

# JAKOB M. HELTON

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## CURRENT POSITION

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I am a fourth-year doctoral candidate at the University of Arizona pursuing an M.S. and Ph.D. in astronomy while studying: (**#1**) **high-redshift galaxies**, (**#2**) **high-redshift galaxy clusters**, and (**#3**) **the large-scale structure of the Universe**. Also, I am one of the key members of the JWST Advanced Deep Extragalactic Survey (JADES) in addition to the JWST/NIRCam and the JWST/MIRI Instrument Science Teams.

## EDUCATION

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### University of Arizona

*August 2021 - May 2025*

Degree: M.S. and Ph.D. in Astronomy

Thesis: *At the Break of Cosmic Dawn: Identifying and Understanding the Most Distant Galaxies and Galaxy Clusters with JWST* (Advisors: Marcia Rieke and Kevin Hainline)

### Princeton University

*September 2017 - May 2021*

Degree: A.B. in Astrophysical Sciences

Thesis: *The Nebular Properties of Star-Forming Galaxies at Intermediate Redshifts from LEGA-C* (Advisors: Allison Strom and Jenny Greene)

## PUBLICATIONS

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[Link to ADS Public Library](#)

*Last Updated: 4 December 2024*

**Summary of All Publications**

number: 53; citations: 3784; h-index: 27

**Summary of Refereed Publications**

number: 37; citations: 3318; h-index: 25

### First-Author

- [6] J. M. Helton, G. H. Rieke, S. Alberts, et al., *The Stellar Populations and Rest-Frame Colors of Star-Forming Galaxies at  $z \approx 8$ : Exploring the Impact of Filter Choice and Star Formation History Assumption with JADES*, 2024, ApJ, in preparation
- [5] J. M. Helton, G. H. Rieke, S. Alberts, et al., *JWST/MIRI photometric detection at  $7.7 \mu\text{m}$  in a galaxy at  $z > 14$* , 2024, Nature Astronomy, accepted
- [4] J. M. Helton, F. Sun, C. Woodrum, et al., *Identification of High-Redshift Galaxy Overdensities in GOODS-N and GOODS-S*, 2024, ApJ, 974, 41
- [3] J. M. Helton, F. Sun, C. Woodrum, et al., *The JWST Advanced Deep Extragalactic Survey: Discovery of an Extreme Galaxy Overdensity at  $z = 5.4$  with JWST/NIRCam in GOODS-S*, 2024, ApJ, 962, 124

- [2] J. M. Helton, A. L. Strom, J. E. Greene, et al., *The nebular properties of star-forming galaxies at intermediate redshift from the Large Early Galaxy Astrophysics Census*, 2022, ApJ, 934, 81
- [1] J. M. Helton, S. D. Johnson, J. E. Greene, et al., *Discovery and origins of giant optical nebulae surrounding quasar PKS0454–22*, 2021, MNRAS, 505, 4

### Second-Author

- [2] K. N. Hainline, J. M. Helton, B. D. Johnson, et al., *Brown Dwarf Candidates in the JADES and CEERS Extragalactic Surveys*, 2024, ApJ, 964, 66
- [1] F. Sun, J. M. Helton, E. Egami, et al., *JADES: Resolving the Stellar Component and Filamentary Overdense Environment of Hubble Space Telescope (HST)-dark Submillimeter Galaxy HDF850.1 at  $z = 5.18$* , 2024, ApJ, 961, 69

### Third-Author

- [2] L. Sandles, F. D'Eugenio, J. M. Helton, et al., *JADES: deep spectroscopy of a low-mass galaxy at redshift 2.3 quenched by environment*, 2023, A&A, in review
- [1] S. Alberts, C. C. Williams, J. M. Helton, et al., *To high redshift and low mass: exploring the emergence of quenched galaxies and their environments at  $3 < z < 6$  in the ultra-deep JADES MIRI F770W parallel*, 2024, ApJ, 975, 85

