William O. **Balmer**

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Research Interests

Direct detection and characterization of exoplanets using optical and infrared observations. Coronagraphic imaging. Optical interferometry. Comparative exoplanetology. Exoplanet orbits, atmospheres, composition.

Appointments

Self-funded Graduate Research Assistant — *Baltimore, MD*
Space Telescope Science Institute — *Jun. 2021 - present*

Observatory Fellow — *Baltimore, MD*
NASA Maryland Space Grant Consortium — *Sept. 2022 - Jun. 2023*

Undergraduate Research Assistant — *Amherst, MA*
Follette Lab, Amherst College — *Jun. 2018 - Aug. 2021*

Undergraduate Research Assistant — *Ithaca, NY*
SIOS Lab, Cornell University — *Jun. 2020 - Aug. 2020*

Teaching Assistant, Grading Assistant, Observatory Operator — *Amherst, MA*
Physics and Astronomy Department, Amherst College — *Sept. 2019 - May. 2021*

Education

Johns Hopkins University — *Baltimore, MD*
Ph.D candidate in Astrophysics — *May 2023 - present*

- Thesis: *Mapping Giant Planet Dynamics and Atmospheres on the Bleeding Edges of Detectability*
  - Advisor: Laurent Pueyo

Baltimore, MD
Masters in Physics — *Aug. 2021 - Apr. 2023*

- Completed Graduate Board Oral (qualifying) exam, achieving candidacy May 2nd, 2023
  - Advisor: Laurent Pueyo
- Courses: *Stellar Structure and Evolution*, *Exoplanets and their Atmospheres*, *Radiative Astrophysics*, *Interstellar Medium and Astrophysical Fluid Dynamics*, *Exoplanets and Planet Formation*, *Fourier Optics and Interferometry in Astronomy*, *Astrophysical Dynamics*

Amherst College — *Amherst, MA*
B.A. *cum laude* in Astronomy; B.A. *cum laude* in Physics — *Aug. 2017 - May. 2021*

- Honors thesis: *The Orbit and Hα Variability of the Embedded Accreting Protostellar Companion HD 142527B*
  - Advisor: Katherine Follette
  - Unanimously nominated by the Department of Physics and Astronomy for *summa cum laude* honors
- Three time Amherst Memorial Fellowship awardee (2021, 2022, 2023)

Research Advising

Gavin Wang: "A Revised Density for the largest known planet from NEID and TESS" and "Constraining Formation Models with a Young Multi-planet System" — *Undergraduate*
Johns Hopkins University, Summer internship — *February 2023 - present*

Gavin is leading a forthcoming first author paper as a result of his internship, and was awarded the Goldwater Scholarship to continue his research with me in his senior year.

Henry Dennen: "Orbits and dynamical masses of directly imaged planets" — *Undergraduate*
Johns Hopkins University, Summer internship — *June 2024 - August 2024*

Henry is a contributing author on our group's 2025 paper as a result of his internship.

Refereed Publications

31 refereed papers • 411 unique refereed citations • h-index = 12 • i10-index = 14 • from NASA ADS Jan. '25

First Author († indicates equal contribution)

6. Bardalez-Gagliuffi, D.† **Balmer, W. O**†, Pueyo, L., et al. (submitted). *JWST images a cold giant planet in a dynamically hot, multi-planet system*
5. **Balmer, W. O.**, Kammerer, J., Pueyo, L., et al. (2025) *AJ*, 169, 209. *JWST-TST High Contrast: Living on the Wedge, or, NIRCam Bar Coronagraphy Reveals CO_2 in the HR 8799 and 51 Eri Exoplanets' Atmospheres*
4. **Balmer, W. O.**, Franson, K., Chomez, A., et al. (2025) *AJ*, 169, 30. *VLTI/GRAVITY Observations of AF Lep b: Preference for Circular Orbits, Cloudy Atmospheres, and a Moderately Enhanced Metallicity*
3. **Balmer, W. O.**, Pueyo, L., Lacour, S., et al. (2024) *AJ*, 167, 64. *VLTI/GRAVITY Provides Evidence the Young, Substellar Companion HD 136164 Ab Formed Like a "Failed Star"*
2. **Balmer, W. O.**, Pueyo, L., Stolker, T., et al. (2023) *ApJ*, 956, 99. *VLTI/GRAVITY Observations and Characterization of the Brown Dwarf Companion HD 72946 B*
1. **Balmer, W. O.**, Follette, K. B., Close, L. M., et al. (2022) *AJ*, 164, 29. *Improved Orbital Constraints and Hα Photometric Monitoring of the Directly Imaged Protoplanet Analog HD 142527 B*

Second- or third- author (* indicates advisee first author)

