Ayan Acharyya

Contact Information

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Research Expertise

Galaxy evolution, Chemical evolution - gas phase metallicity, ISM properties, translating simulations to mock IFU datacubes, analysing cosmological hydrodynamical simulations.

Post-PhD Experience

INAF Padova, Italy. May 2024–present
Post-doctoral researcher: working on JWST/NIRISS data with the JWST-PASSAGE team.

Johns Hopkins University, Baltimore, USA. January 2021–April 2024
Assistant Research Scientist: Post-doctoral researcher with the FOGGIE group. This involves using Enzo to produce cosmological zoom-in simulations of galaxies and developing my own tools (Github link) for creating mock data products.

Education

Australian National University, Canberra, Australia; September 2015–September 2020
PhD

- Thesis title: *Chemical evolution of the Universe across the cosmic time*
- Advisors: Prof. Lisa Kewley, Prof. Mark Krumholz, A/Prof. Christoph Federrath.

Indian Institute of Technology Kharagpur, India August 2010– April 2015
Integrated Bachelors and Masters of Science

- Thesis title: *Simulating HII bubble around quasars to be used for matched filter technique in redshifted 21cm maps*
- Advisor: Prof. Somnath Bharadwaj

University of Manitoba, Winnipeg, Canada May–July 2014
MITACS Research Scholar

- Project title *Colorizing the dance of galaxies*
- Advisor: Dr. Jayanne English

Observing Experience

- 6 nights total on Keck/ESI, from Keck HQ at Waimea, Hawaii. I was co-I on two out of the three observing proposals.
- 1 night on ANU 2.3m telescope: WiFeS spectrograph.

Successful Proposals

- *How do galaxies move their metals? Unraveling z ¿ 2 disks with controlled numerical experiments tailored to JWST*, JWST (Cycle 3), Theory/AR, **PI: Dr. Ayan Acharyya**
- *CO Kinematics at Cosmic Noon: Timing the Redistribution of Metals Around Galaxies*, ALMA/Band3 (Cycle 8), PI: Dr. Raymond Simons
- *Unwrapping the epoch of reionization through analogs at cosmic noon*, VLT/XSHOOTER (Cycle P108), PI: Dr. Anshu Gupta
- *Rest-frame Ultraviolet spectroscopy of Two Lensed Galaxies at z=1.4*, Keck/ESI (2016B), PI: Dr. Fuyan Bian
- *Galaxy Feedback in two lensed galaxies at z=1.4*, Keck/ESI (2016B), PI: Dr. Jane Rigby

Highlights

- **Three first-authored** and 15 total **refereed publications**, with over 400 citations, and h-index = 10.
- Given over **40 talks and colloquia** at conferences and institutes across 10 countries, including four invited talks. Hosted over 30 outreach tours, involving public talks.
- Secured over **$12,000 in awards** and travel grants.
- Total **7 nights observing experience** on Keck telescope in Hawaii and the ANU 2.3m telescope in Australia.
- **PI on one** successful JWST theory proposal and **Co-I on four** successful observing proposals.
- **Mentor/research-supervisor** for two high-school students and one undergraduate student.
- **Co-organised four conferences**, including an international one.

Awards and Grants

11. 2023: AAS International Travel Grant $1700
10. 2023: Astro3D visitor travel grant $3500
9. 2019: RSAA student travel grant $4000
8. 2019: Astronomical Society of Australia (ASA) student travel award $1000
7. 2019: ANU Vice Chancellor's travel grant $1500
6. 2017: Olin J Eggen Research Award 2017 at RSAA, ANU
5. 2015: ANU PhD Scholarship (International) and RSAA Research Supplementary Scholarship
4. 2014: MITACS Globalink Research Internship award
3. 2013: Visiting Students Research fellowship (Indian Institute of Technology Gandhinagar)
2. Second-best poster award in the Theme Meeting on Ultrafast Science UFS 2013, IIT Kharagpur
1. 2012: Visiting Students Research fellowship (Indian Academy of Sciences)

