

Education & Appointments

Visiting Assistant Professor

Colgate University, Department of Physics & Astronomy.

2025 - Current

- Faculty teaching introductory observational techniques to astronomy majors
- Mentor to four undergraduates in spectroscopic research

PhD, Astronomy & Astrophysics

University of Chicago.

2025

Advisor: Prof. Alexander Ji

Thesis: *Probing Chemical Enrichment Patterns in Globular Clusters Using Stellar Streams*

- Observed and analyzed primarily red giant branch stars in globular clusters and globular cluster stellar streams to chemically tag their stars and identify correlated abundance patterns called *multiple populations*
- Mentored two undergraduate women on spectroscopic research in stellar streams, including the identification of the smallest disrupted dwarf galaxy ever observed.

Fermi National Laboratory, Computer Science Division.

Summer 2020

Advisor: Dr. Brian Nord.

Summer Research Intern.

- Developed a convolutional neural network for delensing the cosmic microwave background

NASA Goddard, Gravitational Astrophysics Laboratory.

Summer 2019

Advisor: Dr. John G Baker.

Summer Research Intern.

- Wrote a pipeline to identify gravitational-wave mergers in theoretical data from the Laser Interferometer Space Antenna

MPhil, Physics & Astronomy

2018

Advisor: Prof. Stephen Fairhurst

Thesis: *Rapid Parameterization & Estimated Inclination of Gravitational Waves from Binary Systems*

- Constrain the impact of the inclination of binary systems on the distance estimates.
- Created the groundwork for a computationally inexpensive, low-latency parameter estimation pipeline

BS, Physics & Math (Double Major)

2016

Advisor: Prof. Duncan Brown

Syracuse University. French Minor, Summa Cum Laude.

Thesis: *The PyCBC Search for Gravitational Waves from Compact Binary Coalescence*

- Tested various configurations of the LIGO data analysis pipeline
- Wrote the paper describing the analysis pipeline used to identify the first detected gravitational wave

California Institute of Technology, Gravitational-Wave Group.

Summer 2015

Advisor: Prof. Alan Weinstein.

Summer Research Intern.

- Tested the ability of the Laser Interferometer Gravitational-Wave Observatory (LIGO) Collaboration to constrain the nuclear equation of state using gravitational wave detections from neutron star mergers

Laboratoire de l'Accélérateur Linéaire, Gravitational-Wave Group.

Summer 2014

Advisor: Dr. Florent Robinet.

Summer Research Intern.

- Quantified the impact of noise removal algorithms on the search for binary mergers using LIGO data.

Teaching

Instructor of Record

Department of Physics & Astronomy, Colgate University

- Instructor for *Astronomical Techniques* and *Electricity & Magnetism Lab* classes 2025 - Current
- Developed hands-on lab to teach introductory astronomy
- Incorporated professional observing at Foggy Bottom and Apache Point Observatories into classwork

Graduate Pedagogy Fellow

Chicago Center for Teaching and Learning, University of Chicago

- Hosted series of seminars on introductory pedagogy for science classes 2023 - 2024
- Ran discussion sections for semester-long pedagogy class

Curriculum Developer

Department of Astronomy and Astrophysics, University of Chicago

- Rewrote lab manuals to improve accessibility and understanding for introductory astronomy classes Spring 2024
- Resequenced experiments in lab classes to optimize student learning Spring 2023
- Wrote novel astronomy experiments incorporating observations from 20-inch telescope at Stone Edge Observatory Fall 2022

Teaching Assistant

Department of Astronomy and Astrophysics, University of Chicago

Galaxies	Winter 2024 Winter 2023 Winter 2020 Winter 2019
Stars	Fall 2023
Exoplanets	Spring 2021 Spring 2020
The Big Bang	Spring 2019 Spring 2020
Matter, Energy, Space & Time	Fall 2020 Fall 2018

Teaching Assistant

Chicago Center for Teaching and Learning, University of Chicago.