4. *Wang, G., **Balmer, W. O.**, Pueyo, L., et al. (submitted). *A Revised Density Estimate for the Largest Known Exoplanet, HAT-P-67 b*
3. Maire, A.-L., Leclerc, A., **Balmer, W. O.**, et al. (2024) *A&A*, 691, A263. *Direct imaging and dynamical mass of a benchmark T-type brown dwarf companion to HD 167665*
2. Franson, K., **Balmer, W. O.**, Bowler, B. P., et al. (2024) *ApJL*, 974, L11. *JWST/NIRCam 4–5 μm Imaging of the Giant Planet AF Lep b*
1. Blunt, S., **Balmer, W. O.**, Wang, J. J., et al. (2023) *AJ*, 166, 257. *First VLTI/GRAVITY Observations of HIP 65426 b: Evidence for a Low or Moderate Orbital Eccentricity*

Co-author

21. Chai, Y., Chen, C. H., Worthen, K., et al. (2024) *ApJ*, 976, 167. *A JWST MIRI MRS View of the η Tel Debris Disk and Its Brown Dwarf Companion*
20. Hoch, K. K. W., Theissen, C. A., Barman, T. S., et al. (2024) *AJ*, 168, 187. *JWST-TST High Contrast: Spectroscopic Characterization of the Benchmark Brown Dwarf HD 19467 B with the NIRSpec Integral Field Spectrograph*
19. Xuan, J. W., Mérand, A., Thompson, W., et al. (2024) *Natur*, 634, 1070-1074. *The cool brown dwarf Gliese 229 B is a close binary*
18. Blunt, S., Wang, J., Hirsch, L., et al. (2024) *JOSS*, 9, 6756. *orbitize! v3: Orbit fitting for the High-contrast Imaging Community*
17. Kammerer, J., Lawson, K., Perrin, M. D., et al. (2024) *AJ*, 168, 51. *JWST-TST High Contrast: JWST/NIRCam Observations of the Young Giant Planet β Pic b*
16. Winterhalder, T. O., Lacour, S., Mérand, A., et al. (2024) *A&A*, 688, A44. *Combining Gaia and GRAVITY: Characterising five new directly detected substellar companions*
15. Ruffio, J.-B., Perrin, M. D., Hoch, K. K. W., et al. (2024) *AJ*, 168, 73. *JWST-TST High Contrast: Achieving Direct Spectroscopy of Faint Substellar Companions Next to Bright Stars with the NIRSpec Integral Field Unit*
14. Nasedkin, E., Mollière, P., Lacour, S., et al. (2024) *A&A*, 687, A298. *Four-of-a-kind? Comprehensive atmospheric characterisation of the HR 8799 planets with VLTI/GRAVITY*
13. Nowak, M., Lacour, S., Abuter, R., et al. (2024) *A&A*, 687, A248. *Catalogue of dual-field interferometric binary calibrators*

12. Pourré, N., Winterhalder, T. O., Le Bouquin, J.-B., et al. (2024) *A&A*, 686, A258. *High contrast at short separation with VLTI/GRAVITY: Bringing Gaia companions to light*

11. Petrus, S., Whiteford, N., Patapis, P., et al. (2024) *ApJL*, 966, L11. *The JWST Early Release Science Program for Direct Observations of Exoplanetary Systems. V. Do Self-consistent Atmospheric Models Represent JWST Spectra? A Showcase with VHS 1256–1257 b*

10. Worthen, K., Chen, C. H., Law, D. R., et al. (2024) *ApJ*, 964, 168. *MIRI MRS Observations of β Pictoris. I. The Inner Dust, the Planet, and the Gas*

9. Sallum, S., Ray, S., Kammerer, J., et al. (2024) *ApJL*, 963, L2. *The JWST Early Release Science Program for Direct Observations of Exoplanetary Systems. IV. NIRISS Aperture Masking Interferometry Performance and Lessons Learned*

8. Grant, D., Lewis, N. K., Wakeford, H. R., et al. (2023) *ApJL*, 956, L32. *JWST-TST DREAMS: Quartz Clouds in the Atmosphere of WASP-17b*

7. Ray, S., Sallum, S., Hinkley, S., et al. (2023) *arXiv*, arXiv:2310.11508. *The JWST Early Release Science Program for Direct Observations of Exoplanetary Systems III: Aperture Masking Interferometric Observations of the star HIP 65426 at 3.8 um*

6. Carter, A. L., Hinkley, S., Kammerer, J., et al. (2023) *ApJL*, 951, L20. *The JWST Early Release Science Program for Direct Observations of Exoplanetary Systems I: High-contrast Imaging of the Exoplanet HIP 65426 b from 2 to 16 μm*

