

# Benjamin V. Rackham

Department of Astronomy • University of Arizona  
933 North Cherry Avenue, Rm. N204 • Tucson, AZ 85721  
brackham@as.arizona.edu • (520) 621-1581

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## EDUCATION

- 2012 – present      *University of Arizona, Tucson, AZ*  
Ph.D. in Astronomy & Astrophysics  
Astrobiology Minor  
Advisor: Dr. Dániel Apai
- 2005 – 2009      *Westminster College, Salt Lake City, UT*  
B.S. in Neuroscience, Honors Degree  
Social Science Minor

## HONORS AND AWARDS

- 2014    *Graduate Research Fellowship*, National Science Foundation
- 2009    *The Trustees' Character Award*, Westminster College Board of Trustees  
(One of only three student awards given at graduation)
- 2008    *The Dr. Barry Quinn and Dr. Bob Warnock Endowed Science Scholarship*, Westminster College
- 2007    *The Barnett Honors Scholarship*, Westminster College

## REFEREED PUBLICATIONS

- Rackham, B. V.**, Apai, D., & Giampapa, M. S. 2018. The Light Source Effect: False Spectral Features and Incorrect Densities for M-dwarf Transiting Planets. *The Astrophysical Journal* 853, 122.
- Rackham, B. V.**, Espinoza, N., Apai, D., et al. 2017. ACCESS I: An Optical Transmission Spectrum of GJ 1214b Reveals a Heterogeneous Stellar Photosphere. *The Astrophysical Journal* 834, 151.
- Spake, J. J. et al. (including **Rackham, B. V.**) 2018. Helium detected in the eroding atmosphere of an exoplanet. *Nature* 557, 68.
- Pinhas, A., **Rackham, B. V.**, Madhusudhan, N., & Apai, D. 2018. Retrieval of planetary and stellar properties in transmission spectroscopy with AURA. *MNRAS* 480, 5314.
- Zhang, Z., Zhou, Y., **Rackham, B. V.**, & Apai, D. The Near-Infrared Transmission Spectra of the TRAPPIST-1 Planets b, c, d, e, f, and g and Stellar Contamination in Multi-Epoch Transit Spectra. *AJ*, in press.

*Publications submitted or under review:*

- Rackham, B. V.**, Apai, D., & Giampapa, M. S. The Transit Light Source Effect II: The Impact of Stellar Heterogeneity on Transmission Spectra of Planets Orbiting Broadly Sun-like Stars. *Submitted to AAS Journals*.

Espinoza, N., **Rackham, B. V.**, Jordán, A. et al. ACCESS: A Featureless Optical Transmission Spectrum for WASP-19b from Magellan/IMACS. *Under review at MNRAS*.

Bixel, A., **Rackham, B. V.**, Apai, D., et al. ACCESS: Ground-based Optical Transmission Spectroscopy of the Hot Jupiter WASP-4b. *Under review at AAS Journals*.

*Publications in preparation:*

**Rackham, B. V.**, Apai, D., López-Morales, M., et al. ACCESS: A Ground-based Optical Transmission Spectrum of the Ultra-hot Jupiter WASP-103b. *Submission expected in Nov. 2018*.

**Rackham, B. V.**, Apai, D., López-Morales, M., et al. ACCESS: A Ground-based Optical Transmission Spectrum of WASP-80b. *Submission expected in Dec. 2018*.

## WHITE PAPERS

Apai, D., **Rackham, B. V.**, Giampapa, M. S., et al. 2018. Understanding Stellar Contamination in Exoplanet Transmission Spectra as an Essential Step in Small Planet Characterization. White paper submitted to the NAS Committee on Exoplanet Science Strategy.  
<https://arxiv.org/abs/1803.08708>

Fortney, J., Kataria, T., Stevenson, K. et al. (including **Rackham, B. V.**) 2018. The Origins Space Telescope: Towards an Understanding of Temperate Planetary Atmospheres. White paper submitted to the NAS Committee on Exoplanet Science Strategy.  
<https://arxiv.org/abs/1803.07730>

## CONFERENCE TALKS

- |          |                                                                                                                                                                                                          |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aug 2018 | Rackham, B. V. et al. Constraining M-dwarf Photospheres through the Transit Light Source Effect. Cool Stars 20, Boston, MA.                                                                              |
| Jul 2018 | Rackham, B. V. et al. The Transit Light Source Effect. ExoPAG 18, Cambridge, MA.                                                                                                                         |
| Jul 2018 | Rackham, B. V. et al. The Fault in Our Stars: Towards Constraining Stellar Contamination in Exoplanet Transmission Spectra. Exoplanets II, Cambridge, UK.                                                |
| Nov 2017 | Rackham, B. V. et al. The Light Source Problem: The Effect of Heterogeneous Stellar Photospheres on Searches for Transiting Exoplanet Biosignatures. Habitable Worlds 2017, Abstract #4032. Laramie, WY. |
| Apr 2017 | Rackham, B. V. et al. The Effect of Heterogeneous Stellar Photospheres on Searches for Transiting Exoplanet Biosignatures. Astrobiology Science Conference 2017, Abstract #3610. Mesa, AZ.               |
| Dec 2016 | Rackham, B. V. et al. An Optical Transmission Spectrum of GJ 1214b Suggesting a Heterogeneous Stellar Photosphere. Magellan Science Symposium 2016. Washington, DC.                                      |

