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Education

Brown University
Ph.D. Physics *2019*
Thesis: *Precision Simulations of Low-Frequency Radio Interferometers*
M.S., Physics *2016*

University of Rochester
B.S., Physics and Astronomy *2013*
B.A., Mathematics *2013*

Research Positions

MIT Kavli Institute
Postdoctoral Associate *Sept 2023 – Present*

Trottier Space Institute at McGill
Postdoctoral Researcher *Aug 2020 – Sept 2023*

Awards & Recognitions

- 2024 Marcel Grossmann Award to the CHIME/FRB Team
- 2022 Brockhouse Canada Prize for Interdisciplinary Research in Science and Engineering to CHIME

Selected Publications

Other collaborative papers listed at the end.

Lead Author

[1] **A. E. Lanman** et al., Constraining Baryon Fractions in Galaxy Groups and Clusters with the First CHIME/FRB Outrigger, arXiv e-prints , arXiv:2509.07097 (2025), doi:10.48550/arXiv.2509.07097.

[2] **A. E. Lanman** et al., CHIME/FRB Outriggers: KKO Station System and Commissioning Results, Astronomical Journal **168**, 87 (2024), doi:10.3847/1538-3881/ad5838.

[3] **A. E. Lanman** et al., A Sudden Period of High Activity from Repeating Fast Radio Burst 20201124A, Astrophysical Journal **927**, 59 (2022), doi:10.3847/1538-4357/ac4bc7.

[4] **A. E. Lanman**, S. G. Murray, and D. C. Jacobs, Validation Solutions to the Full-sky Radio Interferometry Measurement Equation for Diffuse Emission, Astrophysical Journal, Supplement **259**, 22 (2022), doi:10.3847/1538-4365/ac45fd.

[5] **A. E. Lanman** et al., Quantifying EoR delay spectrum contamination from diffuse radio emission, Monthly Notices of the RAS **494**, 3712 (2020), doi:10.1093/mnras/staa987.

[6] **A. E. Lanman** and J. C. Pober, Fundamental uncertainty levels of 21 cm power spectra from a delay analysis, Monthly Notices of the RAS **487**, 5840 (2019), doi:10.1093/mnras/stz1639.

[7] **A. Lanman** et al., pyuvsim: A comprehensive simulation package for radio interferometers in python., The Journal of Open Source Software **4**, 1234 (2019), doi:10.21105/joss.01234.

Co-Author

[8] CHIME/FRB Collaboration et al., A Catalog of Local Universe Fast Radio Bursts from CHIME/FRB and the KKO, Astrophysical Journal, Supplement **280**, 6 (2025), doi:10.3847/1538-4365/addbda.

[9] K. Shin et al., Investigating the Sightline of a Highly Scattered Fast Radio Burst through a Cosmic Sheet Structure in the Local Universe, ApJ**993**, 208 (2025), doi:10.3847/1538-4357/ae093b.

[10] CHIME/FRB Collaboration et al., FRB 20250316A: A Brilliant and Nearby One-off Fast Radio Burst Localized to 13 pc Precision, Astrophysical Journal, Letters **989**, L48 (2025), doi:10.3847/2041-8213/adf62f.

[11] C. Leung et al., Stellar Mass-Dispersion Measure Correlations Constrain Baryonic Feedback in Fast Radio Burst Host Galaxies, arXiv e-prints , arXiv:2507.16816 (2025), doi:10.48550/arXiv.2507.16816.

[12] C. Leung et al., A VLBI Software Correlator for Fast Radio Transients, Astronomical Journal **170**, 53 (2025), doi:10.3847/1538-3881/add876.

[13] H. Wang et al., Measurement of the Dispersion-Galaxy Cross-Power Spectrum with the Second CHIME/FRB Catalog, arXiv e-prints , arXiv:2506.08932 (2025), doi:10.48550/arXiv.2506.08932.

[14] CHIME/FRB Collaboration et al., CHIME/FRB Outriggers: Design Overview, ApJ**993**, 55 (2025), doi:10.3847/1538-4357/adfdcc.

[15] G. Keating et al., pyuvdata v3: an interface for astronomical interferometric data sets in Python, The Journal of Open Source Software **10**, 7482 (2025), doi:10.21105/joss.07482.

