Neelesh Amrutha

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My research focuses on understanding the physics of active galactic nuclei through optical spectroscopy and time-domain observations. I develop and apply methods to decompose AGN spectra, measure black hole masses, and link spectroscopic variability to the structure and dynamics of the broad-line region.

Education

The Australian National University — Canberra
Doctor of Philosophy, Astronomy and Astrophysics — 2023–*pres.*

- Supervisory Panel: A/Prof. Christian Wolf (Chair), Dr. Christopher Onken, Prof. Rachel Webster
- Thesis topic (tentative): Understanding AGN sub-types: Orientation, Obscuration and Accretion States

The Australian National University — Canberra
Bachelor of Science (Advanced) (Honours) GPA - 6.8/7 — 2019–2022

- Majors: Astronomy and Astrophysics, Computer Science; Minor: Mathematics
- Honours: Astronomy and Astrophysics

Research Experience

The Australian National University — Feb 2022 - Nov 2022
Honours in Astronomy and Astrophysics at RSAA

- Characterising variability in AGN lightcurves to search for changing-look AGN.

Centre of Excellence for Engineered Quantum Systems — Dec 2020 - Feb 2021
Summer Research Scholarship

- Low-temperature electromagnetic characterisation of crystals and defects.

The Australian National University — Jul 2020 - Oct 2020
Undergraduate Astrophysics Research Project

- Characterising young stellar associations with Chronostar, a Bayesian forward-modelling tool.

Publications

Correcting Black Hole Masses Biased by Size Inertia in Broad Line Regions
Amrutha, N.; Wolf, C; Onken, C. A.; Hon, W-J.; Lai, S.; Raithel, D.; Tan, A. H-T.; Webster, R.
Nature Communications, **under review**

Discovering changing-look AGN in the 6dF Galaxy Survey using ATLAS light curves
Amrutha, N.; Wolf, C; Onken, C. A.; Hon, W-J.; Lai, S.; Tonry, J. L.; Webster, R.
Monthly Notices of the Royal Astronomical Society, **2024**

The accretion of a solar mass per day by a 17-billion solar mass black hole
Wolf, C; Lai, S.; Onken, C. A.; **Amrutha, N.**; Bian, F.; Hon, W-J.; Tisserand, P.; Webster, R.
Nature Astronomy, **2024**

Skills

- **Research Skills:**
  - **Observations (ANU 2.3m; $\sim 10^3$ AGN spectra) -** Plan and execute observation blocks for multiple projects in the research group, reduce and calibrate raw data to produce IFU cubes.
  - PI: 173 hours (ANU 2.3m); CoI: 224 hours (ANU 2.3m); 212 hours (VLTI GRAVITY/MATISSE, submitted P117)
  - **Astronomical Data Analysis** — Decompose AGN spectra, derive virial black hole mass estimates, analyse light-curve variability to identify anomalous sources, and compile a spectral atlas data product from the observed AGN spectra.
- **Programming Languages:**
  - **Python -** Manage and analyse data, apply basic machine learning, and build GUIs to streamline research tasks.
  - **Basic proficiency -** C, C++, Java, Haskell
- **Technical Software:** Unix shell (bash/zsh), Mathematica, MATLAB, LaTeX, Git, TOPCAT, QFitsView
- **Other Software:** Blender (3D modeling and animation)

Presentations

Talks

- Stromlo Science Lunch (Canberra) — May 2025
- Australia/eROSITA-DE Workshop (online) — Mar 2024
- Mt Stromlo Student Seminars (Canberra) — Nov 2023
- Astronomical Society of Australia Annual Science Meeting (Sydney) — Jul 2023

Poster/Video

- Astronomical Society of Australia Annual Science Meeting (Adelaide) — Jul 2025
- Astronomical Society of Australia Annual Science Meeting (online) — Jun 2024

Scholarships and Awards

- Astronomical Society of Australia Student Travel Grant — 2025
- ANU Research School of Astronomy and Astrophysics Supplementary Scholarship — 2024–*pres.*
- Australian Government Research Training Program Scholarship — 2023–*pres.*
- Joan Duffield PhD Supplementary Scholarship — 2023
- Engineered Quantum Systems Summer Research Scholarship — 2021

Teaching and Mentoring

Teaching Assistant/Course Tutor — Feb 2024 - Nov 2025

The Australian National University undergraduate courses

- ASTR1003 Astronomy and Space, ASTR3002/ASTR6002 Galaxies and Cosmology

Research — Feb 2024 - Nov 2025

Mentoring and teaching other relevant research skills

- ASTR3005 Astrophysics Research Project Course, spectrum decomposition, ANU 2.3m Telescope observation block management, Honours - PhD buddy system mentor

Indigenous Tuition Program — Apr 2023 - Jul 2025

The Australian National University, funded by National Indigenous Australians Agency

- One-on-one tutoring 8 undergraduate students.
- Courses: Foundations of Physics, Physics I/II, Astronomy and Space, Discrete Mathematical Models, Mathematics and Applications I/II, Applied Mathematics I/II, Quantum Physics

Community and Professional Services

- Astronomical Society of Australia Harley Wood School of Astronomy 2026
  Part of the annual school organising committee
- Mt Stromlo Student Writing Retreat 2025
  Organised a 5-day student writing retreat (10 000 AUD)
- ANU 2.3m Telescope Time Allocation Committee 2024
  Student member for the committee
- Mt Stromlo Student Seminars 2023
  Organised a 3-day, student-led, Australia-wide conference for graduate students (5 000 AUD)

Referees

- A/Prof. Christian Wolf — The Australian National University
  christian.wolf@anu.edu.au
- Dr. Christopher Onken — The Australian National University
  christopher.onken@anu.edu.au
- Prof. Rachel Webster — University of Melbourne
  r.webster@unimelb.edu.au