### Co-Author with Major Contributions

- [20] Y. Zhu, S. Alberts, et al., including J. M. Helton, *SMILES: Discovery of Higher Ionizing Photon Production Efficiency in Overdense Regions*, 2024, ApJ, in review
- [19] S. Carniani, F. D'Eugenio, et al., including J. M. Helton, *The eventful life of a luminous galaxy at  $z = 14$ : metal enrichment, feedback, and low gas fraction?*, 2024, A&A, in review
- [18] Z. Ji, C. C. Williams, et al., including J. M. Helton, *Extended hot dust emission around the earliest massive quiescent galaxy*, 2024, Nature, in review
- [17] J. Witstok, P. Jakobsen, et al., including J. M. Helton, *Witnessing the onset of Reionisation via Lyman- $\alpha$  emission at redshift 13*, 2024, Nature, in review
- [16] Z. Li, Z. Cai, et al., including J. M. Helton, *MAGNIF: A Tentative Lensed Rotating Disk at  $z = 8.34$  detected by JWST NIRCам WFSS with Dynamical Forward Modeling*, 2023, ApJ, in review
- [15] K. N. Hainline, R. Maiolino, et al., including J. M. Helton, *An Investigation Into The Selection and Colors of Little Red Dots and Active Galactic Nuclei*, 2024, ApJ, accepted
- [14] J. Witstok, R. Maiolino, et al., including J. M. Helton, *JADES: Primaeval Lyman- $\alpha$  emitting galaxies reveal early sites of reionisation out to redshift  $z \sim 9$* , 2025, MNRAS, 536, 27

- [13] S. Alberts, J. Lyu, et al., including J. M. Helton, *SMILES Initial Data Release: Unveiling the Obscured Universe with MIRI Multiband Imaging*, 2024, ApJ, 976, 224
- [12] K. N. Hainline, F. D'Eugenio, et al., including J. M. Helton, *Searching for Emission Lines at  $z > 11$ : The Role of Damped Ly $\alpha$  and Hints About the Escape of Ionizing Photons*, 2024, ApJ, 976, 160
- [11] K. N. Hainline, F. D'Eugenio, et al., including J. M. Helton, *JADES: Spectroscopic Confirmation and Proper Motion for a T-Dwarf at 2 kpc*, 2024, ApJ, 975, 31
- [10] S. Carniani, K. Hainline, et al., including J. M. Helton, *Spectroscopic confirmation of two luminous galaxies at a redshift of 14*, 2024, Nature, 633, 318
- [9] S. Lim, S. Tacchella, et al., including J. M. Helton, *The FLAMINGO simulation view of cluster progenitors observed in the epoch of reionization with JWST*, 2024, MNRAS, 532, 4551
- [8] B. Robertson, B. D. Johnson, et al., including J. M. Helton, *Earliest Galaxies in the JADES Origins Field: Luminosity Function and Cosmic Star-Formation Rate Density 300 Myr after the Big Bang*, 2024, ApJ, 970, 31
- [7] Y. Sun, G.-H. Lee, et al., including J. M. Helton, *Evolution of Gas Flows along the Starburst to Post-Starburst to Quiescent Galaxy Sequence*, 2024, MNRAS, 682, 40
- [6] K. N. Hainline, B. D. Johnson, et al., including J. M. Helton, *The Cosmos in its Infancy: JADES Galaxy Candidates at  $z > 8$  in GOODS-S and GOODS-N*, 2024, ApJ, 964, 71
- [5] J. Witstok, R. Smit, et al., including J. M. Helton, *Inside the bubble: exploring the environments of reionisation-era Lyman- $\alpha$  emitting galaxies with JADES and FRESCO*, 2024, A&A, 682, A40
- [4] S. Tacchella, D. J. Eisenstein, et al., including J. M. Helton, *JADES Imaging of GN-z11: Revealing the Morphology and Environment of a Luminous Galaxy 430 Myr After the Big Bang*, 2023, ApJ, 952, 74
- [3] E. Curtis-Lake, S. Carniani, et al., including J. M. Helton, *Spectroscopic confirmation of four metal-poor galaxies at  $z = 10.3 - 13.2$* , 2023, Nature Astronomy, 7, 622
- [2] B. E. Robertson, S. Tacchella, et al., including J. M. Helton, *Identification and properties of intense star-forming galaxies at redshifts  $z > 10$* , 2023, Nature Astronomy, 7, 611
- [1] S. Aiola, E. Calabrese, et al., including J. M. Helton, *The Atacama Cosmology Telescope: DR4 Maps and Cosmological Parameters*, 2020, JCAP, 12, 047

