Ayan Acharyya

Contact Information

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Research Interests

Galaxy evolution, Chemical evolution - gas phase metallicity, ISM properties, translating simulations to mock observables.

Post-PhD Experience

Johns Hopkins University, Baltimore, USA. January 2021–present
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

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.

Awards and Grants

12. 2019: RSAA student travel grant $4000
11. 2019: Astronomical Society of Australia (ASA) student travel award $1000
10. 2019: ANU Vice Chancellor's travel grant $1500
9. 2017: Olin J Eggen Research Award 2017 at RSAA, ANU
8. 2015: ANU PhD Scholarship (International) and RSAA Research Supplementary Scholarship
7. 2014: MITACS Globalink Research Internship award
6. 2014: Visiting Students Programme at Tata Institute of Funamental Research(TIFR) Mumbai, India (declined)
5. 2014: NCTU Elite Internship Programme, Taiwan (declined)
4. 2014: Charpak Fellowship for summer project in France (declined)
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: Visting Students Research (Indian Academy of Sciences)

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 Observing Proposals as Co-I

- *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

Technical Skills

- **Programming Languages (skill level)**: C/C++ (basic), Python (proficient), IDL (moderate).
- **Technical Softwares**: Mathematica, MATLAB, IRAF, LaTeX

Talks

Conferences (Contributed talks, 9)

9. **Space Telescope Science Institute, Discovery Seminar series** "Mockulus reparo" — to fix the effects on metallicity gradient measurements due to our insufficient "seeing" *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 (13)

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. **Institue 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)

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

Posters (3)

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

MENTORING EXPERIENCE

Currently mentoring 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 am responsible for teaching them the relevant physics and mathematics as well as help them with the data analysis and report writing.

SERVICES

7. Over 30 stargazing tours as **Outreach Assistant** at **Mount Stromlo Observatory outreach team** 2017–Present
6. Organiser of **GEARS3D group meeting** at RSAA 2018–Present
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

Prof. Lisa J. Kewley
Australian National University
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Prof. Mark R. Krumholz
Australian National University
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A/Prof. Christoph Federrath
Australian National University
E-mail: christoph.federrath@anu.edu.au

Dr. Jane R. Rigby
NASA Goddard Space Flight Centre
E-mail: jane.r.rigby@nasa.gov

PUBLICATIONS

14. 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* (in prep).
13. 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* (Submitted to MNRAS).
12. 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.
11. 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.
10. 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.
9. 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.
8. 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.
7. **Acharyya, A.**, Kewley, L. J., Rigby, J. R., Byler, N., Bayliss, M., et al.*Metallicities of 15 lensed galaxies at* $1.5 \lesssim z \lesssim 4$ *based on rest-frame UV diagnostics*, (in prep).
6. **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.
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. **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.
3. 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.
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.