

Ruby Byrne

Curriculum Vitae

California Institute of Technology
1200 E California Blvd
Pasadena, CA 91125

rbyrne@caltech.edu
rubybyrne.com
github.com/rbyrne

EDUCATION

- 2021 PhD, Physics, University of Washington
Dissertation: “Enabling the Next Generation of 21 cm Cosmology: Precision Analysis Techniques for Radio Cosmology Observations”
- 2017 MS, Physics, University of Washington
- 2014 BA, Physics and Mathematics, Macalester College

APPOINTMENTS

- 2023-present National Science Foundation Astronomy and Astrophysics Postdoctoral Fellow, California Institute of Technology
- 2021-2023 Postdoctoral Scholar Research Associate in Astronomy, California Institute of Technology

PUBLICATIONS

First- and Single-Author Publications

6. **Byrne, R.**, 2023. “Delay-weighted Calibration: Precision Calibration for 21 cm Cosmology with Resilience to Sky Model Error.” *ApJ* 943, 117. arXiv: 2208.04406.
5. **Byrne, R.**, M. F. Morales, B. Hazelton, I. Sullivan, and N. Barry, 2022. “The FHD Polarised Imaging Pipeline: A New Approach to Widefield Interferometric Polarimetry.” *PASA* 39, E023. arXiv: 2201.10653.
4. **Byrne, R.**, M. F. Morales, B. Hazelton, I. Sullivan, N. Barry, C. Lynch, J. L. B. Line, and D. C. Jacobs, 2021. “A Map of Diffuse Radio Emission at 182 MHz to Enhance Epoch of Reionization Observations in the Southern Hemisphere.” *MNRAS* 510, 2. arXiv: 2107.11487.
3. **Byrne, R.**, M. F. Morales, B. Hazelton, and M. Wilensky, 2021. “A Unified Calibration Framework for 21 cm Cosmology.” *MNRAS* 503, 2. arXiv: 2004.08463.
2. **Byrne, R.**, and D. Jacobs, 2021. “Development of a High Throughput Cloud-Based Data Pipeline for 21 cm Cosmology.” *Astronomy and Computing* 34. arXiv: 2009.10223.
1. **Byrne, R.**, M. F. Morales, B. Hazelton, W. Li, N. Barry, A. P. Beardsley, R. Joseph, J. C. Pober, I. Sullivan, and C. Trott, 2019. “Fundamental Limitations on the Calibration of Redundant 21 cm Cosmology Instruments and Implications for HERA and the SKA.” *ApJ* 875, 1. arXiv: 1811.01378.

Other Publications

16. Wilensky, M., ..., **R. Byrne**, et al. [10 authors], 2023 (in review). “Evidence of Ultra-faint RFI in Deep 21 cm Epoch of Reionization Power Spectra with the Murchison Widefield Array.” Submitted to *ApJ*.
15. Xu, J., ..., **R. Byrne**, et al. [80 authors], 2022. “Direct Optimal Mapping for 21 cm Cosmology: A Demonstration with Data from the Hydrogen Epoch of Reionization Array.” *ApJ* 938, 2. arXiv: 2204.06021.