[16] V. Shah et al., A Repeating Fast Radio Burst Source in the Outskirts of a Quiescent Galaxy, Astrophysical Journal, Letters **979**, L21 (2025), doi:10.3847/2041-8213/ad9ddc.

[17] K. Nimmo et al., Magnetospheric origin of a fast radio burst constrained using scintillation, Nature **637**, 48 (2025), doi:10.1038/s41586-024-08297-w.

[18] T. Cassanelli et al., A fast radio burst localized at detection to an edge-on galaxy using very-long-baseline interferometry, Nature Astronomy **8**, 1429 (2024), doi:10.1038/s41550-024-02357-x.

[19] K. Shin et al., Investigating the sightline of a highly scattered FRB through a filamentary structure in the local Universe, arXiv e-prints , arXiv:2410.07307 (2024), doi:10.48550/arXiv.2410.07307.

[20] B. Hazelton, M. Kolopanis, **A. Lanman**, and J. Pober, pyradiosky: A Python package for Radio Sky Models, The Journal of Open Source Software **9**, 6503 (2024), doi:10.21105/joss.06503.

[21] P. Sanghavi et al., TONE: A CHIME/FRB Outrigger Pathfinder for Localizations of Fast Radio Bursts using Very Long Baseline Interferometry, Journal of Astronomical Instrumentation **13**, 2450010 (2024), doi:10.1142/S2251171724500107.

[22] J. Mena-Parra et al., A Clock Stabilization System for CHIME/FRB Outriggers, Astronomical Journal **163**, 48 (2022), doi:10.3847/1538-3881/ac397a.

[23] T. Cassanelli et al., Localizing FRBs through VLBI with the Algonquin Radio Observatory 10 m Telescope, Astronomical Journal **163**, 65 (2022), doi:10.3847/1538-3881/ac3d2f.

[24] A. Ewall-Wice et al., DAYENU: a simple filter of smooth foregrounds for intensity mapping power spectra, Monthly Notices of the RAS **500**, 5195 (2021), doi:10.1093/mnras/staa3293.

[25] N. S. Kern et al., Mitigating Internal Instrument Coupling for 21 cm Cosmology. II. A Method Demonstration with the Hydrogen Epoch of Reionization Array, Astrophysical Journal **888**, 70 (2020), doi:10.3847/1538-4357/ab5e8a.

[26] N. S. Kern et al., Mitigating Internal Instrument Coupling for 21 cm Cosmology. I. Temporal and Spectral Modeling in Simulations, Astrophysical Journal **884**, 105 (2019), doi:10.3847/1538-4357/ab3e73.

Non-Refereed

[27] **A. E. Lanman**, V. Shah, and CHIME/FRB Collaboration, CHIME/FRB Outrigger Localization of the Prolific Repeating FRB 20240209A, The Astronomer's Telegram **16682**, 1 (2024).

[28] **A. E. Lanman** and M. H. van Kerkwijk, pycalc11: A python interface to the calc vlbi delay model, in *2024 United States National Committee of URSI National Radio Science Meeting (USNC-URSI NRSM)*, pages 362–363, 2024, doi:10.23919/USNC-URSINRSM60317.2024.10464974.

[29] CHIME/FRB Collaboration, Recent high activity from a repeating Fast Radio Burst discovered by CHIME/FRB, The Astronomer's Telegram **14497**, 1 (2021).

Software Packages

Lead developer / maintainer

pyuvsim: https://github.com/RadioAstronomySoftwareGroup/pyuvsim — *High-precision interferometry simulation.*

lunarsky: https://github.com/aelanman/lunarsky — *An astropy extension for describing Moon-based coordinate systems.*

pycalc11: https://github.com/pycalc11 — *A Python interface to the CALC11 VLBI delay model.*

Skills and Certifications

- Programming – Python (numpy, scipy, astropy, matplotlib, pandas), MPI, C++
- Linux sysadmin – systemd, cron, account management, networking
- Docker, Docker Swarm
- Prometheus, Grafana
- ARRL Technician License (Call sign KC1ING)

Conference Presentations

FRB 202X (Annual FRB conference)
- *The First FRB Host Galaxies from the First CHIME/FRB Outrigger* — *2024*
- *Commissioning Results of KKO: The First CHIME/FRB Outrigger Telescope* — *2023*

