Matthew M. Murphy

Steward Observatory, University of Arizona – mmmurphy@arizona.edu
ORCID 0000-0002-8517-8857

EDUCATION

University of Arizona, Tucson, AZ, USA
Graduate Studies (Expected Masters & Ph.D. in Astronomy/Astrophysics, Spring 2025)

- Advisors: Dr. Thomas Beatty & Dr. Daniel Apai
- Specialized in observations of exoplanet atmospheres, transit and phase curve spectroscopy, space- and ground-based telescope data analysis.

State University of New York at Stony Brook, Stony Brook, NY, USA
Undergraduate Studies (B.S. w/ Honors Physics, B.S. w/ Honors Astronomy/Planetary Science)
Graduated May 2020

- Summa Cum Laude (GPA 3.91/4.0)
- Honors Thesis: "Weak Resonant Effects in Secular Massive Planet Systems", advisor Dr. Phil Armitage

FIRST AUTHOR PUBLICATIONS (Hyperlink to an ADS library of these)

1. **Panchromatic Characterization of the Evening and Morning Atmosphere of WASP-107b: Compositional and Cloud Variations and Insight into the Effect of Stellar Contamination**.
   Murphy, et al. *In preparation.*

2. **HST Transmission Spectra of the Hot-Neptune HD 219666 b: Detection of Water and the Challenge of Constraining Both Water and Methane with HST.**
   Murphy, Beatty, Welbanks, & Fu. *In review (submitted to the Astrophysical Journal)*

3. **An Analytic Characterization of the Limb Asymmetry - Transit Time Degeneracy.**
   Murphy, Beatty, & Apai. 2024, *ApJ* 974 179. arXiv:2407.17564

4. **Evidence for Morning-to-Evening Limb Asymmetry on the Cool Low-Density Exoplanet WASP-107b.**
   Murphy, Beatty, Schlawin, et al. 2024, *Nature Astronomy*. arXiv:2406.09863

5. **A Lack of Variability between Repeated Spitzer Phase Curves of WASP-43b.**
   Murphy, Beatty, Roman, et al. 2023, *AJ* 165 107. arXiv:2212.03240

6. **Instability from High-Order Resonant Chains in Wide-Separation Massive Planet Systems.**
   Murphy & Armitage. 2022, *MNRAS* 512 2. arXiv:2203.08870

SELECT CO-AUTHORED PUBLICATIONS (Full List Attached)

1. **Inhomogeneous Terminators on the Exoplanet WASP-39b.**
   Espinoza, et al. (incl. Murphy). 2024, *Nature* 632 8027.
   a. Performed independent lightcurve fitting of JWST TSO observations using a specialized technique to independently determine the key result.

2. **Possible Carbon Dioxide Above the Thick Aerosols of GJ 1214 b.**
   Schlawin, et al. (incl. Murphy). 2024, *ApJL* 974 L33.
   a. Performed joint analysis of panchromatic JWST data to refine GJ 1214 b's orbit, independent reduction and fitting of its transmission spectrum, and reanalysis of archival HST observations of GJ 1214 b

3. **A High Internal Heat Flux and Large Core in a Warm Neptune Exoplanet.**
   Welbanks, et al. (incl. Murphy). 2024, *Nature* 630 836-840.
   a. Conducted a joint analysis of panchromatic space- and ground-based transit and radial velocity data to significantly refine the target planet's orbital parameters.

4. **A Terminology and Quantitative Framework for Assessing the Habitability of Solar System and Extraterrestrial Worlds.**
   Apai, et al. (incl. Murphy). *In review (submitted to the Planetary Science Journal)*.
   a. Helped develop a python-based quantitative framework for calculating habitat suitability given models of physical environments (of planets, moons, etc.) and potential habiting organisms (e.g., methanogens), for use in defining and interpreting the "habitability" of exoplanets and icy moons.

SELECT CONFERENCE PRESENTATIONS

Other Worlds Laboratory. July 2024, Santa Cruz, CA, USA.
Talk: *Diagnosing Exoplanet Limb Asymmetries with JWST*

Exoplanets V. June 2024, Leiden, NL.
Talk: *Cloudy Mornings on WASP-107b: Panchromatic limb-asymmetry on WASP-107b*

Exoclimes VI. June 2023, Exeter, UK.
Talk: *New Dimensions: Looking for limb asymmetries on WASP-107b*

Emerging Researchers in Exoplanet Science. June 2023, New Haven, CT, USA.
Poster: *New Dimensions: Looking for limb asymmetries on WASP-107b*

Cloud Academy 3. March 2023, Les Houches, FR.
Poster: *Lessons learned from a search for limb asymmetry with JWST*

AAS 241. January 2023, Seattle, WA, USA.
Talk: *Where's the Weather on WASP-43b?*

NOIRLab FLASH Talk Series. October 2022, Tucson, AZ, USA.