Mentoring/Teaching Experience

4. **Summer At Space telescope Program (SASP) mentor**: I was the primary mentor of an undergraduate student for an intensive 9 week summer research program, as part of the SASP program, which is aimed at providing a diverse, international batch of students with an opportunity of a short research experience. As primary mentor my role ranged from guiding my student on broad science research to teaching and helping them learn soft skills such as coding, writing and science communication. Their work led to a non-refereed publication on RNAAS. *Baltimore, USA;* June - August 2023

3. **Exploring the Universe with Space Telescopes**: I was one of the two competitively hired course instructors for this 2 week intensive summer course at Johns Hopkins University for prospective undergraduate students. My role included delivering lectures, evaluating tests, and manage the cohort of 20-30 students. *Baltimore, USA;* July - August 2023

2. **One Sky**: Volunteered as one of the two instructors for a fully-virtual, free, 18 week Introduction to Astronomy course for high school students in India, as a part of Open Field Collective. I was responsible for developing the course materials for student sin Grade 8-10, as well as delivering the lecture in weekly 1-2 hour sessions. *Virtual;* August - December 2022

1. **Science Mentors ACT**: Mentored two high-school students for their 'ACT Science Mentors' Project, on "Cepheid Variables" and "Eclipsing binaries" respectively, on the MSATT telescope at Mount Stromlo Observatory. I was responsible for teaching them the relevant physics and mathematics as well as help them with the data analysis and report writing.
Canberra, Australia; August 2018 - March 2019

Service

9. Co-organiser of the weekly **Informal Science Hour** at Space Telescope Science Institute. I initiated this meeting format to revive the in-person, collaborative and scientific environment at STScI post-pandemic, and it has so far been very successful. My role includes soliciting discussion leaders every week, run the meetings, and organising some light refreshments (sponsored by the institute). December 2022 - current
8. **Panel Support Scientist for the James Webb Space Telescope** Cycle 2 Time Allocation Committee. This involved all day virtual meetings for a week, to help smooth running of one of the JWST panels that met virtually to discuss and rank telescope proposals. My role was to manage the grading software platform, handle queries from the panelists, and assist the panel chair in running the meeting. April 2023
7. Over 30 stargazing tours as **Outreach Assistant** at **Mount Stromlo Observatory outreach team** 2017–2020
6. Organiser of **GEARS3D group meeting** at RSAA 2018–2020
5. OC member of the **ASTRO3D Student Retreat** May 2019
4. LOC member of the **Harley Wood School of Astronomy** July 2017
3. PhD student representative on the **RSAA Education Committee** June 2016 - February 2017
2. LOC/SOC member of the **Mount Stromlo Student Seminars** December 2016
1. LOC member of the **DAE-BRNS Theme meeting on Ultrafast Science**, Kharagpur 2013

Talks

Conferences (Contributed talks)

13. **STScI Spring Symposium: Recipes to Regulate Star Formation at All Scales** Robust measurements of gas-phase metallicity distributions with FOGGIE simulations *Baltimore, USA;* April 2024
12. **Space Telescope Science Institute, Hot-Sci Colloquium series** Gas-phase metallicity distributions with FOGGIE simulations *Baltimore, USA;* August 2023
11. **Feedback & the Baryon Cycle in Galaxies** Gas-phase metallicity distributions with FOGGIE simulations *Healesville, Australia;* July 2023
10. **Oases in the Cosmic Desert Conference** Robust measurements of gas-phase metallicity distributions with FOGGIE simulations *Tempe, USA;* February 2023
9. **Space Telescope Science Institute, Discovery Seminar series** "Mockulus reparo" — to fix the effects on metallicity gradient measurements due to our insufficient "seeing" [Recording link] *Baltimore, USA;* May 2022
8. **Johns Hopkins University** "Mockulus reparo" — to fix the effects on metallicity gradient measurements due to our insufficient "seeing" *Baltimore, USA;* September 2021
7. **Chemical Abundances in Gaseous Nebulae** "Abundances from UV spectra at high-redshift" *virtual;* May 2021
6. **American Astronomical Society (AAS) 2019** "Testing new rest-frame optical & UV diagnostics on lensed galaxy at z∼1.7" *Seattle, USA;* January 2019
5. **AAS 2019** "Determining effects of telescope resolution on metallicity gradient with synthetic observations of galaxy simulations" *Seattle, USA;* January 2019
4. **Australian National Institute for Theoretical Astrophysics (ANITA)** *Perth, Australia;* February 2018
3. **5th Annual GMT Community Science Meeting** *New York, USA;* July 2017
2. **ASA Annual Science Meeting** *Canberra, Australia;* July 2017
1. **Mount Stromlo Student Seminars** *Canberra, Australia;* December 2015

