). *Detecting prompt and afterglow jet emission of gravitational wave events from LIGO/Virgo/KAGRA and next generation detectors.* arXiv preprint arXiv:2410.10579. [Submission in prep.]

2. Palmese, A., **Kaur, R.**, Hajela, A., Margutti, R., McDowell, A., & MacFadyen, A. (2024). *Standard siren measurement of the Hubble constant using GW170817 and the latest observations of the electromagnetic counterpart afterglow.* Physical Review D, 109(6), 063508. https://doi.org/10.1103/PhysRevD.109.063508

Research Experience

Graduate Student Researcher — September 2024 – Present
University of California, Santa Cruz — *Advisor: Prof. Ryan Foley*

- Creating a data driven, time-evolving kilonova SED based on data from the AT2017gfo kilonova
- Completing spectroscopic observations of supernovae and other transients with the KAST spectrograph on the Shane 3-m telescope at Lick Observatory [4 nights], NIRES on Keck II at Keck Observatory [3 half nights], and LRIS on Keck I [1 half night]
    - 1 ATel, 1 GCN circular

Astrophysics Undergraduate Honors Thesis — September 2023 – October 2024
University of California, Berkeley & Carnegie Mellon University

- **Prospects for multimessenger observations for next generation gravitational wave detectors:** For my honors thesis, I worked closely with Prof. Antonella Palmese and Dr. Brendan O'Connor at Carnegie Mellon University and Prof. Raffaella Margutti at UC Berkeley to simulate afterglows at different wavelengths in combination with gravitational wave (GW) simulations. The goal of this project was to assess the promise of different electromagnetic counterpart detections for future GW events in the O5 LVK observing run and in next-generation GW detectors.

Harvard CfA/SAO NSF REU — June 2023 – September 2023
Harvard Center for Astrophysics & Smithsonian Astrophysical Observatory

- **A streamlined process for X-ray lightcurve extraction:** In my summer research, I worked closely with Dr. Rosanne Di Stefano to develop and automate an accurate process for extracting X-ray lightcurves from Chandra Source Catalog data.
- **Intriguing Time Variability in X-ray binaries in 47 Tucanae:** The main goal of this project was to search through X-ray source lightcurves to find potential transiting planets. I discovered an unusual transit in the X-ray binary eclipsing system X5 and we conducted hardness ratio and ingress/egress analysis to determine the possibility of a 3-body system. REU paper can be found here. AAS poster can be found here.

Undergraduate Researcher — February 2022 – May 2023
University of California, Berkeley & Lawrence Berkeley National Lab

- **Multimessenger Constraints on H_0 from GW170817:** In this project I worked closely with Antonella Palmese and under Prof. Saul Perlmutter to re-analyze constraints on the Hubble Constant (H_0) derived from electromagnetic emission of the gravitational wave event GW170817. In addition to using MCMC sampling, we developed a hierarchical Bayesian formalism and 2D posterior reconstruction and derived a 6.5% precision measurement of H_0 from x-ray and radio afterglow data.

Undergraduate Lab at Berkeley - Theoretical Astrophysics Project September 2020 – May 2021

ULAB mentee at University of California, Berkeley

- **Measuring Cosmic Distances using Gravitational Waves:** I constructed software to determine distances from LIGO strain data for 10 GW events. From this data, I calculated Hubble parameter estimates and derived an inclination angle equation to amplify strain data.

Posters and Talks

- **243rd American Astronomical Society Meeting iPoster Presentation:** I presented my research on X-ray binary systems that I did over the summer at the Harvard CfA/SAO REU. Poster can be found here.
- **Harvard CfA/SAO REU Summer Talk:** Presented my research to CfA/SAO research scientists, mentors in the program, and fellow REU interns. Talk can be found here.
- **2022 American Association of Physics Teachers Summer Meeting Talk:** Gave an 8 minute talk on the structure and effectiveness of ULAB as an organization. Abstract can be found here.
- **2022 American Physical Society April Meeting Poster:** Presented research that was done on the effectiveness of ULAB as an organization. Abstract can be found here.
- **Physics Innovators Initiative (Pi^2) Summer Poster:** Presented my research on Hubble constant constraints and gravitational waves to the UC Berkeley Physics department. Poster can be found here.
- **ULAB Physics and Astronomy Division Poster session:** Presented our group research on gravitational waves and cosmic distances to the Astronomy and Physics departments at UC Berkeley. Poster can be found here.