5. Follette, K. B., Close, L. M., Males, J. R., et al. (2023) *AJ*, 165, 225. *The Giant Accreting Protoplanet Survey (GAPlanetS)-Results from a 6 yr Campaign to Image Accreting Protoplanets*

4. Hinkley, S., Lacour, S., Marleau, G.-D., et al. (2023) *A&A*, 671, L5. *Direct discovery of the inner exoplanet in the HD 206893 system. Evidence for deuterium burning in a planetary-mass companion*

3. Miles, B. E., Biller, B. A., Patapis, P., et al. (2023) *ApJL*, 946, L6. *The JWST Early-release Science Program for Direct Observations of Exoplanetary Systems II: A 1 to 20 μm Spectrum of the Planetary-mass Companion VHS 1256-1257 b*

2. Adams Redai, J. I., Follette, K. B., Wang, J., et al. (2023) *AJ*, 165, 57. *The Giant Accreting Protoplanet Survey (GAPlanetS): Optimization Techniques for Robust Detections of Protoplanets*

1. Betti, S. K., Follette, K. B., Ward-Duong, K., et al. (2022) *ApJL*, 935, L18. *Near-infrared Accretion Signatures from the Circumbinary Planetary-mass Companion Delorme 1 (AB)b*

Grants & Awards

$50,000	**James Webb Space Telescope Program DD 4558 (Co-PI)**, NASA	*2024*
$170,704	**James Webb Space Telescope Program GO 3337 (Co-PI)**, NASA	*2024-2025*
$132,841	**Hubble Space Telescope Program GO 17122 (Co-PI)**, NASA	*2023-2024*
$6,000	**NASA WIYN PI Data Award 2023**, NExScI, on behalf of NASA NN-EXPLORE	*2023-2024*
$6,000	**NASA WIYN PI Data Award 2022**, NExScI, on behalf of NASA NN-EXPLORE	*2022-2023*
$18,000	**George E. Owen Fellowship**, Krieger School of Arts and Sciences, JHU	*2021-2024*
Award	**Amherst Memorial Fellowship (x3)**, Amherst College Board of Trustees	*2021-2023*
Award	**Chambliss Student Poster Award Honorable Mention**, AAS 237th meeting	*2021*
$4,500	**Charles Hamilton Houston Award**, Charles Hamilton Houston Internship Program	*2020*
$3,500	**Gregory S. Call Student Researcher Award**, Gregory S. Call Student Research Program	*2019*
$3,500	**Sarles Fellow Award**, The Sarles Science Fund	*2018*

Presentations

Conference talks

- **"The Bleeding Edges of Direct Imaging with JWST"**, NASA ExoPAG 31 — *Jan. 2025*
- **"Long baseline optical interferometry of exoplanets and brown dwarfs"**, Chesapeake Bay Area Exoplanet Meeting #11 — *May 2024*
- **"Direct Detection and Characterization of Ice-line Giants with Optical Interferometry"**, Pathways to Characterizing Non-Transiting Planets, SEEC Symposium 2024 — *April 2024*
- **"The Unexpected Detection of HR8799e with NIRCam Coronagraphy and Implications for Cycle 3"**, Planetary Systems and the Origins of Life in the Era of *JWST*, STScI Spring Symposium 2023 — *May 2023*
- **"Unprecedented precision: using VLTI/GRAVITY jointly with Gaia to characterize substellar companions near and far, young and old"**, Cool Stars 21 Splinter Session — *Aug. 2022*

Colloquia & Seminars

- **"Living on the Wedge: New insights from Bar Coronagraphy"**, NIRCam Team Meeting 2025 — *Mar. 2025*
- **MPIA/APEX ExoCoffee**, Heidelberg, Germany — *Jan. 2025*
- **STScI-JHU ExoJamboree**, Baltimore, MD — *Nov. 2024*
- **Carnegie EPL Astronomy Seminar**, Washington DC — *Oct. 2024*
- **OCA Protoplanets Group Meeting**, Nice, France — *Jun. 2024*
- **ESO Garching Star and Planet Formation Seminar**, Garching, Germany — *Nov. 2023*
- **ESO Garching Stellar Coffee and Planetary Tea**, Garching, Germany — *Nov. 2023*
- **ExoGRAVITY Collaboration Workshop**, Heidelberg, Germany — *Nov. 2023*
- `petitRADTRANS` **Collaboration Workshop**, Heidelberg, Germany — *Nov. 2023*
- **American Museum of Natural History Astronomy Colloquium**, New York City, NY — *Feb. 2023*
- **STScI HotSci 2022**, Baltimore, MD — *August 17th, 2022*