#### **Co-Author with Minor Contributions**

- [24] P. Rinaldi, N. Bonaventura, et al., including J. M. Helton, *Not Just a Dot: the complex UV morphology and underlying properties of Little Red Dots*, 2024, ApJ, in review

- [23] Y. Zhu, M. J. Rieke, et al., including J. M. Helton, *A Systematic Search for Galaxies with Extended Emission Line and Potential Outflows in JADES Medium-Band Images*, 2024, ApJ, in review
- [22] Y. Sun, J. Lyu, et al., including J. M. Helton, *No evidence for a significant evolution of  $M_{\bullet} - M_{*}$  relation up to  $z \sim 4$* , 2024, ApJ, in review
- [21] F. D'Eugenio, A. J. Cameron, et al., including J. M. Helton, *JADES Data Release 3 – NIRSpec/MSA spectroscopy for 4,000 galaxies in the GOODS fields*, 2024, ApJS, in review
- [20] S. Tacchella, W. McClymont, et al., including J. M. Helton, *Resolving the nature and putative nebular emission of GS9422: an obscured AGN without exotic stars*, 2024, MNRAS, in review
- [19] Z. Ji, C. C. Williams, et al., including J. M. Helton, *JADES: Rest-frame UV-to-NIR Size Evolution of Massive Quiescent Galaxies from Redshift  $z = 5$  to  $z = 0.5$* , 2024, ApJ, in review
- [18] D. J. Eisenstein, B. D. Johnson, et al., including J. M. Helton, *The JADES Origins Field: A New JWST Deep Field in the JADES Second NIRCам Data Release*, 2023, ApJ, in review
- [17] D. J. Eisenstein, C. Willott, et al., including J. M. Helton, *Overview of the JWST Advanced Deep Extragalactic Survey (JADES)*, 2023, ApJ, in review
- [16] W. M. Baker, S. Tacchella, et al., including J. M. Helton, *A core in a star-forming disc as evidence of inside-out growth in the early Universe*, 2024, Nature Astronomy, Advanced Online Publication
- [15] F. D'Eugenio, R. Maiolino, et al., including J. M. Helton, *JWST/NIRSpec WIDE survey: a  $z = 4.6$  low-mass star-forming galaxy hosting a jet-driven shock with low ionisation and solar metallicity*, 2025, MNRAS, 536, 51
- [14] C. Woodrum, M. Rieke, et al., including J. M. Helton, *JADES: Using NIRCам Photometry to Investigate the Dependence of Stellar Mass Inferences on the IMF in the Early Universe*, 2024, PNAS, 121, 42
- [13] Z. Ji, C. C. Williams, et al., including J. M. Helton, *JADES+JEMS: A Detailed Look at the Buildup of Central Stellar Cores and Suppression of Star Formation in Galaxies at Redshifts  $3 < z < 4.5$* , 2024, ApJ, 974, 135
- [12] A. J. Bunker, A. J. Cameron, et al., including J. M. Helton, *JADES NIRSpec initial data release for the Hubble Ultra Deep Field: redshifts and line fluxes of distant galaxies from the deepest JWST Cycle 1 NIRSpec multi-object spectroscopy*, 2024, A&A, 690, 288
- [11] R. Endsley, D. P. Stark, et al., including J. M. Helton, *The star-forming and ionizing properties of dwarf  $z \sim 6 - 9$  galaxies in JADES: insights on bursty star formation and ionized bubble growth*, 2024, MNRAS, 533, 1111

