

# Samuel Lai

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## Statement

I am an astrophysics researcher specialising in accretion onto compact objects. By combining high performance computing simulations of accretion discs with high quality spectroscopic observations, I develop novel ways of understanding the diversity of observable phenomena. My goal is to study multiwavelength data of ultraluminous black holes in the early universe to understand their cosmic history, how they continue to grow, and how they affect their host galaxies/environment.

## Education

March 2021 – Present	<b>Australian National University, Australia</b> Research School of Astronomy & Astrophysics Website: <a href="https://www.anu.edu.au/">https://www.anu.edu.au/</a> <ul style="list-style-type: none"><li>Astrophysics PhD</li></ul>
Sept 2018 – Nov 2019	<b>University College London, United Kingdom</b> Department of Physics & Astronomy Website: <a href="https://www.ucl.ac.uk">https://www.ucl.ac.uk</a> <ul style="list-style-type: none"><li>Astrophysics MSc</li><li>Distinction, 87.85/100.00</li></ul>
Sept 2014 – June 2018	<b>University of California – Los Angeles, United States</b> College of Letters and Science Website: <a href="https://www.ucla.edu">https://www.ucla.edu</a> <ul style="list-style-type: none"><li>Astrophysics BSc</li><li>Magna Cum Laude, 3.87/4.00 GPA</li></ul>

## Research

Sept 2020 – Present	<b>High-Redshift Ultraluminous Quasi-Stellar Objects</b> Mentor(s): Dr. Christopher Onken, A/Prof. Christian Wolf, and Dr. Fuyan Bian
Nov 2015 – Sept 2020	<b>Contaminated White Dwarfs with Infrared Excess</b> Mentor(s): Dr. Siyi Xu (许偲艺), assistant astronomer at Gemini Observatory
Oct 2018 – Nov 2019	<b>Emission from Black Hole Event Horizon</b> Mentor(s): Dr. Ziri Younsi and Prof. Kinwah Wu Thesis Title: <i>Black Hole Jet Simulation and Images</i>
Jul 2017 – June 2018	<b>Harmonic Analysis of Gravitational Wave Power in Binary System</b> <b>Simulation of Stochastically Driven Coupled Oscillator Grid</b> Mentor(s): Prof. Kenneth Young, Emeritus Professor at CUHK Thesis Title: <i>Gravitational waves from a binary system: A detailed analysis of orbital decay</i>
Apr 2017 – Aug 2018	<b>Galactic Morphology by Surface Brightness and Isophotal Contours</b> Mentor(s): Dr. Michael Rich, research astronomer at UCLA

## Relevant Work Experience

July 2022 – Present	<b>Australian National University</b> , RSAA Publications Officer ANU2.3m Time Allocation Committee Website: <a href="https://rsaa.anu.edu.au/research/publications">https://rsaa.anu.edu.au/research/publications</a>
Aug – Oct 2021	<b>European Southern Observatory</b> , PhD Studentship Programme Website: <a href="https://www.eso.org/">https://www.eso.org/</a>
Jan – June 2020	<b>Gemini Observatory</b> , Short-term Research Scholar Website: <a href="https://www.gemini.edu/">https://www.gemini.edu/</a>
June – Aug 2013	<b>Cluster Technology Limited</b> , Software Trainee Website: <a href="https://www.clustertech.com">https://www.clustertech.com</a> <ul style="list-style-type: none"><li>Project Management Team</li></ul>
June – Aug 2012	<ul style="list-style-type: none"><li>Software Development Team</li></ul>