VLBI in the SKA Era
- *Measuring Delay Rates of Fast Radio Bursts with CHIME/FRB Outriggers* — *2022*

Science at Low Frequencies
- *Measuring Circumgalactic and Intragroup Media using FRBs Localized by CHIME/FRB Outriggers* — *2025*
- *CHIME/FRB observations of highly-active repeating Fast Radio Burst 20201124A* — *2021*
- *pyuvsim: A comprehensive radio interferometry simulator in Python* — *2019*
- *Precision Simulations of Cosmic Dawn Experiments* — *2016*

URSI National Radio Science Meeting
- *The CHIME/FRB Outrigger Program* — *2024*
- *pycalc11: A Python Interface to the CALC VLBI Delay Model* — *2024*
- *Sample Variance in Realistic 21 cm EoR Simulations* — *2018*
- *Precision Simulations of Cosmic Dawn Experiments* — *2017*

American Astronomical Society Meetings
- *Recovering 21 cm Power Spectra in Simulated Delay Spectrum Pipelines* — *2019*

Colloquia and Seminars

Probing Galaxy Groups and Clusters with the First CHIME/FRB Outrigger
Seminar, Northwestern University CIERA — *2025*

Rapid & Precise Fast Radio Burst Localization with CHIME/FRB Outriggers
Seminar, University of Rochester — *2024*

VLBI for Fast Radio Burst Localization with the CHIME/FRB Outrigger system
Colloquium, Queen's University — *2022*

VLBI for Fast Radio Burst Localization with the CHIME/FRB Outrigger system
CFPU Seminar, Brown University — *2022*

Teaching

Student Mentoring

- Zimi Zhang, MIT Undergraduate *2024 – 2025*
- Vishwangi Shah, McGill University Master's Student *2021 – 2023*
- Mattias Lazda, McGill University Undergraduate *2021 – 2023*

Course Instruction

Brown University

- CEPI 0905, *From the Solar System to the Universe: An Introduction to Astrophysics and Cosmology* 2015,2016

Training

Brown University Sheridan Center for Teaching and Learning

Certificate I – Reflective Teaching *2015*

Teaching Assistant

Brown University

- Phys 0270, *Introduction to Astronomy* *Fall 2013*
- Phys 0220, *Astronomy* *Spring 2014, 2015*
- Phys 2010, *Techniques in Experimental Physics* *Fall 2014*

Service and Public Outreach

- Participation with *Astrogazers* public outreach group at MIT *2025*
- Science Organizing Committee (SOC) of the workshop "Multi-wavelength follow-up of Fast Radio Bursts in the era of routine (sub)arcsecond localizations" *2023*
- Quotations in popular literature:
  - Rao R. 2022. Two bizarre stars might have beamed a unique radio signal to Earth. Popular Science. Link
  - Skuse B. 2022. New Observations Add Fuel to Fast Radio Burst Origin Debate. Sky & Telescope. Link
  - Young M. 2022. An Unusual Source Deepens Fast Radio Burst Mysteries. Sky & Telescope. Link
- Career skills workshop at McGill University *2022*
- Peer review services for *The Astrophysical Journal*, *Astronomy and Astrophysics*, *Monthly Notices of the Royal Astronomical Society*, *RAS Techniques and Instruments*
- *Sidewalk Astronomy* outreach program in Providence, RI *2018*
- Organized *Brown Astrophysics Seminar Series* *2016 – 2018*
- Co-Founded Brown University's *Physics Organization* for graduate students *2017 – 2018*
  - Peer-mentoring program
  - Career skills workshops for undergraduates

Other Publications

[30] S. S. Patil et al., A Spatial Gap in the Sky Distribution of Fast Radio Burst Detections Coinciding with Galactic Plasma Overdensities, (2025), doi:10.48550/arXiv.2509.06721.

[31] Z. Xu et al., Direct Optimal Mapping for 21 cm Cosmology: A Demonstration with the Hydrogen Epoch of Reionization Array, Astrophysical Journal **938**, 128 (2022), doi:10.3847/1538-4357/ac9053.

