

Nicholas Ballering

Research Scientist, Space Science Institute
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Education

- 2016 Ph.D. Astronomy, University of Arizona
Advisor: George Rieke
Dissertation: *Measuring the Structure and Composition of Circumstellar Debris Disks*
- 2008 B.S. Astronomy, Physics, Mathematics, Applied Math Engineering & Physics (AMEP),
University of Wisconsin - Madison

Research Appointments

- 2024–Present Research Scientists, Space Science Institute
- 2024–Present Visiting Scholar, Department of Astronomy, University of Virginia
- 2019–2024 Origins Fellow, Virginia Initiative on Cosmic Origins, Department of Astronomy, University of Virginia
- 2016–2019 Postdoctoral Research Associate, Steward Observatory, University of Arizona
- 2010–2016 Graduate Research Assistant, Steward Observatory, University of Arizona
- 2009 Research Intern, Department of Astronomy, University of Wisconsin
- 2007–2008 Research Assistant, IceCube Neutrino Detector, University of Wisconsin

Teaching Experience

- 2019–2023 Substitute Teaching (led six lectures), Astronomy 1210: Introduction to the Sky and Solar System,
Astronomy 3150: The Interstellar Medium From Hydrogen to Humans, University of Virginia
- 2014 Teaching Assistant, Astronomy 202: Life in the Universe, University of Arizona
- 2013 Teaching Assistant, Astronomy 202: Life in the Universe, University of Arizona
- 2009 Tutor, Sylvan Learning Center, Madison, WI
- 2009 Tutor, AVID/TOPs Program, East High School, Madison, WI
- 2006–2008 Physics Tutor, Academic Advancement Program, University of Wisconsin
- 2006 Physics Tutor (volunteer), Greater University Tutoring Service, University of Wisconsin

Mentoring/Advising

- 2022–2023 Shane Sawyer, University of Virginia Astronomy Major
Topic: fitting infrared ice spectra (co-advised with Dr. Ilse Cleeves)
- 2021 James Good, University of Virginia Astronomy Major
Topic: modeling a minimum mass extrasolar nebula
- 2020–2021 Colette Levens, Mary Baldwin University Applied Mathematics Major
Topic: modeling the G29-38 white dwarf dust disk
Next position: PhD student in Atmospheric, Oceanic, and Planetary Physics at the University of Oxford
- 2020 Ashini Modi, Junior at Caddo Parish Magnet High School, Shreveport, LA
Topic: analyzing disk chemical evolution models (co-advised with Dr. Ilse Cleeves)
- 2017–2019 Tyler Baines, University of Arizona Astronomy Major
Topic: modeling protoplanetary disk SEDs
Next position: Science Researcher at NASA GSFC

Honors and Awards

- ❖ ALMA Ambassador, NRAO, 2018
- ❖ Phi Beta Kappa Society, 2008
- ❖ Leadership Prize, AMEP Program, University of Wisconsin, 2008
- ❖ Albert Radtke Scholarship, Physics Department, University of Wisconsin, 2007
- ❖ Bernal-Johnson Scholarship, College of Letters and Science, University of Wisconsin, 2006

Professional Service

2022–Present	Science Team, Far-IR Spectroscopy Space Telescope (FIRSST) Probe Concept
2019–2022	Co-organizer for University of Virginia Astronomy Astro-ph Journal Club
2018– Present	Referee, AAS Journals, Monthly Notices of the Royal Astronomical Society, Astronomy & Astrophysics
2019	ALMA Ambassador Selection Committee, NRAO
2019	Co-author of four Astro2020 Science White Papers
2018	Workshop Organizer, University of Arizona ALMA Community Day
2017	External Reviewer, NASA ROSES Program
2013–2014	Author, Astrobites (www.astrobites.org)
2014	LOC, Search for Life Beyond the Solar System: Exoplanets, Biosignatures & Instruments, Tucson AZ
2014	Treasurer, Steward Observatory Graduate Student Council
2012–2013	Vice-President, Steward Observatory Graduate Student Council
2013	Graduate Student Rep, Astronomy Department Faculty Hiring Committee, University of Arizona
2012	Organizer, Steward Observatory Summer Computing Seminar

Selected Observing Proposals (as PI)