Poster presentations

- **"Constraining the Atmosphere and Interior of the Directly Imaged Planet AF Leporis b with VLTI/GRAVITY"**, Extreme Solar Systems V — *March 2024*
- **"The orbit and Hα variability of HD 142527B"**, Coolstars 21 — *July 2022*
- **"Charaterization of the L-type Brown Dwarf Companion to the Nearby Solar-type Star HD 72946 with VLTI/GRAVITY, VLT/SPHERE, and RVs"**, In The Spirit of Lyot — *June 2022*
- **"The orbit and Hα variability of HD 142527B"**, STScI Spring Symposium — *April 2021*

Princple Investigator Observing Programs

PI	GO 6915 | JWST, *"Direct Detection and Characterization of a Nearby Temperate Giant Planet,"* PI: W. Balmer, et al. **(47.3 hours)**	*Cycle 4*
PI	GO 6905 | JWST, *"The Bleeding Wedge: Constraining Metal Enrichment of Close-in Companions to Trace Formation,"* PI: W. Balmer, et al. **(22.5 hours)**	*Cycle 4*
Co-PI	MINERVA-A | NN-EXPLORE, *"Unlocking the periods and masses of two young long-period planets,"* Co-PIs: G. Wang, W. Balmer. **(23.0 hours)**	*2025A*
PI	VLTI/GRAVITY | ESO, *"The ExoGRAVITY+ Orbital Refinery,"* PI: W. Balmer, et al. **(7 hours)**	*P114*
Co-PI	DD 4558 | JWST, *"Establishing the Formation of AF Lep b with NIRCam: The Lowest-Mass Imaged Exoplanet with a Dynamical Mass,"* Co-PIs: K. Franson, W. Balmer, et al. **(6.4 hours)**	*Cycle 2*
PI	VLTI/GRAVITY | ESO, *"Investigating the 25 Myr L-T transition with VLTI/GRAVITY observations of the new planet AF Lep b,"* PI: W. Balmer, et al. **(9 hours)**	*P112*
Co-PI	GO 3337 | JWST, *"Solving a Solar Neighborhood Crime Scene by Imaging 14 Her c,"* Co-PIs: D. Bardalez Gagliuffi, W. Balmer, et al. **(7.6 hours)**	*Cycle 2*
PI	VLTI/GRAVITY | ESO, *"Monitoring 51 Eri b for a perturbing inner companion,"* PI: W. Balmer, et al. **(15 hours)**	*P111-114*
Co-PI	GO 17122 | HST, *"Testing Planetary Formation Mechanisms through the First FUV - Optical Spectrum of a Young, Accreting Planet,"* Co-PIs: C. Robinson, W. Balmer, et al. **(9 orbits)**	*Cycle 30*
PI	VLTI/GRAVITY | ESO, *"Characterizing the target of a novel JWST Cycle 1 GO observation with VLTI/GRAVITY,"* PI: W. Balmer, et al. **(3 hours)**	*P109*
PI	WIYN 3.5m | NN-EXPLORE, *"A precision mass measurement of the most inflated hot-Saturn HAT-P-67 b,"* PI: W. Balmer, et al. **(2.4 nights)**	*2022A*
PI	SOAR 4.1m | NOIRLAB, *"Characterization of exoGRAVITY Host Stars (GHOSTS): in the Southern Hemisphere,"* PI: W. Balmer, et al. **(2 nights)**	*2022A*
PI	ARC 3.5m | Apache Point Observatory, *"Characterization of exoGRAVITY Host Stars (GHOSTS): Northern Hemisphere,"* PI: W. Balmer **(24 hrs)**	*2021, Q4*

Outreach & Service

Service	— Exoplanet No-PhDs Journal Club Facilitator, *JHU P&A*	*2022 - present*
Outreach	— Observatory Open Houses and K-12 Tours (as Fellow 2022-23 & volunteer to present), *MDSGO*	*2022 - present*
Outreach	— Pen Pal, *Letters to a Pre-Scientist*	*2024-present*
Outreach	— Invited talk, *North County High School*	*June 2023*
Outreach	— Invited talk, *Howard Astronomical League*	*Jun. 2022*
Outreach	— Invited talk, *Balticon 56*	*May 2022*
Sci-Comm	— Author, *Astrobites*	*2019 - 2021*
Sci-Comm	— Astronomy Editor, *The Amherst STEM Network*	*2019 - 2021*
Volunteer	— Observatory Operator, *Amherst College Observatory*	*2021*
Outreach	— Invited talk, *UMass Amherst Astronomy Club*	*Apr. 2021*

Code

</> Code I manage:

- `backtracks`: Relative motion of background sources with proper motion and parallax
- `stellaluna`: My own pedagogical zero-age main sequence stellar structure code

Code I contribute to

- `species`: Toolkit for atmospheric characterization of directly imaged planets
- `spaceKLIP`: High contrast imaging routines for JWST data
- `petitRADTRANS`: Spectral modeling and atmospheric retrieval code