Talk: *Where's the Weather on WASP-43b?*

Exoplanets IV. May 2022, Las Vegas, NV, USA.
Poster: *Where's the Weather on WASP-43b?*

Origins Seminar Series. November 2021, Tucson, AZ, USA.
Talk: *Where's the Weather on WASP-43b?*

INVITED RESEARCH PRESENTATIONS

Max Planck Institute for Astronomy. November 2024, online.
Talk: *Limb Asymmetry on WASP-107b*

University of Chicago. October 2024, Chicago, IL, USA.
Talk: *Exoplanets in 4 Dimensions*

University of Michigan. October 2024, Ann Arbor, MI, USA.
Talk: *Exoplanets in 4 Dimensions*

University of Leicester. July 2023, Leicester, UK.
Talk: *Exoplanets in 4 Dimensions*

Max Planck Institute for Astronomy. March 2023, online.
Talk: *Where's the Weather on WASP-43b?*

ACCEPTED PROPOSALS AS PRINCIPAL INVESTIGATOR

1. **Enabling a New Frontier in Transmission Spectroscopy by Refining the Transit Time Uncertainty of WASP-107 b**.
   NOIRLab Proposal 2023A-840705. Southern Astrophysical Research Telescope.

2. **Refining the Transit Times of Three Planets to Support Pushing New Frontiers with JWST.**
   University of Arizona Observatories 2023A. Kuiper 61" Telescope.

3. **What is a Temperature Sub-Neptune? A Case Study of TOI-1266b**.
   Large Binocular Telescope Observatory 2022A.

4. **Characterizing V1298 Tau: A System of Newborn Planets.**
   TESS Cycle 4 Guest Investigator Proposal

OUTREACH AND SERVICE WORK

Journal Reviewer. 2024 – Present.
- Monthly Notices of the Royal Astronomical Society.

Organizer, Space Drafts (Astronomy on Tap). 2020 – Present.
- Organize, promote, and host monthly public astronomy talks (~75 member audience)

Member, Mentorship Practices Task Force, Steward Observatory DEI Committee. 2020 – present.

- Developed a website to share mentorship resources with the department and university community

Volunteer, Research and Travel Grant Reviewer. 2020 – 2023.

- University of Arizona Graduate and Professional Student Council
- Reviewed graduate student research and travel grant proposals (~5 per semester)

Full List of Matthew M. Murphy's first-authored publications:

1. **Panchromatic Characterization of the Evening and Morning Atmosphere of WASP-107b: Compositional and Cloud Variations and Insight into the Effect of Stellar Contamination**
    - Murphy et al., 2025 *in preparation.*
2. **HST Transmission Spectra of the Hot-Neptune HD-219666 b: Detection of Water and the Challenge of Constraining Both Water and Methane with HST**
    - Murphy, Beatty, Welbanks, & Fu. 2024 *in review*
    - Submitted to the Astronomical Journal
3. **An Analytic Characterization of the Limb Asymmetry – Transit Time Degeneracy**
    - Murphy, Beatty, & Apai. 2024. *ApJ* 974 179
    - arXiv:2407.17564
4. **Evidence for Morning-to-Evening Limb Asymmetry on the Cool Low-Density Exoplanet WASP-107b**
    - Murphy, Beatty, Schlawin et al., 2024. *Nature Astronomy*
    - arXiv:2406.09863
5. **A Lack of Variability between Repeated Spitzer Phase Curves of WASP-43b**
    - Murphy, Beatty, Roman et al., 2023. *AJ* 165 107
    - arXiv:2212.03240
6. **Instability from High-Order Resonant Chains in Wide-Separation Massive Planet Systems**
    - Murphy & Armitage. 2022. *MNRAS* 512 2.
    - arXiv:2203.08870

Full List of published co-authored publications:

1. **Possible Carbon Dioxide Above the Thick Aerosols of GJ 1214 b**
    - Schlawin, Ohno, Bell, *Murphy* et al., 2024. *ApJL* 974 L33
2. **Multiple Clues for Dayside Aerosols and Temperature Gradients in WASP-69 b from a Panchromatic JWST Emission Spectrum**
    - Schlawin et al. *(incl. Murphy)*, 2024. *AJ* 168 3.
3. **Inhomogeneous terminators on the exoplanet WASP-39 b**
    - Espinoza et al. *(incl. Murphy)*, 2024. *Nature* 632 8027.
4. **Sulfur Dioxide and Other Molecular Species in the Atmosphere of the Sub-Neptune GJ 3470 b**

- Beatty et al. *(incl. Murphy)*, 2024. *ApJL* 970 L10.

5. **A high internal heat flux and large core in a warm Neptune exoplanet**
    - Welbanks et al. *(incl. Murphy)*, 2024. *Nature* 630 8018.
6. **A Possible Metal-Dominated Atmosphere Below the Thick Aerosols of GJ 1214 b Suggested by its JWST Panchromatic Transmission Spectrum**
    - Ohno, Schlawin, Bell, *Murphy* et al., 2024 *in review*
    - Submitted to AAS journals
7. **A Terminology and Quantitative Framework for Assessing the Habitability of Solar System and Extraterrestrial Worlds**
    - Apai, Barnes, Lichtenberg, *Murphy* et al., 2024 *in review*
    - Submitted to the Planetary Science Journal
8. **A Panchromatic Emission Spectrum of WASP-80b: A Warm Gas Giant Around a Low-Mass Star**
    - Wiser et al. *(incl. Murphy)*, 2024 *in review*
    - Submitted to Proceedings of the National Academy of Sciences
9. **A JWST Panchromatic Thermal Emission Spectrum of the Warm Neptune Archetype GJ 436b**
    - Mukherjee et al. *(incl. Murphy)*, 2024 *in review*
    - Submitted to Astrophysical Journal Letters