2024	JWST Cycle 3, 20.1 hours, <i>A Panchromatic View of Protoplanetary Disk Dispersal</i>
2024	ALMA Cycle 11, 4.9 hours (12 m), <i>Proplyd Kinematics with CI</i>
2024	Large Binocular Telescope, 4 hours, <i>Vertical Structure and Grain Properties of the Largest Edge-On Protoplanetary Disk</i>
2022/2023	Large Binocular Telescope, 5 hours, <i>Characterizing Water Ice in the AB Aur Planet-Forming Disk</i>
2022/2023	Large Binocular Telescope, 5 hours, <i>ALES Observations of Two Directly Imaged Substellar Companions Discovered by Gaia</i>
2019/2020	SOFIA Cycles 8, 9, 6.0 hours (survey program), <i>Lurking Giants: Verifying and Characterizing Nearby Bright Debris Disks</i>
2018–2020	SOFIA Cycles 7, 8, 9, 13.9 hours, <i>Probing Protoplanetary Disk Dispersal with the 63 micron Oxygen Line</i>
2018	ALMA Cycle 6, 10.8 hours (12m), <i>Protoplanetary Disk Masses and Grain Properties in the Orion Nebula Cluster</i>
2018	Large Binocular Telescope, 0.5 nights, <i>Mapping the Distribution of PAHs in Transition Disks with the LBT/ALES Integral Field Spectrograph</i>

Selected Observing Proposals (as Co-I)

2024	Chandra Cycle 26, 150 ks, PI: Ryan Boyden, <i>The NGC 1977 inner disk chemistry survey, II. X-ray photometry for 15 JWST MIRI-MRS targets</i>
2024	JWST Cycle 3, 16.4 hours, PI: Ryan Boyden, <i>The most typical planet formation in the most typical environments</i>
2024	ALMA Cycle 11, 13.9 hours (12 m), PI: Ryan Boyden, <i>The Band 1 Orion Nebula Cluster Disk Survey</i>
2024	ALMA Cycle 11, 17.5 hours (12 m), PI: Josh Eisner, <i>Protoplanetary Disk Masses, Sizes, and Dust Grain Properties in the NGC 2024 Cluster</i>
2024	ALMA Cycle 11, 5.8 hours (12 m), PI: Karina Mauco, <i>Resolving the disk of the most prominent Proplyd in the Orion Nebula Cluster with ALMA</i>
2024	ALMA Cycle 11, 3.3 hours (12 m) + 1.5 hours (7m), PI: Thomas Maher, <i>A Deep CI Search for a Photoevaporative Wind in the IM Lup Disk</i>
2024	ESO P114, VLT/MUSE, 16 hours, PI: Carlo Manara, <i>Spectrally resolving the [CI]8727, 9824, and 9850 AA lines with UVES to decipher external photoevaporation</i>
2024	VLA 2024B, 70 hours, PI: Ryan Boyden, <i>The VLA Orion Nebula Cluster Disk Survey</i>
2023	Large Binocular Telescope, 5 hours, PI: Yifan Zhou, <i>ALES Spectroscopic Characterization of Directly Imaged Exoplanet AF Lep b</i>
2023	JWST Cycle 2, 19.7 hours, PI: Kate Su, <i>Characterizing the End Stage of Exoplanetary Systems</i>
2021	VLA 2022A, 5.5 hours, PI: Ryan Boyden, <i>Constraining free-free emission and photoevaporation rates in NGC 2024 disks</i>
2021	ALMA Cycle 8, 14.9 hours (12m), PI: Feng Long, <i>Tracing planet-forming pebbles across the water snow line with the synergy of ALMA and JWST</i>