[32] E. Rath et al., Investigating mutual coupling in the hydrogen epoch of reionization array and mitigating its effects on the 21-cm power spectrum, Monthly Notices of the RAS **541**, 1125 (2025), doi:10.1093/mnras/staf1012.

[33] Y. Dong et al., Searching for Historical Extragalactic Optical Transients Associated with Fast Radio Bursts, arXiv e-prints , arXiv:2506.06420 (2025), doi:10.48550/arXiv.2506.06420.

[34] CHIME/FRB Collaboration et al., FRB 20250316A: A Brilliant and Nearby One-Off Fast Radio Burst Localized to 13 parsec Precision, arXiv e-prints , arXiv:2506.19006 (2025), doi:10.48550/arXiv.2506.19006.

[35] G. Keating et al., pyuvdata v3: an interface for astronomical interferometric data sets in Python, The Journal of Open Source Software **10**, 7482 (2025), doi:10.21105/joss.07482.

[36] K. Shin et al., The CHIME/FRB Discovery of the Extremely Active Fast Radio Burst Source FRB 20240114A, arXiv e-prints , arXiv:2505.13297 (2025), doi:10.48550/arXiv.2505.13297.

[37] CHIME/FRB Collaboration et al., CHIME/FRB Outriggers: Design Overview, arXiv e-prints , arXiv:2504.05192 (2025), doi:10.48550/arXiv.2504.05192.

[38] S. Andrew et al., A Very Long Baseline Interferometry Calibrator Grid at 600 MHz for Fast Radio Transient Localizations with CHIME/FRB Outriggers, Astrophysical Journal **981**, 39 (2025), doi:10.3847/1538-4357/adaf8d.

[39] T. Eftekhari et al., The Massive and Quiescent Elliptical Host Galaxy of the Repeating Fast Radio Burst FRB 20240209A, Astrophysical Journal, Letters **979**, L22 (2025), doi:10.3847/2041-8213/ad9de2.

[40] K.-F. Chen et al., Impacts and Statistical Mitigation of Missing Data on the 21 cm Power Spectrum: A Case Study with the Hydrogen Epoch of Reionization Array, Astrophysical Journal **979**, 191 (2025), doi:10.3847/1538-4357/ad9b91.

[41] P. Kittiwisit et al., matvis: a matrix-based visibility simulator for fast forward modelling of many-element 21 cm arrays, RAS Techniques and Instruments **4**, rzaf001 (2025), doi:10.1093/rasti/rzaf001.

[42] H. Garsden et al., A demonstration of the effect of fringe-rate filtering in the hydrogen epoch of reionization array delay power spectrum pipeline, Monthly Notices of the RAS **535**, 3218 (2024), doi:10.1093/mnras/stae2541.

[43] G. G. Murphy et al., Bayesian estimation of cross-coupling and reflection systematics in 21cm array visibility data, Monthly Notices of the RAS **534**, 2653 (2024), doi:10.1093/mnras/stae2242.

[44] N. Charles et al., Mitigating calibration errors from mutual coupling with time-domain filtering of 21 cm cosmological radio observations, Monthly Notices of the RAS **534**, 3349 (2024), doi:10.1093/mnras/stae2303.

[45] H.-H. Lin et al., Do All Fast Radio Bursts Repeat? Constraints from CHIME/FRB Far Sidelobe FRBs, Astrophysical Journal **975**, 75 (2024), doi:10.3847/1538-4357/ad779d.

[46] T. Cassanelli et al., A fast radio burst localized at detection to an edge-on galaxy using very-long-baseline interferometry, Nature Astronomy **8**, 1429 (2024), doi:10.1038/s41550-024-02357-x.

[47] A. M. Cook et al., Contemporaneous X-Ray Observations of 30 Bright Radio Bursts from the Prolific Fast Radio Burst Source FRB 20220912A, Astrophysical Journal **974**, 170 (2024), doi:10.3847/1538-4357/ad6a13.

[48] Z. Xu et al., Direct Optimal Mapping Image Power Spectrum and its Window Functions, Astrophysical Journal **971**, 16 (2024), doi:10.3847/1538-4357/ad528c.

[49] M. Bhardwaj et al., Host Galaxies for Four Nearby CHIME/FRB Sources and the Local Universe FRB Host Galaxy Population, Astrophysical Journal, Letters **971**, L51 (2024), doi:10.3847/2041-8213/ad64d1.