Colloquia

27. **Max Planck Institute for Astronomy** (Contributed) *Heidelberg, Germany;* February 2025
26. **Leibniz Institute for Astrophysics** (Contributed) *Potsdam, Germany;* February 2025
25. **Space Telescope Science Institute** (Contributed) *Baltimore, USA;* November 2024
24. **California Institute of Technology** (Contributed) *Pasadena, USA;* October 2024
23. **Stockholm University** (Contributed) *Sweden;* October 2024
22. **Lund University** (Contributed) *Sweden;* October 2024
21. **Cosmic Dawn Center** (Contributed) *Coppenhagen, Denmark;* October 2024
20. **INAF Padova** (Invited) *Padova, Italy;* April 2024
19. **Macquarie University** (Contributed) *Sydney, Australia;* July 2023
18. **University of New South Wales** (Contributed) *Sydney, Australia;* July 2023
17. **Australian National University** (Contributed) *Canberra, Australia;* July 2023
16. **Curtin University** (Contributed) *Perth, Australia;* June 2023
15. **University of Western Australia** (Contributed) *Perth, Australia;* June 2023
14. **University of Connecticut** (Invited) *Hartford, USA;* March 2023
13. **Universidad Nacional Autonoma de Mexico** (Contributed) *Mexico City;* September 2019
12. **University of Texas at Austin** (Contributed) *Austin, USA;* September 2019
11. **Ohio State University** (Contributed) *Columbus, USA;* September 2019
10. **New York University** (Contributed) *New York City, USA;* September 2019
9. **Space Telescope Science Institute** (Contributed) *Baltimore, USA;* September 2019
8. **Sri Venkateswara College of Engineering** (Invited) *Chennai, India;* March 2019
7. **Vellore Institute fo Technology** (Invited) *Vellore, India;* March 2019
6. **R V College of Engineering** (Invited) *Bengaluru, India;* March 2019

5. **Leiden Observatory** (Contributed) *Leiden, Netherlands;* September 2018
4. **Max Planck Institute for Astronomy** (Contributed) *Heidelberg, Germany;* September 2018
3. **Institute for Theoretical Astrophysics** (Contributed) *Heidelberg, Germany;* September 2018
2. **Indian Institute of Technology** (Contributed) *Kharagpur, India;* December 2016
1. **National Centre for Radio Astrophysics** (Contributed) *Pune, India;* December 2016

Outreach

2. **Mount Stromlo Observatory Space Squad** (Invited) *Canberra, Australia;* April 2019
1. **Physics in the Pub** (Invited) *Canberra, Australia;* October 2018

Posters

6. **EAS 2024 S12: Zooming In, Zooming Out: Exploring Galaxy Formation through Simulations** *Padova, Italy;* July 2024
5. **GAS-PISA Conference** *Pisa, Italy;* May 2024
4. **JWST First Science Conference** *Baltimore, USA;* December 2022
3. **IAU Focus Meeting** *Vienna, Austria;* August 2018
2. **ASA Annual Science Meeting** *Melbourne, Australia;* July 2018
1. **DAE-BRNS Theme Meeting on Ultrafast Science** *Kharagpur, India;* 2013

Pre-PhD Research Experience

University of Manitoba, Winnipeg, Canada. May–July 2014
MITACS Research Scholar: Project title "Colorizing the dance of galaxies" with Dr. Jayanne English. This involved simulating galaxies spanning diverse morphologies with a MATLAB based code 'Ferret'.

Indian Institute of Technology Gandhinagar, India. May–July 2013
Summer Research Scholar: "Black Hole Kinematic" with Dr. Sudipta Sarkar. I used Mathematica to investigate the evolution of the event horizon of a Schwarzschild Black Hole under small perturbations in the mass.