- [10] C. C. Williams, S. Alberts, et al., including J. M. Helton, *The Galaxies Missed by Hubble and ALMA: The Contribution of Extremely Red Galaxies to the Cosmic Census at  $3 < z < 8$* , 2024, ApJ, 968, 34
- [9] A. Saxena, A. J. Bunker, et al., including J. M. Helton, *JADES: The production and escape of ionizing photons from faint Lyman-alpha emitters in the epoch of reionization*, 2024, A&A, 684, A84
- [8] M. Curti, R. Maiolino, et al., including J. M. Helton, *JADES: Insights into the low-mass end of the mass-metallicity-SFR relation at  $3 < z < 10$  from deep JWST/NIRSpec spectroscopy*, 2024, A&A, 684, A75
- [7] R. Maiolino, J. Scholtz, et al., including J. M. Helton, *A small and vigorous black hole in the early Universe*, 2024, Nature, 627, 8002
- [6] M. J. Rieke, B. Robertson, et al., including J. M. Helton, *JADES Initial Data Release for the Hubble Ultra Deep Field: Revealing the Faint Infrared Sky with Deep JWST NIRCам Imaging*, 2023, ApJS, 269, 16
- [5] C. C. Williams, S. Tacchella, et al., including J. M. Helton, *JEMS: A Deep Medium-band Imaging Survey in the Hubble Ultra Deep Field with JWST NIRCам and NIRISS*, 2023, ApJS, 268, 64
- [4] A. J. Cameron, A. Saxena, et al., including J. M. Helton, *JADES: Probing interstellar medium conditions at  $z \approx 5.5 - 9.5$  with ultra-deep JWST/NIRSpec spectroscopy*, 2023, A&A, 677, A115
- [3] A. J. Bunker, A. Saxena, et al., including J. M. Helton, *JADES NIRSpec Spectroscopy of GN-z11: Lyman- $\alpha$  emission and possible enhanced nitrogen abundance in a  $z = 10.60$  luminous galaxy*, 2023, A&A, 677, A88
- [2] S. Tacchella, B. D. Johnson, et al., including J. M. Helton, *JWST NIRCам+NIRSpec: interstellar medium and stellar populations of young galaxies with rising star formation and evolving gas reservoirs*, 2023, MNRAS, 522, 4
- [1] B. E. Robertson, S. Tacchella, et al., including J. M. Helton, *Morpheus Reveals Distant Disk Galaxy Morphologies with JWST: The First AI/ML Analysis of JWST Images*, 2023, ApJ, 942, 42

## SELECTED PRESENTATIONS

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- [9] **Outreach talk** at the North Houston Astronomy Club in Humble, TX (August 2025). *Understanding the Most Distant Galaxies and Galaxy Clusters with the James Webb Space Telescope (JWST)*.
- [8] **Contributed talk** at the “MIRI Team Meeting” in Tucson, AZ (October 2024). *JWST/MIRI at the Highest Redshifts*.
- [7] **Invited talk** at the “Cosmic Dawn Revealed by JWST: The Physics of the First Stars, Galaxies, and Black Holes” Conference in Santa Barbara, CA (August 2024).