## Selected Publications

2023	<b>Characterising SMSS J2157–3602, the most luminous known quasar, with accretion disc models</b> Authors: <b>Samuel Lai</b> , Christian Wolf, Christopher A Onken, Fuyan Bian <i>Monthly Notices of the Royal Astronomical Society</i> <b>ALIBRICQS: The All-sky BRIght, Complete Quasar Survey</b> Authors: Christopher A Onken, Christian Wolf, Wei Jeat Hon, <b>Samuel Lai</b> , Patrick Tisserand, Rachel Webster <i>Publications of the Astronomical Society of Australia</i>
2022	<b>Chemical Abundance of <math>z \sim 6</math> quasar broad-line regions in the XQR-30 sample</b> Authors: <b>Samuel Lai</b> , Fuyan Bian, Christopher A Onken, Christian Wolf, Chiara Mazzucchelli, Eduardo Banados, Manuela Bischetti, Sarah E I Bosman, George Becker, Guido Cupani, Valentina D’Odorico, Anna-Christina Eilers, Xiaohui Fan, Emanuele Paolo Farina, Masafusa Onoue, Jan-Torge Schindler, Fabian Walter, Feige Wang, Jinyi Yang, Yongda Zhu <i>Monthly Notices of the Royal Astronomical Society</i> <b>Discovery of the most luminous quasar of the last 9 Gyr</b> Authors: Christopher A Onken, <b>Samuel Lai</b> , Christian Wolf, Adrian B Lucy, Wei Jeat Hon, Patrick Tisserand, Jennifer L Sokolowski, Gerardo J M Luna, Rajeev Manick, Xiaohui Fan, Fuyan Bian <i>Publications of the Astronomical Society of Australia</i>

- 2021 **Infrared Excesses around Bright White Dwarfs from Gaia and unWISE. II.**  
 Authors: **Samuel Lai**, Erik Dennihy, Siyi Xu, Atsuko Nitta, Scot Kleinman, S.K. Leggett, Amy Bonsor, Simon Hodgkin, Alberto Rebassa-Mansergas, Laura K. Rogers  
*Astrophysical Journal*
- 2020 **Five New Post-main-sequence Debris Disks with Gaseous Emission**  
 Authors: Erik Dennihy, Siyi Xu, **Samuel Lai**, Amy Bonsor, J.C. Clemens, Patrick Dufour, Boris T. Gansicke, Nicola Pietro Gentile Fusillo, Francois Hardy, R.J. Hegedus, J.J. Hermes, B.C. Kaiser, Markus Kissler-Patig, Beth Klein, Christopher J. Manser, Joshua S. Reding  
*Astrophysical Journal*
- Infrared Excesses around Bright White Dwarfs from Gaia and unWISE. I.**  
 Authors: Siyi Xu, **Samuel Lai**, Erik Dennihy  
*Astrophysical Journal*

## Grants, Awards, and Prizes

2023	RSAA Travel Grant	Australian National University
	• \$1,200, Destination: Sydney	
	RSAA Travel Grant	Australian National University
	• \$168, Destination: Kioloa	
	Observation Proposal	European Southern Observatory
	• European Southern Observatory/X-shooter: 0.3h	
2022	Community Science Meeting Travel Support	GMTO Corporation
	• \$1,615, Destination: United States	
	RSAA Travel Grant	Australian National University
	• \$3,620, Destination: United States	
	RSAA Travel Grant	Australian National University
	• \$1,920, Destination: Siding Spring Observatory	
	RSAA Travel Grant	Australian National University
	• \$1,400, Destination: Tasmania	
	Observation Proposal	European Southern Observatory
	• European Southern Observatory/X-shooter: 16.4h	
	Observation Proposal	National Optical Infrared Laboratory
	• Southern Astrophysical Research Telescope/TripleSpec4.1: 5 nights	
2021	Mt. Stromlo Student Seminars – Best Science Talk	Australian National University
	Observation Proposal	European Southern Observatory
	• European Southern Observatory/X-shooter: 21.5h	
	Observation Proposal	National Optical Infrared Laboratory
	• Southern Astrophysical Research Telescope/TripleSpec4.1: 4 nights	
2020	University Research Scholarship	Australian National University
	• \$34,000/annum, 3.5 years	
	HDR Fee Remission Merit Scholarship	Australian National University
	• Full tuition, 4 years	
	RSAA Supplementary Scholarship	Australian National University
	• \$5,000/annum, 3 years	
	President's PhD Scholarship	Imperial College London
	• Full tuition, \$26,420/annum, 3.5 years, not accepted	
	Croucher Scholarship	The Croucher Foundation
	• Full tuition, \$30,300/annum, 3 years, not accepted	
	Observation Proposal	National Optical Infrared Laboratory
	• Gemini Observatory: NIRI/Flamingos2: 24.8h	
2019	Harrie Massey Prize – Best Overall Astrophysics MSc	University College London
	• \$150	
	Mathematical and Physical Sciences Dean's Commendation	University College London
	MSc with Distinction	University College London
2018	BSc – Magna Cum Laude	University of California – Los Angeles
	Dean's List	University of California – Los Angeles
2017	Dean's List	University of California – Los Angeles
2016	Dean's List	University of California – Los Angeles
2015	Dean's List	University of California – Los Angeles
2014	Dean's List	University of California – Los Angeles
	Intermural Tennis Championship – Silver	International Schools Sports Federation
	Musicianship Service Award	International Christian School
2012	Outstanding Musician Award	International Christian School
	Intermural Tennis Championship – Bronze	International Schools Sports Federation