Indian Institute of Technology Kharagpur, India. January–April 2013
Summer Research Scholar: "Z Scan based non linear optical characterization of nano-materials" with Prof. Prasanta K. Datta.

Bhabha Atomic Research Centre, Mumbai, India. May–July 2012
Summer Research Scholar: "Small Angle Neutron Scattering Studies of Biological Systems in Solution" with Dr. Vinod K. Aswal.

Publications

First-authored

4. **Acharyya, A.**, Tumlinson, J., Peeples, M. S., O'Shea B. W., Lochhaas, C., Augustin, R., Wright A., Simons, R. *FOGGIE VIII: Evolution and scatter in simulated gas-phase metallicity distribution* (2025), ApJ, 979, 31. (7 citations as of 23 May 2025)
3. **Acharyya, A.**, Krumholz, M. R., Federrath, C., Kewley, L. J., Sanchez, S. F., & Poetrodjojo, H. *MaNGA, SAMI and CALIFA metallicity gradients corrected for spatial resolution effects*, (in prep; draft available upon request)
2. ***Acharyya, A.**, Krumholz, M. R., Federrath, C., Kewley, L. J., & Sharp, R. *Quantifying the effects of spatial resolution and noise on galaxy metallicity gradients*, (2020), MNRAS, 495, 3819. (23 citations as of 23 May 2025)
1. ***Acharyya, A.**, Kewley, L. J., Rigby, J. R., Bayliss, M., Bian, F., Nicholls, D., Federrath, C., Kaasinen, M., Florian, M., & Blanc, G. A. *Rest-frame UV and optical emission line diagnostics of ionised gas properties: a test case in a lensed galaxy at z 1.7* (2019), MNRAS, 488, 5862. (11 citations as of 23 May 2025)

Co-authored

19. Werle, A., Poggiant, B., Moretti, A., Fritz, J., Vulcani, B., Bellhouse, C., Radovich, M., Gullieuszik, M., Marasco, A., Khoram, A. H., Campbell, S., Leung, H., **Acharyya A.**, et al. *Tracing Ongoing Quenching in Jellyfish Galaxies at z∼0.35* (submitted to A&A)

18. Augustin, R., Tumlinson, J., Peeples, M. S., O'Shea, Smith, B. D., Lochhaas, C., Wright, A. C., **Acharyya, A.**, C., Werk, J. K., et al. *Figuring Out Gas & Galaxies in Enzo (FOGGIE). X: Characterizing the Small-Scale Structure of the CGM and its Imprint on Observables* (submitted to ApJ).

17. Peluso, G., Vulcani, B., Radovich, M., Moretti, A., Poggianti, B. M., Watson, P. J., **Acharyya, A.**, Lassen, A. E., et al. *The interplay between Active Galactic Nuclei and Ram-pressure stripping: spatially-resolved gas-phase abundances of stripped and undisturbed galaxies* (accepted by A&A).

16. Simons, R. C., Peeples, M. S., Tumlinson, J., O'Shea, Lochhaas, C., Wright, A. C., **Acharyya, A.**, C., Augustin, R., et al. *Figuring Out Gas & Galaxies in Enzo (FOGGIE). IX: The Angular Momentum Evolution of Milky Way-like Galaxies and their Circumgalactic Gas* (submitted to ApJ).

15. Runnholm, A., Hayes, M. J., Mehta, V., Malkan, M. A., Scarlata, C., Nedkova, K. V., Rafelski, M., Vulcani, B., Huberty, M., Herenz, E. C., Hutter, A., Bruton, S., **Acharyya, A.** et al. *The JWST/PASSAGE Survey: Testing Reionization Histories with JWSTś First Unbiased Survey for Lyα Emitters at Redshifts 7.5–9.5*, (2025), ApJ, 984, 15.

14. Gupta, A., Trott, C. M., Jaiswar, R., Ryan-Weber, E. V., Bunker, A. J., **Acharyya, A.** et al. *MOSEL Survey: Spatially Offset Lyman-continuum Emission in a New Emitter at z = 3.088 Can Explain the Low Number Density of Observed LyC Leakers* (2024), ApJ, 973, 11.