- 2021 HST Cycle 29, 32 orbits, PI: Schuyler Wolff, *A deep and complete characterization of the Vega debris disk in scattered light*
- 2021 JWST Cycle 1, 16.2 hours, PI: Ilsedore Cleeves, *Illuminating Ice: A 3D View of Water Ice During Planet Formation*
- 2021 JWST Cycle 1, 19.1 hours, PI: Andrea Banzatti, *The infrared water spectrum as a tracer of pebble delivery*
- 2020 SOFIA Cycle 9, 6.2 hours, PI: Ilsedore Cleeves, *Solving the Mystery of Missing Cold Water in Protoplanetary Disks*
- 2019 ALMA Cycle 7, 20.9 hours (12m) + 41.3 hours (ACA), PI: Patrick Sheehan, *A Complete Survey of Protostellar Disk Gas and Dust Structure in Taurus*
- 2019 HST Cycle 27, 8 orbits, PI: Andras Gaspar, *Imaging planetary perturbations in the epsilon Eridani debris disk*
- 2019 HST Cycle 27, 8 orbits, PI: Andras Gaspar, *Resolving the Asteroid-belt of the Fomalhaut planetary system*

Funding

- ❖ NASA JWST Cycle 3, PI: Ballering, 2/1/2025-1/31/2027, \$319,365 total, *A Panchromatic View of Protoplanetary Disk Dispersal*
- ❖ NASA JWST Cycle 2, PI: Kate Su, 12/1/2023-11/30/2026, \$27,232 for co-I Ballering, *Characterizing the End Stage of Exoplanetary Systems*
- ❖ NSF AAG, co-PI: Ballering (PI: Ilsedore Cleeves), 9/1/2022-8/31/2025, \$406,504 total, *Uncovering the Hidden Ice Reservoir During Planet Formation*
- ❖ NASA XRP, PI: Kate Su, 1/1/2022-12/31/2023, \$261,786 total, \$42,703 for Co-I Ballering, *Characterizing Rejuvenated Exoplanetary Systems - A Comprehensive View of Dusty White Dwarfs Using Archival Spitzer Data*
- ❖ SOFIA, PI: Ballering, 7/1/2021-6/30/2023, \$139,400, *Probing Protoplanetary Disk Dispersal with the 63 micron Oxygen Line*
- ❖ SOFIA, PI: Ballering, 6/29/2020-6/28/2023, \$28,700, *Lurking Giants: Verifying and Characterizing Nearby Bright Debris Disks*

Public Outreach

- 03/2023 McCormick Observatory Public Night, public lecture
- 01/2020 Charlottesville Day School 3rd Grade Class, presentation and hands-on activity
- 03/2018 Huachuca Astronomy Club, public lecture
- 02/2018 Splendido Community Center, public lecture
- 01/2012 University of Wisconsin Space Place, public lecture
- 2006–2008 University of Wisconsin Space Place, star party volunteer

Presentations

- 07/2024 New Heights in Planet Formation, ESO Garching, Germany, contributed talk
- 06/2024 Exoplanets 5, Leiden, Netherlands, contributed talk
- 12/2023 UVa and NRAO Joint Colloquium, invited talk
- 12/2023 Virginia Initiative on Cosmic Origins Workshop, contributed talk
- 05/2023 Planetary Systems and the Origins of Life in the Era of JWST, STScI, poster
- 04/2023 RIKEN Star and Planet Formation Laboratory, Tokyo, Japan, seminar talk
- 04/2023 Protostars and Planets VII, Kyoto, Japan, poster
- 04/2023 STScI Exoplanets, Star & Planet Formation Seminar, invited talk
- 12/2022 Virginia Initiative on Cosmic Origins Workshop, contributed talk
- 07/2022 Science with the Hubble and James Webb Space Telescopes VI, Stockholm, Sweden, contributed talk
- 03/2022 University of Washington in St. Louis Physics Colloquium, invited talk (virtual)
- 12/2021 UVa and NRAO Joint Colloquium, invited talk (virtual)
- 12/2021 SOFIA Colloquium, invited talk (virtual)
- 10/2021 Virginia Tech Colloquium, invited talk (virtual)
- 10/2021 Star Formation: From Clouds to Discs, A Tribute to the Career of Lee Hartmann, Dublin, poster (virtual)
- 09/2021 European Conference on Laboratory Astrophysics, Anacapri, Italy, contributed talk (virtual)
- 08/2021 NASA JPL, invited talk (virtual)
- 06/2021 Astrochemistry in the JWST Era, University of Leeds, UK, contributed talk (virtual)
- 06/2021 AAS #238, contributed talk (virtual)