Course Design and College Teaching	Fall 2023
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Telescope Allocation

Apache Point, 3.5-meter – ARCES (2 half-nights) 2025B
Characterizing the multiple stellar populations of M15 globular cluster.

Magellan Clay – MIKE (1.5 nights) 2025A
Characterizing the multiple stellar populations of the Jet stream.

Magellan Clay – MIKE (1 night) 2023B
Constraining multiple populations in globular cluster stellar streams.

Publications

First-Author and Mentored Publications

7. Are AGB-star Mass-Transfer events more frequent in stellar streams compared to undisrupted systems?
S. A. Usman, M. McKenzie, and N. Weatherford.
In preparation for publication in the Astrophysical Journal Letters..
 - Exploring current literature on mass-transfer stars and the chemical enrichment from an asymptotic giant branch (AGB) companions
6. Globular Cluster Properties and Enrichment Patterns:
 Second-Population and AGB Mass-Transfer Star in the GD-1 Stellar Stream
S. A. Usman, N. Carl, A. P. Ji, T. S. Li, S. Martell, and M. McKenzie.
In preparation for publication in the Open Journal of Astrophysics..
 - Discussing the fraction of enriched stars identified in the GD-1 stellar stream using observations from spectrograph Magellan/MIKE
5. Chemical Abundances in the Metal-Poor Globular Cluster ESO280-SC06:
 A Tidally Disrupted Globular Cluster
S. A. Usman, A. P. Ji, J. Rodriguez, J. Simpson, S. Martell, T. S. Li, A. Bonaca, S. Shah, and M. McKenzie.
The Open Journal of Astrophysics, Volume 8, article id. 86.
 - Constraining multiple populations and confirming the identification of an AGB mass-transfer star in the most metal-poor intact Milky Way globular cluster, ESO 280-SC06
4. Chemical Abundances in the Leiptr Stellar Stream:
 a Disrupted Ultra-faint Dwarf Galaxy?
 K. R. Atzberger, **S. A. Usman**, A. P. Ji, L. R. Cullinane, D. Erkal, T. T. Hansen, G. F. Lewis, T. S. Li, et al.
The Open Journal of Astrophysics, Volume 8, article id. 68.
 - Chemically tagging the least massive disrupted dwarf galaxy ever found, the Leiptr stellar stream.
 - Mentor to undergraduate first-author.
3. Multiple Populations and a CH Star Found in the 300S Globular Cluster Stellar Stream
S. A. Usman, A. P. Ji, T. S. Li, A. B. Pace, L. R. Cullinane, G. S. Da Costa, S. E. Koposov, G. F. Lewis, D. B. Zucker, et al. (The S^5 Collaboration)
Monthly Notices of the Royal Astronomical Society, Volume 529, Issue 3, pp.2413-2427..
 - The first confirmation of multiple stellar populations in a globular cluster stellar stream using high-resolution spectroscopy.
2. Constraining the Inclination of Binary Mergers from Gravitational-wave Observations
S. A. Usman, J. C. Mills, and S. Fairhurst.
The Astrophysical Journal, Volume 877, Issue 2, article id. 82, 10 pp.
 - Demonstration of limitations of measuring distance to gravitational-wave sources using current and future interferometer networks.
1. The PyCBC search for gravitational waves from compact binary coalescence
S. A. Usman, A. H. Nitz, I. W. Harry, C. M. Biwer, D. A. Brown, M. Cabero, C. D. Capano, T. Dal Canton, T. Dent, S. Fairhurst, et al.
Classical and Quantum Gravity, Volume 33, Issue 21, article id. 215004.
 - An in-depth description of the analysis pipeline used to identify gravitational waves, including the first confirmed detection GW150914.