Leadership and Outreach

Research Director, ULAB: Physics and Astronomy Division May 2022 – May 2024

University of California, Berkeley – Undergraduate Lab at Berkeley

- **Research director and lead instructor for ULAB:** As head instructor, I led ULAB, which is a course that seeks to make research accessible to students traditionally underrepresented and unsupported in academia.
- Along with course staff, I developed Python assignments, taught over 60 students, and oversaw 10+ staff members and mentors.
- I helped secure funding through the Berkeley Discover Grant to pay mentors.
- **Lab Manager:** Held this position from August 2021-May 2022 and assisted with duties listed above.

President, Undergraduate Astronomy Society May 2022 – May 2024

University of California, Berkeley

- Managed club staff of 12+ officers, organized and planned club meetings, and coordinated with the astronomy department to hold professional and community outreach events.
- Developed a cluster program that allows students to form mentorship groups with an experienced mentor.
- Planned and helped run star parties by operating the 17 inch telescope on the roof of the astronomy department, and hosted local high school students for astronomy talks and viewing parties.
- **Club Officer:** Held this position from **August 2021-May 2022**

Undergraduate Representative for Astronomy Department August 2023 - May 2024

University of California, Berkeley

- Served as a liaison between the astronomy faculty and astronomy undergraduates, and advocated on behalf of the astronomy undergraduates.

Undergraduate Climate Advisor for Astronomy Department August 2022 – May 2023

University of California, Berkeley

- I served as a non-confidential department resource for students that experience harassment or other climate issues. I organized meetings with the Climate Advisor Committee monthly to report issues, suggestions, and feedback from students, and raised important concerns and harassment cases to the committee.

Teaching

Teacher's Assistant for ASTR 2 Winter 2025
University of California, Santa Cruz *Santa Cruz, CA*

- I was a TA for ASTR 2: Overview of the Universe taught at UC Santa Cruz. I taught 3 discussion sections of 15+ students each and managed course logistics for 200 students.

Teacher's Assistant for Astro C12 Spring 2024
University of California, Berkeley *Berkeley, CA*

- I was a TA/UGSI for the Introduction to the Planets course taught by Prof. Courtney Dressing and Prof. Raymond Jeanloz at UC Berkeley. I taught 2 discussion sections of 25+ students each and led homework help sessions.

Teacher's Assistant for Astro C10 Fall 2022, Fall 2023
University of California, Berkeley *Berkeley, CA*

- I was a TA/UGSI for the Introduction to General Astronomy course taught by Prof. Alex Filippenko at UC Berkeley. I taught 4 discussion sections of 30+ students each, held weekly office hours, and led homework help sessions. I also operated various telescopes for telescope viewing nights, and managed course logistics for 900+ students.

Course Reader for Astron C12 Spring 2022, Spring 2023
University of California, Berkeley *Berkeley, CA*

- I was a grader for the Introduction to the Planets course taught by Prof. Courtney Dressing at UC Berkeley. I graded 160+ homework assignments weekly, and 4 exams/projects throughout the semester. I also delegated responsibilities to fellow graders and organized homework logistics.

Service

- Organized and planned the 2025 prospective graduate student visit at UC Santa Cruz. Managed travel logistics, activities, faculty event planning, and informational presentations.

Awards

Dorothea Klumpke Roberts Prize Recipient University of California, Berkeley
$1,000 awarded for outstanding scholarly achievement

Daniel Edward Wark Award Recipient University of California, Berkeley
$10,000 awarded on the basis of academic merit and character

FUTURE Women in Physics 2022 Cohort California Institute of Technology
Invited to FUTURE conference for women in physics; member of the 2022 cohort

Physics Innovators Initiative (Pi^2) Summer Scholar University of California, Berkeley
$5,500 grant received to fund summer research. Final paper can be found here.

Skills

Programming Languages: Python, UNIX, LaTeX
Libraries/Software: MESA, CIAO, NumPy, Pandas, astropy, SciPy, Pickle, emcee, Matplotlib, Jupyter
Tools: GitHub, SAOImageDS9, Microsoft Office Programs, Google Suite