- Oct 2016 Rackham, B. V. et al. An Optical Transmission Spectrum of GJ 1214b Suggesting a Heterogeneous Stellar Photosphere. 48<sup>th</sup> Annual DPS Meeting, Abstract #302.03. Pasadena, CA.
- Jun 2015 Rackham, B. V. et al. How Can Ground-based Efforts Complement JWST Follow-up of Exciting TESS Planets? Astrobiology Science Conference 2015, Abstract #7491. Chicago, IL.
- Oct 2014 Rackham, B. V. et al. An Optical Transmission Spectrum (4000-10000 Å) of the Super-Earth GJ 1214b. 46<sup>th</sup> Annual DPS Meeting, Abstract #104.07. Tucson, AZ.

## **SEMINARS AND LECTURES**

- Aug 2018 Exoplanet transmission spectroscopy and the transit light source effect. Earth in Other Solar Systems All-Hands Meeting. Tucson, AZ.
- May 2018 Disentangling stellar and planetary signals in transmission spectra. Origins Lecture. Department of Astronomy, University of Arizona. Tucson, AZ.
- Nov 2017 The effect of stellar contamination on transmission spectra of low-mass exoplanets. Lunch Talk. ESO Vitacura. Santiago, Chile.
- Sep 2017 The transit light source problem: the effect of stellar contamination on transmission spectra of low-mass exoplanets. Earths in Other Solar Systems All-Hands Meeting. Tucson, AZ.
- Jul 2017 Effect of stellar contamination on transmission spectra of low-mass exoplanets. Special Exoplanet Seminar. Institute of Astronomy, University of Cambridge. Cambridge, UK.
- May 2017 ACCESSing exoplanet atmospheres & constraining stellar photospheres. Origins Lecture. Department of Astronomy, University of Arizona. Tucson, AZ.
- Mar 2017 An optical transmission spectrum of GJ 1214b reveals a heterogeneous stellar photosphere. Steward Internal Symposium. Department of Astronomy, University of Arizona. Tucson, AZ.
- Sep 2016 Arizona-CfA-Católica Exoplanet Spectroscopy Survey update. Earths in Other Solar Systems All-Hands Meeting. Tucson, AZ.
- Sep 2015 Transmission spectroscopy of transiting exoplanets. Earths in Other Solar Systems All-Hands Meeting. Tucson, AZ.
- Oct 2014 Exoplanet atmospheres. Steward Internal Symposium. Department of Astronomy, University of Arizona. Tucson, AZ.
- Jan 2014 How will we characterize habitable exoplanets? Origins Debate. Department of Astronomy, University of Arizona. Tucson, AZ.

## **POSTER PRESENTATIONS**

- May 2016 Rackham, B. V., Apai, D., López-Morales, M., et al. ACCESS: Exploring exoplanet atmospheres through ground-based transmission spectroscopy. NExSS Face-to-Face Meeting. Washington, DC.

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|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dec 2015 | Espinoza, N., Jordán, A., Apai, D., et al. (including Rackham, B. V.). Exploring the diversity of exoplanet atmospheres from the ground with the ACCESS Survey. Extreme Solar Systems III, Abstract #111.21. Waikoloa Village, HI.                           |
| Jan 2015 | Wells, R. López-Morales, M., Lewis, N., et al. (including Rackham, B. V.). Constraining the atmospheric composition of WASP-18b. AAS Meeting #225, Abstract #257.01. Seattle, WA.                                                                            |
| Jun 2014 | López-Morales, M., Apai, D., Jordán, A., et al. (including Rackham, B. V.). ACCESS: The Arizona-CfA-Católica Exoplanet Spectroscopy Survey. AAS Meeting #224, Abstract #120.14. Boston, MA.                                                                  |
| Mar 2014 | Rackham, B. V. Espinoza, N., Apai, D., et al. Exploring the hot Neptune / super-Earth transition via ground-based transmission spectroscopy. Search for Life Beyond the Solar System: Exoplanets, Biosignatures, & Instruments, Abstract #P3.55. Tucson, AZ. |
| Mar 2014 | Espinoza, N., Jordán, A., Rackham, B. V., et al. A ground-based optical transmission spectrum of WASP-31b. Search for Life Beyond the Solar System: Exoplanets, Biosignatures, & Instruments, Abstract #P3.53. Tucson, AZ.                                   |