14. Sullivan, I., N. Barry, **R. Byrne**, M. F. Morales, B. Hazelton, A. Beardsley, and A. Lanman, 2022. “FHD: Fast Holographic Deconvolution.” Astrophysics Source Code Library. Bibcode: 2022ascl.soft05014S.
13. Rahimi, M., ..., **R. Byrne**, et al. [31 authors], 2021. “Epoch of Reionization Power Spectrum Limits from Murchison Widefield Array Data Targeted at EoR1 Field.” MNRAS 508, 4. arXiv: 2110.03190.
12. Trott, C., ..., **R. Byrne**, et al. [32 authors], 2021. “Constraining the 21 cm Brightness Temperature of the IGM at $z=6.6$ Around LAEs with the Murchison Widefield Array.” MNRAS 507, 1. arXiv: 2107.14493.
11. Yoshiura, S., ..., **R. Byrne**, et al. [32 authors], 2021. “A New MWA Limit on the 21 cm Power Spectrum at Redshifts $\sim 13-17$.” MNRAS 505, 4. arXiv: 2105.12888.
10. Trott, C., ..., **R. Byrne**, et al. [36 authors], 2020. “Deep Multi-Redshift Limits on Epoch of Reionisation 21 cm Power Spectra from Four Seasons of Murchison Widefield Array Observations.” MNRAS 493, 4. arXiv: 2002.02575.
9. Wilensky, M., N. Barry, M. F. Morales, B. Hazelton, and **R. Byrne**, 2020. “Quantifying Excess Power from Radio Frequency Interference in Epoch of Reionization Measurements.” MNRAS 598, 1. arXiv: 2004.07819.
8. Zhang, Z., ..., **R. Byrne**, et al. [29 authors], 2020. “The Impact of Tandem Redundant/Sky-Based Calibration in MWA Phase II Data Analysis.” PASA 37. arXiv: 2009.09269.
7. Barry, N., A. P. Beardsley, **R. Byrne**, B. Hazelton, M. F. Morales, J. C. Pober, and I. Sullivan, 2019. “The FHD/epsilon Epoch of Reionization Power Spectrum Pipeline.” PASA 36. arXiv: 1901.02980.
6. Barry, N., ..., **R. Byrne**, et al. [30 authors], 2019. “Improving the Epoch of Reionization Power Spectrum Results from Murchison Widefield Array Season 1 Observations.” ApJ 884, 1. arXiv: 1909.00561.
5. Li, W., ..., **R. Byrne**, et al. [47 authors], 2019. “First Season MWA Phase II EoR Power Spectrum Results at Redshift 7.” ApJ 887, 2. arXiv: 1911.10216.
4. Trott, C., ..., **R. Byrne**, et al. [45 authors], 2019. “Gridded and Direct Epoch of Reionisation Bispectrum Estimates Using the Murchison Widefield Array.” PASA 36. arXiv: 1905.07161.
3. Trott, C., ..., **R. Byrne**, et al. [29 authors], 2019. “Robust Statistics Toward Detection of the 21 cm Signal from the Epoch of Reionisation.” MNRAS 486, 4. arXiv: 1904.11623.
2. Wilensky, M., M. F. Morales, B. Hazelton, N. Barry, **R. Byrne**, and S. Roy, 2019. “Absolving the SSINS of Precision Interferometric Radio Data: A New Technique for Mitigating Faint Radio Frequency Interference.” PASP 131, 1005. arXiv: 1906.01093.
1. Li, W., ..., **R. Byrne**, et al. [56 authors] (2018). “Comparing Redundant and Sky-model-based Interferometric Calibration: A First Look with Phase II of the MWA.” ApJ 863, 2. arXiv: 1807.05312.

AWARDS AND GRANTS

2023-present	National Science Foundation Astronomy and Astrophysics Postdoctoral Fellowship
2018-2019	University of Washington High Performance Computing grant
2019	Travel grant in recognition of service to the Conference for Undergraduate Women in Physics (CUWiP) Organizing Committee
2015-2018	Achievement Rewards for College Scientists (ARCS) graduate fellowship
2014	Macalester College Physics and Astronomy Department Russel B. Hastings book award