Contributed Publications

9. LESSPayne: Labeling Echelle Spectra with SMHR and Payne
 A. P. Ji, A. R. Casey, Y.S. Ting, E.M. Holmbeck, A. Frebel, **S. A. Usman**, G. Limberg, S.P. Shah, A. Chiti, R. Ezzeddine, T.T. Hansen, et al.
Published in the Astrophysics Source Code Library. Additionally in preparation for publication in the Journal of Open Source Software.
 - Contributed to the uncertainty propagation of stellar abundances given measurements of multiple absorption lines.
8. S^5 : New insights from deep spectroscopic observations of the tidal tails of the globular clusters NGC 1261 and NGC 1904
 P. Awad, T. S. Li, D. Erkal, R. F. Peletier, K. Bunte, S. E. Koposov, A. Li, E. Balbinot, R. Smith, M. Canducci, P. Tiño, A. M. Senkevich et al.
Accepted to Astronomy & Astrophysics.
7. Extending the Chemical Reach of the H3 Survey: Detailed Abundances of the Dwarf-galaxy Stellar Stream Wukong/LMS-1
 G. Limberg, A. P. Ji, R. P. Naidu, A. Chiti, S. Rossi, **S. A. Usman**, Y.-S. Ting, D. Zaritsky, A. Bonaca, L. Borbolato, J. S. Speagle, et al.
Monthly Notices of the Royal Astronomical Society, Volume 530, Issue 3, pp.2512-2525y.
6. Spectacular Nucleosynthesis from Early Massive Stars
 A. P. Ji, S. Curtis, N. Storm, V. Chandra, K. C. Schlaufman, K. G. Stassun, A. Heger, M. Pignatari, A. M. Price-Whelan, M. Bergemann, et al.
The Astrophysical Journal Letters, Volume 961, Issue 2, id.L41, 25 pp.
 - Observed uniquely enriched star as part of Sloan Digital Sky Survey follow-up.
5. Simple parameter estimation using observable features of gravitational-wave signals
 S. Fairhurst, C. Hoy, R. Green, C. Mills, **S. A. Usman**
Physical Review D 108, 082006.
 - Wrote base framework for low-latency computationally efficient parameter estimation program.

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| 4. Observation of Gravitational Waves from a Binary Black Hole Merger
B. P. Abbott et al. (The LIGO Scientific Collaboration and Virgo Scientific Collaboration)
<i>Physical Review Letters</i> 116, 061102.
• Conducted analysis of LIGO data, resulting in first confirmed observation of a gravitational wave, GW150914. | 2016 |
| 3. GW150914: First Results from the search for binary black hole coalescence with Advanced LIGO
B. P. Abbott et al. (The LIGO Scientific Collaboration and Virgo Scientific Collaboration)
<i>Physical Review D</i> 93, 122003. | 2016 |
| 2. Characterization of transient noise in Advanced LIGO relevant to gravitational wave signal GW150914
B. P. Abbott et al. (The LIGO Scientific Collaboration and Virgo Scientific Collaboration)
<i>Classical and Quantum Gravity</i> 33, 134001. | 2016 |
| 1. The Rate of Binary Black Hole Mergers Inferred from Advanced LIGO Observations Surrounding GW150914
B. P. Abbott et al. (The LIGO Scientific Collaboration and Virgo Scientific Collaboration)
<i>The Astrophysical Journal Letters</i> , 833, 1, L1, 8. | 2016 |