*Identification of High-Redshift Galaxy Overdensities in GOODS-N and GOODS-S.*

- [6] **Outreach talk** at the Sun City Oro Valley Astronomy Club in Oro Valley, AZ (March 2024). *Understanding the Most Distant Galaxies and Galaxy Clusters with the James Webb Space Telescope (JWST).*
- [5] **Contributed poster** at the “242th American Astronomical Society Meeting” in Albuquerque, NM (June 2023). *The JWST Advanced Deep Extragalactic Survey: Discovery of an Extreme Galaxy Overdensity at  $z = 5.4$  with JWST/NIRCam in GOODS-S.*
- [4] **Contributed talk** at the “100 Years of Astronomy at the University of Arizona” Celebration in Tucson, AZ (April 2023). *The JWST Advanced Deep Extragalactic Survey: Discovery of an Extreme Galaxy Overdensity at  $z = 5.4$  with JWST/NIRCam in GOODS-S.*
- [3] **Contributed talk** at the “Early Results from the James Webb Space Telescope” Conference in Cambridge, United Kingdom (March 2023). *The JWST Advanced Deep Extragalactic Survey: Discovery of an Extreme Galaxy Overdensity at  $z = 5.4$  with JWST/NIRCam in GOODS-S.*
- [2] **Outreach talk** at the Canyon del Oro High School in Oro Valley, AZ (December 2022). *An Overview of the James Webb Space Telescope (JWST).*
- [1] **Contributed poster** at the “International Astronomical Union Symposium 373” in Busan, South Korea (August 2022). *The Spatially Resolved Star-Formation Histories of Post-Starburst Galaxies in SDSS-IV MaNGA.*

## TELESCOPE ALLOCATIONS

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<b>JWST/NIRCam &amp; JWST/MIRI in parallel</b>	19.7 Hours (PID: 4549; Co-PI)
<b>JWST/NIRCam &amp; JWST/MIRI in parallel</b>	37.2 Hours (PID: 4540; Co-I)
<b>JWST/NIRSpec</b>	24.5 Hours (PID: 3659; Co-I)
<b>JWST/NIRCam</b>	27.6 Hours (PID: 3577; Co-I)
<b>JWST/NIRCam &amp; JWST/NIRSpec in parallel</b>	135.6 Hours (PID: 3215; Co-I)
<b>JWST/NIRSpec</b>	24.0 Hours (PID: 2959; Co-I)
<b>JWST/NIRCam &amp; JWST/NIRISS in parallel</b>	42.5 Hours (PID: 2883; Co-I)
<b>Keck/MOSFIRE</b>	0.5 Nights (Co-I)
<b>Magellan/IMACS</b>	5.0 Nights (Co-I)
<b>Magellan/FIRE</b>	6.5 Nights (Co-I)
<b>MMT/Binospec</b>	3.0 Nights (Co-I)

## EXTRA-CURRICULARS

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**University of Arizona** *June 2023 - Present*  
 Co-organizer for the Early Universe/REionization Conversations at Arizona (EURECA) at the Department of Astronomy and Steward Observatory.

**Carnegie Observatories***June 2020 - Present*

Mentor for the Carnegie Astrophysics Summer Student Internship (CASSI) Program.

**Princeton University***January 2018 - May 2021*

Head Tutor for Single-Variable Calculus, Multi-Variable Calculus, and Linear Algebra at the McGraw Center for Teaching and Learning.

**Princeton University***January 2020 - August 2020*

Co-organizer for the Galactic/Extragalactic Reading Group (Galread) at the Department of Astrophysical Sciences.

**Princeton University***January 2019 - January 2020*

Undergraduate Teaching Assistant for Introductory Mechanics and Electromagnetism at the Department of Physics.

**MISCELLANEOUS**

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<b>Invited Peer Reviewer</b>	A&A, ApJ, MNRAS, Astron. Comput.
<b>Programming Languages</b>	Python, IDL, Java, Javascript, HTML/CSS
<b>Software &amp; Tools</b>	Unix, Excel, L <sup>A</sup> T <sub>E</sub> X, TensorFlow, FIREHOSE
<b>Observing</b>	Keck/MOSFIRE, Magellan/IMACS, Magellan/LDSS3

**REFERENCES**

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Prof. Marcia Rieke	University of Arizona	mrieke@gmail.com
Prof. Kevin Hainline	University of Arizona	kevinhainline@arizona.edu
Prof. Daniel Eisenstein	Harvard University	deisenstein@cfa.harvard.edu