2010-2014 Macalester College DeWitt Wallace merit scholarship

PROFESSIONAL SERVICE

- 2023-present Mentor and workshop leader, Astronomy Mentoring Program for Upcoming Postdocs (AMP-UP)
- 2022-present Mentor, Caltech Future Ignited Accountability Partners Program
- 2022-present Representative, Caltech Postdoc Association: divisional representative for the Division of Physics, Mathematics, and Astronomy 2022-2023; elections committee co-chair 2023; bylaws committee member 2023-present
- 2021-present Referee, ApJ, MNRAS, A&A, JATIS
- 2023 Organizer, OVRO-LWA Beam Team workshop and retreat
- 2022 Judge, Caltech Perpall SURF speaking competition
- 2016-2021 Union steward, UAW Local 4121
- 2017-2021 Founding member and co-president, University of Washington Physicists for Inclusion and Equity
- 2018-2019 Organizing committee, APS Conference for Undergraduate Women in Physics (CUWiP)
- 2019 Science organizing committee, MWA Project Meeting
- 2017-2019 Board of directors, University of Washington Engage science communication program
- 2016-2017 Graduate peer mentor, University of Washington Physics Department

TEACHING EXPERIENCE

- 2019 Guest lecturer, Honors Wave Mechanics, University of Washington
- 2016-2018 Math instruction volunteer, Freedom Education Project Puget Sound Prison Education Program
- 2017 Feminist Studies instruction volunteer, University Beyond Bars Prison Education Program
- 2013-2014 Grader, Modern Physics, Macalester College
- 2012 Classroom assistant, Teach for America's "Three Weeks for America" Program

OUTREACH

- 2023 Public lecture, "Cosmic Archaeology: Uncovering the History of the Universe with Radio Astronomy," Astronomy on Tap Los Angeles, Pasadena, California
- 2023 Science educator, Death Valley Dark Sky Festival, Death Valley National Park
- 2022 Public lecture, "Historians of the Early Universe: Studying the Distant Past from the Owens Valley Radio Observatory," Palomar Observatory Greenway Talks (online)
- 2021 Public lecture, "Historians of the Early Universe: Studying the Distant Past from the Owens Valley Radio Observatory," Owens Valley Radio Observatory Fall Lecture Series, Bishop, California
- 2021 Guest speaker, Bishop Union High School, Bishop, California
- 2018 Public lecture, "Uncovering the Ancient Universe," UW Science Now Lecture Series, Seattle, Washington

PRESENTATIONS

- 2023 Conference talk, "Probing the Cosmic Dawn with the OVRO-LWA Stage III," URSI GASS, Sapporo, Japan
- 2023 Conference talk, "Overcoming Systematics in 21 cm Cosmology Measurements with Next-Generation Radio Arrays," AAS 242 Meeting, Albuquerque, New Mexico
- 2023 Conference talk, "The Upgraded OVRO-LWA," LWA Users Meeting, Albuquerque, New Mexico
- 2023 Conference talk, "21 cm Intensity Mapping with the DSA-2000," Scientific Frontiers and Synergies for the DSA-2000 Radio Camera, Pasadena, California
- 2023 Colloquium, "Revealing the History of the Universe with 21 cm Cosmology," Duke University, Durham, North Carolina
- 2023 Conference talk, "Delay-Weighted Calibration: Precision Calibration for 21 cm Cosmology with Resilience to Sky Model Error," AAS 241 Meeting, Seattle, Washington
- 2022 Invited seminar, "Understanding the Early Universe with 21 cm Cosmology: Progress, Challenges, and Next Steps," Observational Cosmology Seminar Series, California Institute of Technology, Pasadena, California
- 2022 Invited seminar, "Understanding the Early Universe with 21 cm Cosmology: Progress, Challenges, and Next Steps," Duke University, Durham, North Carolina
- 2022 Conference talk, "Progress Toward Constraint of the Cosmic Dawn from 21 cm Measurements with the OVRO-LWA Stage III," 21 cm Cosmology Workshop (online)
- 2022 Conference talk, "Achieving Precision Calibration for 21 cm Cosmology with DWCal," 21 cm Cosmology Workshop (online)
- 2022 Contributed talk, "Delay-Weighted Calibration: Precision Calibration in the Presence of Sky Model Error," HERA Collaboration Datacon (online)
- 2022 Invited seminar, "Precision Calibration for 21 cm Cosmology," McGill Space Institute, Montreal, Quebec
- 2022 Conference talk, "Mapping Diffuse Radio Emission at 182 MHz to Enhance Epoch of Reionization Observations in the Southern Hemisphere," URSI NRSM (online)
- 2021 Invited seminar, "Mapping Diffuse Radio Emission at 182 MHz to Enhance Epoch of Reionization Observations in the Southern Hemisphere," Galactic Science with CMB Data Seminar Series (online)
- 2021 Conference talk, "Mapping Diffuse Radio Emission at 182 MHz to Enhance Epoch of Reionization Observations in the Southern Hemisphere," Science at Low Frequencies VIII (online)
- 2021 Invited seminar, "Achieving Precision Calibration for 21 cm Cosmology with Unified Calibration," PUMA Collaboration Seminar Series (online)
- 2021 Conference talk, "A Unified Calibration Framework for 21 cm Cosmology," URSI GASS (online)
- 2021 Invited seminar, "Measuring the Epoch of Reionization: Progress, Challenges, and Next Steps," Arizona State University School of Earth and Space Exploration (online)
- 2021 Invited seminar, "Precision Calibration Techniques to Enable 21 cm Cosmology," Caltech Radio Camera Initiative Seminar Series (online)