Other LIGO Collaboration Papers

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| 12. Open data from the first and second observing runs of Advanced LIGO and Advanced Virgo
R. Abbott, et al. (The LIGO Scientific Collaboration and The VIRGO Collaboration)
<i>SoftwareX</i> , Volume 13, article id. 100658. | 2021 |
| 11. GW190412: Observation of a binary-black-hole coalescence with asymmetric masses
R. Abbott, et al. (The LIGO Scientific Collaboration and The VIRGO Collaboration)
<i>Physical Review D</i> , Volume 102, Issue 4, article id.043015. | 2020 |
| 10. Full band all-sky search for periodic gravitational waves in the O1 LIGO data
B. P. Abbott, et al. (The LIGO Scientific Collaboration and The VIRGO Collaboration)
<i>Physical Review D</i> , Volume 97, Issue 10, article id.102003. | 2018 |
| 9. GW170817: Implications for the Stochastic Gravitational-Wave Background from Compact Binary Coalescences
B. P. Abbott, et al. (The LIGO Scientific Collaboration and The VIRGO Collaboration)
<i>Physical Review Letters</i> , Volume 120, Issue 9, id.091101. | 2018 |
| 8. Effects of data quality vetoes on a search for compact binary coalescences in Advanced LIGO's first observing run
B. P. Abbott, et al. (The LIGO Scientific Collaboration and The VIRGO Collaboration)
<i>Classical and Quantum Gravity</i> , Volume 35, Issue 6, article id. 065010. | 2018 |
| 7. Search of the Orion spur for continuous gravitational waves using a loosely coherent algorithm on data from [...]
J. Aasi, et al. (The LIGO Scientific Collaboration and The VIRGO Collaboration)
<i>Physical Review D</i> , Volume 93, Issue 4, id.042006. | 2016 |
| 6. All-sky search for long-duration gravitational wave transients in the first Advanced LIGO observing run
B. P. Abbott, et al. (The LIGO Scientific Collaboration and The VIRGO Collaboration)
<i>Physical Review D</i> , Volume 93, Issue 4, id.042005. | 2016 |
| 5. Astrophysical Implications of the Binary Black-hole Merger GW150914
B. P. Abbott, et al. (The LIGO Scientific Collaboration and The VIRGO Collaboration)
<i>The Astrophysical Journal Letters</i> , Volume 818, Issue 2, article id. L22, 15 pp. | 2016 |
| 4. Advanced LIGO
J. Aasi, et al. (The LIGO Scientific Collaboration and The VIRGO Collaboration)
<i>Classical and Quantum Gravity</i> , Volume 32, Issue 7, article id. 074001. | 2015 |
| 3. Multimessenger search for sources of gravitational waves and high-energy neutrinos: Initial results for LIGO-Virgo [...]
J. Aasi, et al. (The LIGO Scientific Collaboration and The VIRGO Collaboration)
<i>Physical Review D</i> , Volume 90, Issue 10, id.102002. | 2014 |
| 2. Search for Gravitational Waves Associated with γ -ray Bursts Detected by the Interplanetary Network
J. Aasi, et al. (The LIGO Scientific Collaboration and The VIRGO Collaboration)
<i>Physical Review Letters</i> , Volume 113, Issue 1, id.011102. | 2014 |
| 1. Methods and results of a search for gravitational waves associated with gamma-ray bursts using the GEO 600, LIGO, [...]
J. Aasi, et al. (The LIGO Scientific Collaboration and The VIRGO Collaboration)
<i>Physical Review D</i> , Volume 89, Issue 12, id.122004. | 2014 |

Co-authored 9 additional LIGO collaboration papers, which can be provided upon request.

Posters and Presentations

Invited Talks

4. Colloquium San José State University	September 2024
3. Invited Talk CeNAM Frontiers Conference	June 2024
2. Colloquium Lowell Observatory	May 2024
1. Astrophysics Seminar University of Notre Dame	March 2024

Contributed Talks

13. Dissertation Talk American Astronomical Society Meeting	January 2026
12. Contributed Talk Out in STEM (oSTEM) National Conference	November 2023
11. Contributed Talk the Great Lakes Clusters and Streams Conference	August 2023
10. Contributed Talk Non-Local Thermodynamic Equilibrium (Non-LTE) Workshop	June 2023
9. Contributed Talk CeNAM Frontiers in Nuclear Astrophysics Conference	May 2023
8. Contributed Talk Queer Atlantic Canadian STEM (QAtCanSTEM) Conference	October 2022
7. Talk University of Chicago Society of Physics Students	December 2019
6. Talk Columbia University	June 2016
5. Internship Talk California Institute of Technology	August 2015
4. Internship Talk La Laboratoire de l'Accélérateur Linéaire d'Orsay	July 2014
3. Internship Talk University of Florida	July 2014
2. Talk National Institute for Subatomic Physics (NIKHEF)	May 2014
1. Talk California State University, Fullerton	May 2014