## Teaching and Outreach

2023	ASTR3002/ASTR6002 – Galaxies and Cosmology Course
	ESO Studentship
	Student: Yanina Bonilla Lopez
	ASTR3005 – Astrophysics Research Course

- Student: Ashley Hai Tung Tan  
ANU 2.3m Telescope Training
- Student: Neelesh Amrutha
- 2022 ANU 2.3m Telescope Training  
Students: Jemma Pilosof, Cassidy Grae Mihalenko  
ASTR3005 – Astrophysics Research Course  
Student: Zachary Steyn  
ASTR3002/ASTR6002 – Galaxies and Cosmology Course  
J1144-4308 NPR Radio Interview  
<https://www.nprillinois.org/2022-06-16/scientists-unexpectedly-discover-the-fastest-growing-black-hole>  
J1144-4308 Discovery  
e.g. <https://cosmosmagazine.com/space/fastest-growing-black-hole-anu/>
- 2020 Journey through the Universe 2020 – Gemini Observatory  
JWST Proposal Workshop  
ICS Alumni Newsletter
- 2019 ICS High School Astronomy Club  
ICS High School Chemistry

## Actively-Maintained Public Codes

- 2023 **PyQSpecFit: Python-based Quasar Spectral Fit Code**  
Authors: **Samuel Lai**  
Purpose: Sensibly model emission features in rest-frame optical and ultraviolet quasar spectra.  
*GitHub/Zenodo*
- BADFit: Black hole Accretion Disc Fitting Code**  
Authors: **Samuel Lai**  
Purpose: Model the large-scale multi-wavelength quasar spectral energy distribution with ray-traced thin and slim accretion disc synthetic spectra in order to constrain black hole properties.  
*GitHub/Zenodo*

## Talks/Presentations

July 2023	Sydney, Australia	Astronomical Society of Australia (ASA) Annual Science Meeting
June 2023	Hong Kong	Astrophysical Black Holes: A Rapidly Moving Field <sup>1</sup>
March 2023	Canberra, Australia	RSAA Journal Club
September 2022	Online	Gemini Observatory Journal Club
September 2022	Tucson, Arizona	University of Arizona Extragalactic Group
September 2022	Tucson, Arizona	Steward / NOIRLab Galaxy Group
September 2022	Sedona, Arizona	Giant Magellan Telescope Community Science Meeting
March 2022	Online	XQR-30 WP3
July 2022	Canberra, Australia	PhD Thesis Presentation
July 2022	Tasmania, Australia	Astronomical Society of Australia (ASA) Annual Science Meeting
February 2022	Online	European Southern Observatory TMT
November 2021	Online	Mt. Stromlo Student Seminars
September 2019	London, United Kingdom	MSc Thesis Defense

<sup>1</sup> Could not attend