## ACCEPTED PI TELESCOPE PROPOSALS

|             |                                                                                                                                                               |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2018B       | "ACCESS: Probing exoplanet atmospheres and enabling TESS follow-up." Magellan 6.5 m, 1.5 nights                                                               |
| 2018A       | "ACCESS: Probing exoplanet atmospheres from the ground and enabling TESS follow-up from the North and the South." Magellan 6.5 m, 1 night; MMT 6.5 m, 1 night |
| 2014 – 2016 | "ACCESS: Probing exoplanet atmospheres from the ground." Magellan 6.5 m, 2.5 nights                                                                           |
| 2013A       | "Exploring the haze in the nearby super-Earth GJ 1214b." VATT 1.8 m, 6 nights                                                                                 |

## SELECTED CO-I TELESCOPE PROPOSALS

|             |                                                                                                                                                                                        |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2013 – 2018 | "ACCESS: The Arizona-CfA-Católica Exoplanet Spectroscopy Survey." (10+ programs, Pls: M. López-Morales, D. Apai, A. Jordán, D. Osip, N. Espinoza, N. Lewis). Magellan 6.5 m, 58 nights |
| 2018A       | "An Independent Verification of TiO Absorption in WASP-19b." (PI: A. Jordán). VLT 8.2 m, 2 × 0.5 nights                                                                                |
| 2015B       | "Inspecting the atmosphere of a transiting hot Jupiter." (PI: F. Rodler). LBT 2 × 8.4 m, 2 nights                                                                                      |
| 2015B       | "Variability monitoring of ACCESS targets: towards a precise and accurate view of exoplanetary atmospheres." (PI: N. Espinoza). LCOGT 1 m, 50 hours                                    |

## OBSERVING EXPERIENCE

|             |                   |          |
|-------------|-------------------|----------|
| 2014 – 2018 | Kuiper 61"/Mont4k | 9 nights |
|-------------|-------------------|----------|

|             |                      |           |
|-------------|----------------------|-----------|
| 2013 – 2017 | Magellan/IMACS       | 14 nights |
| 2013 – 2017 | VATT/VATT4K          | 30 nights |
| 2017B       | NTT/SOFI             | 7 nights  |
| 2016A       | VATT/VATTSpec        | 5 nights  |
| 2013B       | Magellan/MMIRS       | 4 nights  |
| 2013A       | Magellan/MIKE        | 1 night   |
| 2012B       | MMT/Hectospec        | 1 night   |
| 2012B       | KPNO 2.1-m/IR Camera | 2 nights  |

## TEACHING EXPERIENCE

|             |                                                                                                                                                    |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Spring 2014 | Teaching Assistant for ASTR 170B1, The Physical Universe, University of Arizona. Gave three lectures and led 100+ students in four lab sessions.   |
| Fall 2013   | Teaching Assistant for ASTR 202, Life in the Universe, University of Arizona. Gave three lectures and developed an in-class lab for 100+ students. |

## MENTORING EXPERIENCE

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|-------------|---------------------------------------------------------------------------------|
| 2018        | Co-advisor (with Dániel Apai) of undergraduate summer student Jose Perez Chavez |
| 2015 – 2016 | Senior graduate student mentor to junior graduate student Peter Senchyna        |
| 2014 – 2015 | Senior graduate student mentor to junior graduate student Jianwei Lyu           |
| 2015        | Co-advisor (with Dániel Apai) of undergraduate summer student Xiao Han          |
| 2013        | Co-advisor (with Dániel Apai) of undergraduate summer student William Nolan     |
| 2013        | Alumni mentor of Westminster College Honors Undergraduate Hannah Zweifel        |

## OUTREACH ACTIVITIES

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|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Jun 2018  | Developed and led activity for 12 middle and high school students with visual impairments as part of Project POEM, which used sonified light curves to explore properties of transiting exoplanets. Mt. Lemmon, AZ. |
| 2016-2017 | Partnered with teacher Ramon Muñoz at Changemaker High School to develop and lead activities on exoplanets in math classes through NOAO Project ASTRO Program. Tucson, AZ.                                          |
| Jan 2015  | Astronomy Activity Leader at Family Science Night at Senita Valley Elementary School. Tucson, AZ.                                                                                                                   |
| Nov 2014  | Developed and instructed activity with Dániel Apai for the Osher Lifelong Learning Institute. Tucson, AZ.                                                                                                           |
| Sep 2013  | Invited public lecture for Sonora Astronomical Society. Green Valley, AZ.                                                                                                                                           |

Jun 2013      Invited public lecture for Tucson Amateur Astronomy Association. Tucson, AZ.  
Mar 2013      Career Day presenter at Southside Community School. Tucson, AZ.

## **PROFESSIONAL SERVICE**

2016            Prospective Student Visit Coordinator, University of Arizona Department of Astronomy  
2015 - 2016   Graduate Editor, University of Arizona NSF GRFP Application Support Program  
2013 - 2014   Local Organizing Committee, Search for Life Beyond the Solar System: Exoplanets,  
                         Biosignatures, & Instruments.