Posters

6. Dwarf Galaxies, Star Clusters, and Streams in the LSST Era Workshop	June 2024
5. Rare Gems in Big Data in Tuscon, AZ	May 2024
4. JINA-CEE, Frontiers in Nuclear Astrophysics	May 2022
3. NASA Goddard Space Center	July 2019
2. LIGO-Virgo Collaboration Meeting	March 2015
1. LIGO-Virgo Collaboration Meeting	March 2014

Awards & Honors

American Dissertation Fellowship <i>American Association for University Women</i>	2024-2025
Graduate Fellowship <i>Chicago Center for Teaching and Learning</i>	2023-2024
LGBT+ Community Engagement Award <i>UChicago Alumni Association and the Center for Sexuality and Gender Studies</i>	2023
Out to Innovate Scholarship <i>Out to Innovate (formerly known as National Organization of Gay and Lesbian Scientists and Technical Professionals (NOGLSTP))</i>	2022
Radix Trading Fellowship <i>Radix Trading, LLC.</i>	2021-2022
URA Summer Graduate Fellowship <i>Universities Research Association</i>	2021

Illinois Space Grant	2019
<i>Illinois Space Grant Consortium</i>	
Special Breakthrough Prize in Fundamental Physics	2016
<i>Breakthrough Prize Board</i>	
Cardiff University USA Excellence Scholarship	2016
<i>Cardiff University</i>	
Syracuse University Scholar	2016
<i>Syracuse University</i>	
Norma Slepecky Undergraduate Research Prize	2016
<i>Women in Science and Engineering (WiSE) at Syracuse University</i>	
Renée Crown Honors Prize	2016
<i>Renée Crown University Honors Program</i>	
Paul M. Gelling Fellowship Fund	2016
<i>Syracuse University, Department of Physics</i>	
Astronaut Scholarship	2015
<i>Astronaut Scholarship Foundation</i>	
Barry Goldwater Scholarship Honorable Mention	2014, 2015
<i>The Barry Goldwater Scholarship and Excellence in Education Foundation</i>	

Volunteer, Outreach and Mentorship Activities

Volunteer

Founder & president. UChicago Plus.	October 2020 - Current
<i>UChicago's largest LGBT+ student network, comprised of 480+ undergraduate and graduate students.</i>	

Mentorship

Graduate Student Peer Mentor. Physical Sciences Division Peer Mentorship Program.	2023 - 2024
Graduate Student Mentor. Women in Physics Mentorship Program.	2018 - 2021
Graduate Student Peer Mentor. Astronomy & Astrophysics Graduate Student Peer Mentorship Program.	2020 - 2021
Graduate Student Peer Mentor. Physical Sciences Division Diversity, Equity and Inclusion Peer Mentorship Program.	2020 - 2021

Outreach

Public Outreach Speaker. Lowell Observatory.	May 2024
<i>Special invited speaker to historic research observatory.</i>	
Public Outreach Speaker. Bryce Canyon Annual Astronomy Festival.	June 2022
<i>Speaker at yearly public astronomy festival at Bryce Canyon National Park.</i>	
LGBT+ Outreach Participant. Out in PSD.	October 2019
<i>Month-long celebration of LGBT+ and ally scientists in the UChicago Physical Sciences Division.</i>	
Physics Outreach Volunteer. Adopt-A-Physicist.	Octobers 2015 - 2019
<i>Program connecting high school physics students to physicists to discuss research.</i>	
Event Creator and Organizer. International LGBT+ in STEM Day at Cardiff University.	July 2018
<i>Event recognizing and celebrating the first International LGBT+ in STEM day, discussing adversity faced by LGBT+ scientists.</i>	
REU Session Facilitator. Conference for Undergraduate Women in Physics (CUWiP).	January 2016
<i>Conference discussing, promoting and supporting undergraduate women interested in pursuing careers in physics.</i>	