05/2021 NRAO Postdoctoral Symposium, contributed talk (virtual)
 04/2021 Origins Seminar, Steward Observatory, invited talk (virtual)
 01/2021 AAS #237, contributed talk (virtual)
 12/2020 Five Years After HL Tau, contributed talk (prerecorded)
 11/2020 Threats from the Surroundings, contributed talk (virtual)
 12/2019 Virginia Initiative on Cosmic Origins Workshop, contributed talk
 10/2018 NASA JPL, invited talk
 05/2018 University of Wisconsin Astronomy Department, lunch talk
 04/2018 Origins Seminar, Steward Observatory
 03/2018 Star and Planet Formation in the Southwest 2, Tucson, AZ, poster
 11/2017 Habitable Worlds 2017, Laramie, WY, breakout session talk
 11/2017 Habitable Worlds 2017, Laramie, WY, poster
 03/2016 Steward Observatory Internal Symposium, contributed talk
 01/2016 AAS #227, dissertation talk
 05/2015 NOAO, FLASH talk
 03/2015 Star and Planet Formation in the Southwest, Tucson, AZ, poster
 08/2014 Lunar and Planetary Laboratory Conference, contributed talk
 04/2014 Habitable Worlds Across Time and Space, STScI, Baltimore, MD, poster presentation
 03/2014 The Search for Life Beyond the Solar System: Exoplanets, Biosignatures & Instruments, Tucson, AZ, poster
 06/2013 IAU Symposium 299: Exploring the Formation and Evolution of Planetary Systems, Victoria, Canada, poster
 07/2012 University of Wisconsin Astronomy Department, lunch talk
 06/2012 Steward Observatory Summer Disk Seminar Series, contributed talk

Refereed First-Authored Publications

1. *Isolating Dust and Free-Free Emission in ONC Proplyds with ALMA Band 3 Observations*
Nicholas P. Ballering, L. Ilse-dore Cleeves, Thomas J. Haworth, John Bally, Josh A. Eisner, Adam Ginsburg, Ryan D. Boyden, Ming Fang, and Jinyoung Serena Kim
 2023, *The Astrophysical Journal*, 954, 127
2. *The Geometry of the G29-38 White Dwarf Dust Disk from Radiative Transfer Modeling*
Nicholas P. Ballering, Colette I. Levens, Kate Y. L. Su, and L. Ilse-dore Cleeves
 2022, *The Astrophysical Journal*, 939, 108
3. *Simulating Observations of Ices in Protoplanetary Disks*
Nicholas P. Ballering, L. Ilse-dore Cleeves, and Dana E. Anderson
 2021, *The Astrophysical Journal*, 920, 115
4. *Protoplanetary Disk Masses from Radiative Transfer Modeling: A Case Study in Taurus*
Nicholas P. Ballering and Josh A. Eisner
 2019, *The Astronomical Journal*, 157, 144
5. *What Sets the Radial Locations of Warm Debris Disks?*
Nicholas P. Ballering, George H. Rieke, Kate Y. L. Su, and Andras Gaspar
 2017, *The Astrophysical Journal*, 845, 120
6. *A Comprehensive Dust Model Applied to the Resolved Beta Pictoris Debris Disk from Optical to Radio Wavelengths*
Nicholas P. Ballering, Kate Y. L. Su, George H. Rieke, and Andras Gaspar
 2016, *The Astrophysical Journal*, 823, 108
7. *Probing the Terrestrial Regions of Planetary Systems: Warm Debris Disks with Emission Features*
Nicholas P. Ballering, George H. Rieke, and Andras Gaspar
 2014, *The Astrophysical Journal*, 793, 57
8. *A Trend between Cold Debris Disk Temperature and Stellar Type: Implications for the Formation and Evolution of Wide-orbit Planets*
Nicholas P. Ballering, George H. Rieke, Kate Y. L. Su, and Edward Montiel
 2013, *The Astrophysical Journal*, 775, 55