- 2021 Conference talk, “A Unified Calibration Framework for 21 cm Cosmology,” URSI NRSM (online)
- 2020 Conference talk, “A Unified Calibration Framework for 21 cm Cosmology,” Science at Low Frequencies VII (online)
- 2020 Invited seminar, “Measuring the Epoch of Reionization: Progress, Challenges, and Next Steps for High Redshift 21 cm Cosmology,” Yale Nuclear Particle Astrophysics Seminar Series (online)
- 2020 Invited seminar, “Enabling Precision EoR Calibration with a Polarized Diffuse Map of the Southern Sky,” CHORD Collaboration Seminar Series (online)
- 2020 Conference talk, “Enabling Precision EoR Calibration,” Cosmology with CMB-S4 (online)
- 2020 Conference talk, “A Unified Calibration Framework for 21 cm Cosmology,” MWA Project Meeting (online)
- 2020 Conference talk, “Enabling Precision EoR Calibration with a Polarized Diffuse Map of the Southern Sky,” AAS 236 Meeting (online)
- 2019 Conference talk, “Enabling Precision EoR Calibration with a Polarized Diffuse Map of the Southern Sky,” Science at Low Frequencies VI, Tempe, Arizona
- 2019 Conference talk, “Precision Calibration for 21cm Cosmology and a Polarized Diffuse Map of the Southern Sky,” Barefoot Reionization, Fitzroy Island, Australia
- 2019 Conference talk, “Error Mitigation for Precision EoR Calibration,” MWA Project Meeting, Providence, Rhode Island
- 2019 Contributed talk, “Fundamental Limitations of Redundant Calibration,” HERA Collaboration Datacon (online)
- 2019 Conference talk, “Fundamental Limitations on the Calibration of Redundant 21 cm Cosmology Instruments,” URSI NRSM, Boulder, Colorado
- 2018 Conference talk, “Fundamental Limitations on the Calibration of Redundant 21 cm Cosmology Instruments,” MWA Project Meeting, Nagoya, Japan
- 2018 Colloquium, “Fundamental Limitations on the Calibration of Redundant 21 cm Cosmology Instruments,” Curtin Institute of Radio Astronomy, Perth, Australia
- 2018 Colloquium, “Fundamental Limitations on the Calibration of Redundant 21 cm Cosmology Instruments,” University of Melbourne School of Physics, Melbourne, Australia
- 2017 Poster, “Precision Modeling of Diffuse Foreground Emission for Southern Hemisphere Epoch of Reionization Measurements,” Science at Low Frequencies IV, Sydney, Australia
- 2017 Poster, “Progress Toward a Precision Model of Diffuse Foreground Emission for Southern Hemisphere Epoch of Reionization Measurements,” The Broad Impact of Low Frequency Observing, Bologna, Italy