

Yan Xiang Lai

PhD student at the University of Queensland

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Education

Bachelor of Advanced Science (First Class Honours)

2017 – 2020

University of Queensland (UQ)

Brisbane, Australia

- Honours thesis title: Can peculiar velocity surveys eliminate cosmic variance?
- Advisors: Dr Cullan Howleet and Prof. Tamara Davis.
- First test with observation data to show that combining the peculiar velocity and galaxy overdensity can eliminate the cosmic variance.
- Thesis nominated for the national Bok prize for best astrophysics honours thesis (13 nominations across Australia in 2021).

Doctor of Philosophy (PhD)

July 2021 – June 2025 (estimated)

University of Queensland

Brisbane, Australia

- PhD thesis title: Using motion of galaxies to probe fundamental physics.
- Advisors: Dr Cullan Howleet and Prof. Tamara Davis.
- Developed an improved method to test General Relativity with the largest (at the time of publication) peculiar velocity survey. This method significantly reduces systematic error compared to previous approaches.
- Combining analytical covariance matrix, data compression, and Taylor series emulator for the first time to show they could return unbiased constraints with significantly shorter computational time.
- Developed the crucial galaxy power spectrum pipeline for the Dark Energy Spectroscopic Instrument (DESI) survey for the Year-1 Full-Modelling analysis.
- Led three first-author papers (the fourth first-author paper is planned to be published before the end of PhD) and one second-author paper.

Awards

- Winner of the student challenge question (How much carbon does online conference save?) during the Astronomical Society of Australia Annual Science Meeting (500 AUD, 2021)
- Graduate School Scholarship of The University of Queensland (35000 AUD per annum, 2021)
- *Three-minute thesis* runner-up of UQ School of Mathematics and Physics (125 AUD, 2023)
- Three-minute thesis people's choice of UQ School of Mathematics and Physics (125 AUD, 2023)
- UQ School of Mathematics and Physics tutor award (50 AUD, 2023, 16 recipients with over 50 nominations)

Publications

Summary: I have authored eleven refereed journal publications. Of these eleven publications, three are first-author (the fourth one is planned to be published before the end of PhD), one is second-author. Please see the separate list of publications for more details or visit [Astrophysics Data System \(ADS\)](#).

Selected seminars and conference presentations

Summary: I gave fifteen presentations during my PhD. Four of them were within UQ or DESI collaboration, three of them were posters, six of them were at national/international conferences, and two of them were outreach talks. I listed the selected high-visibility talks below.

- “Using peculiar velocity surveys to constrain the growth rate of structure with the wide-angle effect” at the VIII Essential Cosmology for the Next Generation conference (Playa del Carmen, Mexico, November 2022).
- “Faster cosmological analysis with power spectrum without simulations” at the seminar at the University of Barcelona (Barcelona, Spain, September 2023).
- “Validating the methods being used within DESI to constrain cosmological parameters from the power spectrum” at the 26th International Conference on Particle Physics and Cosmology (Madrid, Spain, September 2023)
- “A comparison between Shapefit compression and Full-Modelling method for DESI and Beyond” at the Astronomical Society of Australia Annual Science Meeting (Online, June 2024).

Outreach

I am passionate about communicating cutting-edge research with the general public. I have participated in various outreach events, such as telescope viewing with the general public and organizing work experience programs. Here are some selected activities:

- “What does the motion of galaxies tell us about models of gravity?”, outreach talk to the UQ stargazing club on August 2022.
- Solar telescope viewing of the total solar eclipse on the 20th of April, 2023, at UQ.
- Collaborating with the local planetarium for telescope viewing for the general public in 2023.
- Main organizer of the work experience program in 2024. In 2024, we have a record high of nine high school students joining the astrophysics work experience program at UQ. My main responsibility was designing the schedule, creating projects, and supervising the students.
- Astrophysics booth at the Laura Street Festival in 2024.

Other roles and responsibilities

- Local Organizing Committee of the Cosmic Flows 2025 conference,
- Organizing the astrophysics group meeting at UQ from August 2024.
- Tutor of the introductory astrophysics course (PHYS2082) at UQ from 2022 to 2023.

Skills

I have extensive project experience with *Python* and *C*. I also use *GitHub* extensively to store the codes for all of my projects.

References

Name	Insitution	Contact detail
○ Dr. Cullan Howlett	University of Queensland	Email: c.howlett@uq.edu.au Phone: (+61) 420766717
○ Prof. Tamara Davis	University of Queensland	Email:tamarad@physics.uq.edu.au Phone: (+61) 432526989
○ Dr. Héctor Gil-Marín	Institut de Ciències del Cosmos de la Universitat de Barcelona	Email:hectorgil@icc.ub.edu Phone: (+34) 934031320