Refereed Co-Authored Publications

1. *High-contrast JWST-MIRI Spectroscopy of Planet-forming Disks for the JDISC Survey*
Klaus M. Pontoppidan, Colette Salyk, Andrea Banzatti, Ke Zhang, Iaria Pascucci, Karin I. Öberg, Feng Long, Carlos Muñoz-Romero, John Carr, Joan Najita, Geoffrey A. Blake, Nicole Arulanantham, Sean Andrews, **Nicholas P. Ballering**, Edwin Bergin, Jenny Calahan, Douglas Cobb, Maria Jose Colmenares, Annie Dickson-Vandervelde, Anna Dignan, Joel Green, Phoebe Heretz, Gregory Herczeg, Anusha Kalyaan, Sebastiaan Krijt, Tyler Pauly, Paola Pinilla, Leon Trapman, and Chengyan Xie
2024, *The Astrophysical Journal*, 963, 158
2. *Water-Rich Disks around Late M-stars Unveiled: Exploring the Remarkable Case of Sz114*
Chengyan Xie, Iaria Pascucci, Feng Long, Klaus M. Pontoppidan, Andrea Banzatti, Anusha Kalyaan, Colette Salyk, Yao Liu, Joan R. Najita, Paola Pinilla, Nicole Arulanantham, Gregory J. Herczeg, John Carr, Edwin A. Bergin, **Nicholas P. Ballering**, Sebastiaan Krijt, Geoffrey A. Blake, Ke Zhang, Karin I. Oberg, Joel D. Green, and the JDISCS collaboration
2023, *The Astrophysical Journal Letters*, 959, L25
3. *JWST reveals excess cool water near the snowline in compact disks, consistent with pebble drift*
Andrea Banzatti, Klaus M. Pontoppidan, John Carr, Evan Jellison, Iaria Pascucci, Joan Najita, Carlos E. Munoz-Romero, Karin I. Oberg, Anusha Kalyaan, Paola Pinilla, Sebastiaan Krijt, Feng Long, Michiel Lambrechts, Giovanni Rosotti, Gregory J. Herczeg, Colette Salyk, Ke Zhang, Edwin Bergin, **Nicholas P. Ballering**, Michael R. Meyer, Simon Bruderer, and the JDISCS collaboration
2023, *The Astrophysical Journal Letters*, 957, L22
4. *Hiding Dust around ϵ Eridani*
Schuyler Grace Wolff, Andras Gaspar, George H. Rieke, **Nicholas Ballering**, and Marie Ygouf
2023, *The Astronomical Journal*, 165, 115
5. *Small Protoplanetary Disks in the Orion Nebula Cluster and OMC1 with ALMA*
Justin Otter, Adam Ginsburg, **Nicholas P. Ballering**, John Bally, Josh A. Eisner, Ciriaco Goddi, Richard Plambeck, and Melvyn Wright
2021, *The Astrophysical Journal*, 923, 221
6. *Protoplanetary Disk Properties in the Orion Nebula Cluster: Initial Results from Deep, High-Resolution ALMA Observations*
J. A. Eisner, H. G. Arce, **N. P. Ballering**, J. Bally, S. M. Andrews, R. D. Boyden, J. Di Francesco, M. Fang, D. Johnstone, J. S. Kim, R. K. Mann, B. Matthews, I. Pascucci, L. Ricci, P. D. Sheehan, J. P. Williams
2018, *The Astrophysical Journal*, 860, 77
7. *The Inner 25 au Debris Distribution in the ϵ Eri System*
Kate Y. L. Su, James M. De Buizer, George H. Rieke, Alexander V. Krivov, Torsten Löhne, Massimo Marengo, Karl R. Stapelfeldt, **Nicholas P. Ballering**, and William D. Vacca
2017, *The Astronomical Journal*, 153, 226
8. *The Correlation Between Metallicity and Debris Disk Mass*
Andras Gaspar, George H. Rieke, and **Nicholas P. Ballering**
2016, *The Astrophysical Journal*, 826, 171
9. *Magnetic Grain Trapping and the Hot Excesses Around Early-type Stars*
George H. Rieke, Andras Gaspar, and **Nicholas P. Ballering**
2016, *The Astrophysical Journal*, 816, 50
10. *Compact HI Clouds from the GALFA-H I Survey*
Ayesha Begum, Snezana Stanimirovic, Joshua E. Peek, **Nicholas P. Ballering**, Carl Heiles, Kevin A. Douglas, Mary Putman, Steven J. Gibson, Jana Greivich, Eric J. Korpela, Min-Young Lee, Destry Saul, and John S. Gallagher III
2010, *The Astrophysical Journal*, 722, 395

Professional References

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