[50] CHIME/FRB Collaboration et al., Updating the First CHIME/FRB Catalog of Fast Radio Bursts with Baseband Data, Astrophysical Journal **969**, 145 (2024), doi:10.3847/1538-4357/ad464b.

[51] L. M. Berkhout et al., Hydrogen Epoch of Reionization Array (HERA) Phase II Deployment and Commissioning, Publications of the ASP **136**, 045002 (2024), doi:10.1088/1538-3873/ad3122.

[52] K. R. Sand et al., A CHIME/FRB Study of Burst Rate and Morphological Evolution of the Periodically Repeating FRB 20180916B, Astrophysical Journal **956**, 23 (2023), doi:10.3847/1538-4357/acf221.

[53] P. M. Keller et al., Search for the Epoch of Reionization with HERA: upper limits on the closure phase delay power spectrum, Monthly Notices of the RAS **524**, 583 (2023), doi:10.1093/mnras/stad371.

[54] M. Pagano et al., Characterization of inpaint residuals in interferometric measurements of the epoch of reionization, Monthly Notices of the RAS **520**, 5552 (2023), doi:10.1093/mnras/stad441.

[55] CHIME/FRB Collaboration et al., CHIME/FRB Discovery of 25 Repeating Fast Radio Burst Sources, Astrophysical Journal **947**, 83 (2023), doi:10.3847/1538-4357/acc6c1.

[56] A. M. Cook et al., An FRB Sent Me a DM: Constraining the Electron Column of the Milky Way Halo with Fast Radio Burst Dispersion Measures from CHIME/FRB, Astrophysical Journal **946**, 58 (2023), doi:10.3847/1538-4357/acbbd0.

[57] A. Gorce et al., Impact of instrument and data characteristics in the interferometric reconstruction of the 21 cm power spectrum, Monthly Notices of the RAS **520**, 375 (2023), doi:10.1093/mnras/stad090.

[58] HERA Collaboration et al., Improved Constraints on the 21 cm EoR Power Spectrum and the X-Ray Heating of the IGM with HERA Phase I Observations, Astrophysical Journal **945**, 124 (2023), doi:10.3847/1538-4357/acaf50.

[59] M. J. Wilensky et al., Bayesian jackknife tests with a small number of subsets: application to HERA 21 cm power spectrum upper limits, Monthly Notices of the RAS **518**, 6041 (2023), doi:10.1093/mnras/stac3484.

[60] C. Leung et al., Constraining primordial black holes using fast radio burst gravitational-lens interferometry with CHIME/FRB, Physical Review D **106**, 043017 (2022), doi:10.1103/PhysRevD.106.043017.

[61] Z. Kader et al., High-time resolution search for compact objects using fast radio burst gravitational lens interferometry with CHIME/FRB, Physical Review D **106**, 043016 (2022), doi:10.1103/PhysRevD.106.043016.

[62] Z. Abdurashidova et al., First Results from HERA Phase I: Upper Limits on the Epoch of Reionization 21 cm Power Spectrum, Astrophysical Journal **925**, 221 (2022), doi:10.3847/1538-4357/ac1c78.

[63] J. E. Aguirre et al., Validation of the HERA Phase I Epoch of Reionization 21 cm Power Spectrum Software Pipeline, Astrophysical Journal **924**, 85 (2022), doi:10.3847/1538-4357/ac32cd.

[64] Z. Abdurashidova et al., HERA Phase I Limits on the Cosmic 21 cm Signal: Constraints on Astrophysics and Cosmology during the Epoch of Reionization, Astrophysical Journal **924**, 51 (2022), doi:10.3847/1538-4357/ac2ffc.

[65] D. Storer et al., Automated Detection of Antenna Malfunctions in Large-N Interferometers: A Case Study With the Hydrogen Epoch of Reionization Array, Radio Science **57**, e2021RS007376 (2022), doi:10.1029/2021RS007376.

[66] B. K. Gehlot et al., Effects of model incompleteness on the drift-scan calibration of radio telescopes, Monthly Notices of the RAS **506**, 4578 (2021), doi:10.1093/mnras/stab2072.