13. Lochhaas, C., Tumlinson, J., Peeples, M. S., O'Shea, B. W., Werk, J. K., Simons, R. C., Juno, J., Kopenhafer, C., Augustin, R., Wright, A. C., **Acharyya, A.**, and Smith, B. D. *Figuring Out Gas & Galaxies in Enzo (FOGGIE). VI. The Circumgalactic Medium of L_* Galaxies Is Supported in an Emergent, Nonhydrostatic Equilibrium* (2023), ApJ, 948, 43.

12. Lehner N., Kopenhafer C., O'Meare J. M., Howk C., Fumagalli M., Prochaska J. X., **Acharyya, A.**, O'Shea, B., et al. *KODIAQ-Z: Metallicity of the cool intergalactic and circumgalactic gas at $2.2 \lesssim z \lesssim 3.6$* (2022), ApJ, 936, 156.

11. Grasha K., Chen Q. H., Battisti A., **Acharyya, A.**, Ridolfo S., et al. *Metallicity and pressure variations of HII regions in the TYPHOON spiral galaxies: NGC 1566, NGC 2835, NGC 3521, NGC 5068, NGC 5236, and NGC 7793* (2022), ApJ, 9129, 118.

10. Florian M., Rigby J. R., **Acharyya, A.**, Sharon, K., Gladders, M. D., Kewley, L. J., et al. *Spatial Variation in Strong Line Ratios and Physical Conditions in Two Strongly-Lensed Galaxies at z 1.4* (2021), ApJ, 916, 50.

9. Sharda, P., Krumholz, M. R., Wisnioski, E., **Acharyya, A.**, Federrath, C., & Forbes, J. C. *On the origin of the mass-metallicity gradient relation in the local Universe* (2021), MNRAS, 504, 53.

8. Sharda, P., Krumholz, M. R., Wisnioski, E., Forbes, J. C., Federrath, C., & **Acharyya, A.** *The physics of gas phase metallicity gradients in galaxies* (2021), MNRAS, 502, 5935.

7. *Rigby J. R., Florian M., **Acharyya A.**, Bayliss, M. B., Gladders, M. D., et al. *A Comparison of Rest-frame Ultraviolet and Optical Emission-Line Diagnostics in the Lensed Galaxy SDSS J1723+3411 at Redshift z=1.3293* (2021), ApJ, 908, 154.

6. Byler, N., Kewley, L., Rigby, J., **Acharyya, A.** Berg, D., Bayliss, M., and Sharon, K. *A comparison of UV and optical metallicities in star-forming galaxies* (2020), ApJ, 893, 1.

5. Kewley, L. J., Nicholls, D. C., Sutherland, R., Rigby, J. R., **Acharya, A.**, Dopita, M. A., Bayliss, M. B. *Theoretical ISM Pressure and Electron Density Diagnostics for Local and High-redshift Galaxies* (2019), ApJ, 880, 24.

4. Rigby, J. R., Bayliss, M. B., Chisholm, J., Bordoloi, R., Sharon, K., Gladders, M. D., Johnson, T., Paterno-Mahler, R., Wuyts, E., Dahle, H., & **Acharyya, A.** *The Magellan Evolution of Galaxies Spectroscopic and Ultraviolet Reference Atlas (MegaSaura). II. Stacked Spectra* (2018), ApJ, 853, 87.

3. Andreoni, I., Ackley, K., Cooke, J., **Acharyya, A.**, Allison, J. R, et al. *Follow Up of GW170817 and Its Electromagnetic Counterpart by Australian-Led Observing Programmes* (2017), PASA, 34, e069.

2. Bayliss, M. B., Sharon, K., **Acharyya, A.**, Gladders, M. D., Rigby, J. R., Bian, F., Bordoloi, R., Runnoe, J., Dahle, H., Kewley, L., Florian, M., Johnson, T., & Paterno-Mahler, R. *Spatially Resolved Patchy Lyα Emission within the Central Kiloparsec of a Strongly Lensed Quasar Host Galaxy at z=2.8* (2017), ApJL, 845, L14.

1. Mondal, R., Bharadwaj, S., Majumdar, S., Bera, A., & **Acharyya, A.** *The effect of non-Gaussianity on error predictions for the Epoch of Reionization (EoR) 21-cm power spectrum.* (2015), MNRAS, 449, L41.

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