[67] J. Tan et al., Methods of Error Estimation for Delay Power Spectra in 21 cm Cosmology, Astrophysical Journal, Supplement **255**, 26 (2021), doi:10.3847/1538-4365/ac0533.

[68] P. La Plante et al., A Real Time Processing system for big data in astronomy: Applications to HERA, Astronomy and Computing **36**, 100489 (2021), doi:10.1016/j.ascom.2021.100489.

[69] CHIME/FRB Collaboration, Recent high activity from a repeating Fast Radio Burst discovered by CHIME/FRB, The Astronomer's Telegram **14497**, 1 (2021).

[70] A. Ewall-Wice et al., DAYENU: a simple filter of smooth foregrounds for intensity mapping power spectra, Monthly Notices of the RAS **500**, 5195 (2021), doi:10.1093/mnras/staa3293.

[71] N. Fagnoni et al., Understanding the HERA Phase I receiver system with simulations and its impact on the detectability of the EoR delay power spectrum, Monthly Notices of the RAS **500**, 1232 (2021), doi:10.1093/mnras/staa3268.

[72] J. S. Dillon et al., Redundant-baseline calibration of the hydrogen epoch of reionization array, Monthly Notices of the RAS **499**, 5840 (2020), doi:10.1093/mnras/staa3001.

[73] Z. Zhang et al., The impact of tandem redundant/sky-based calibration in MWA Phase II data analysis, Publications of the Astron. Soc. of Australia **37**, e045 (2020), doi:10.1017/pasa.2020.37.

[74] C. D. Nunhokee et al., Measuring HERA's Primary Beam in Situ: Methodology and First Results, Astrophysical Journal **897**, 5 (2020), doi:10.3847/1538-4357/ab9634.

[75] N. Thyagarajan et al., Detection of cosmic structures using the bispectrum phase. II. First results from application to cosmic reionization using the Hydrogen Epoch of Reionization Array, Physical Review D **102**, 022002 (2020), doi:10.1103/PhysRevD.102.022002.

[76] C. L. Carilli et al., Imaging and Modeling Data from the Hydrogen Epoch of Reionization Array, Astrophysical Journal, Supplement **247**, 67 (2020), doi:10.3847/1538-4365/ab77b1.

[77] N. S. Kern et al., Absolute Calibration Strategies for the Hydrogen Epoch of Reionization Array and Their Impact on the 21 cm Power Spectrum, Astrophysical Journal **890**, 122 (2020), doi:10.3847/1538-4357/ab67bc.

[78] N. S. Kern et al., Mitigating Internal Instrument Coupling for 21 cm Cosmology. II. A Method Demonstration with the Hydrogen Epoch of Reionization Array, Astrophysical Journal **888**, 70 (2020), doi:10.3847/1538-4357/ab5e8a.

[79] W. Li et al., First Season MWA Phase II Epoch of Reionization Power Spectrum Results at Redshift 7, Astrophysical Journal **887**, 141 (2019), doi:10.3847/1538-4357/ab55e4.

[80] N. Barry et al., Improving the Epoch of Reionization Power Spectrum Results from Murchison Widefield Array Season 1 Observations, Astrophysical Journal **884**, 1 (2019), doi:10.3847/1538-4357/ab40a8.

[81] N. S. Kern et al., Mitigating Internal Instrument Coupling for 21 cm Cosmology. I. Temporal and Spectral Modeling in Simulations, Astrophysical Journal **884**, 105 (2019), doi:10.3847/1538-4357/ab3e73.

[82] J. Kerrigan et al., Optimizing sparse RFI prediction using deep learning, Monthly Notices of the RAS **488**, 2605 (2019), doi:10.1093/mnras/stz1865.

[83] J. R. Kerrigan et al., Improved 21 cm Epoch of Reionization Power Spectrum Measurements with a Hybrid Foreground Subtraction and Avoidance Technique, Astrophysical Journal **864**, 131 (2018), doi:10.3847/1538-4357/aad8bb.

[84] W. Li et al., Comparing Redundant and Sky-model-based Interferometric Calibration: A First Look with Phase II of the MWA, Astrophysical Journal **863**, 170 (2018), doi:10.3847/1538-4357/aad3c3.