

# Benjamin V. Rackham

Postdoctoral Research Associate

Steward Observatory • University of Arizona

933 North Cherry Avenue, Rm. N204 • Tucson, AZ 85721

brackham@as.arizona.edu • +1 (520) 621-1581 • <http://rackham.space>

---

## EDUCATION

- 2012–2018      *University of Arizona, Tucson, AZ*  
Ph.D. in Astronomy & Astrophysics  
Astrobiology Minor  
*Magna Cum Laude*  
Advisor: Dr. Dániel Apai
- 2005–2009      *Westminster College, Salt Lake City, UT*  
B.S. in Neuroscience, Honors Degree  
Social Science Minor  
*Magna Cum Laude*

## EMPLOYMENT

- Sep. 2019–      **51 Pegasi b Fellow**, *Massachusetts Institute of Technology, Cambridge, MA*
- 2018–present   **Postdoctoral Research Associate**, *University of Arizona, Tucson, AZ*
- 2017–2018      **Graduate Research Assistant**, *University of Arizona, Tucson, AZ*
- 2014–2017      **NSF Graduate Research Fellow**, *University of Arizona, Tucson, AZ*
- 2014–2014      **Graduate Teaching Assistant**, *University of Arizona, Tucson, AZ*
- 2012–2013      **Graduate Research Assistant**, *University of Arizona, Tucson, AZ*
- 2010–2012      **Biological Technician**, *WestLand Resources, Inc., Tucson, AZ*
- 2009–2010      **Wildlife Technician**, *Utah Division of Wildlife Resources, Salt Lake City, UT*

## HONORS AND AWARDS

- 2019      **51 Pegasi b Fellowship in Planetary Astronomy**, *Heising-Simons Foundation*  
(Three-year, \$375,000 grant)
- 2019      **CSH Fellowship** (declined), *Center for Space and Habitability, University of Bern*
- 2014      **Graduate Research Fellowship**, *National Science Foundation*  
(Three-year, \$138,000 grant)
- 2009      **Trustees' Character Award**, *Westminster College Board of Trustees*  
(One of only three student awards given at graduation)
- 2008      **Dr. Barry Quinn and Dr. Bob Warnock Endowed Science Scholarship**, *Westminster College*
- 2007      **Barnett Honors Scholarship**, *Westminster College*

## REFEREED PUBLICATIONS

**9 total (148 citations), 3 first-author (75 citations), ADS: <https://goo.gl/T1Dzwf>**

### **First-author publications:**

1. **Rackham, B. V.**, Apai, D., & Giampapa, M. S. 2019. *The Transit Light Source Effect II: The Impact of Stellar Heterogeneity on Transmission Spectra of Planets Orbiting Broadly Sun-like Stars*. AJ 157, 96.
2. **Rackham, B. V.**, Apai, D., & Giampapa, M. S. 2018. *The Transit Light Source Effect: False Spectral Features and Incorrect Densities for M-dwarf Transiting Planets*. ApJ 853, 122.
3. **Rackham, B. V.**, Espinoza, N., Apai, D., et al. 2017. *ACCESS I: An Optical Transmission Spectrum of GJ 1214b Reveals a Heterogeneous Stellar Photosphere*. ApJ 834, 151.

### **Second-author publications:**

4. Bixel, A., **Rackham, B. V.**, Apai, D., et al. 2019. *ACCESS: Ground-based Optical Transmission Spectroscopy of the Hot Jupiter WASP-4b*. AJ 157, 68.
5. Espinoza, N., **Rackham, B. V.**, Jordán, A. et al. 2019. *ACCESS: A Featureless Optical Transmission Spectrum for WASP-19b from Magellan/IMACS*. MNRAS 482, 2065.
6. Pinhas, A., **Rackham, B. V.**, Madhusudhan, N., & Apai, D. 2018. *Retrieval of planetary and stellar properties in transmission spectroscopy with AURA*. MNRAS 480, 5314.

### **Co-authored publications:**

7. Schlawin, E. et al. (including **Rackham, B. V.**, author 6 of 8) 2018. *Back to “Normal” for the Disintegrating Planet Candidate KIC 12557548 b*. AJ 152, 281.
8. 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 156, 178.
9. Spake, J. J. et al. (including **Rackham, B. V.**, author 7 of 23) 2018. *Helium in the eroding atmosphere of an exoplanet*. Nature 557, 68.

### *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 Mar. 2018.*

**Rackham, B. V.**, Apai, D., López-Morales, M., et al. *ACCESS: A Ground-based Optical Transmission Spectrum of WASP-80b. Submission expected in May. 2019.*

## 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>

## INVITED TALKS

- Jan 2019 CSH Symposium. University of Bern Center for Space and Habitability. Bern, Switzerland.
- Jan 2019 Exocoffee Seminar. Max Planck Institute for Astronomy. Heidelberg, Germany.
- Nov 2018 Stars & Planets Seminar. Harvard-Smithsonian Center for Astrophysics. Cambridge, MA.
- Nov 2018 Special Exoplanets Seminar. Massachusetts Institute of Technology. Cambridge, MA.
- Nov 2018 Astrophysics Luncheon Talk. Jet Propulsion Laboratory. Pasadena, CA.
- Nov 2017 Lunch Talk. ESO Vitacura. Santiago, Chile
- Jul 2017 Special Exoplanet Seminar. Institute of Astronomy, University of Cambridge. Cambridge, UK.

## CONFERENCE TALKS

- Jan 2019 Rackham, B. V. et al. The Transit Light Source Effect in F to M Dwarf Systems. Dissertation Talk. 233<sup>rd</sup> Meeting of the AAS. Seattle, WA.
- 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.

## OTHER SEMINARS AND LECTURES

- Nov 2018 Disentangling stellar and planetary signals in exoplanet transmission spectra. Origins Lecture. Lunar and Planetary Laboratory, University of Arizona. Tucson, AZ.
- Oct 2018 Disentangling stellar and planetary signals in transmission spectra. Special Talk. Center for Space and Habitability, University of Bern. Bern, Switzerland.
- 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.
- 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.
- 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

- Sep 2018 Rackham, B. V., Apai, D., Giampapa, M., Espinoza, N., Pinhas, A., Madhusudhan, N., Zhang, Z., Zhou, Y., and the ACCESS Team. Disentangling Stellar and Planetary Features in Transmission Spectra. Cloud Academy, Les Houches, France.
- 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.
- 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

- 2014–2018 “ACCESS: Probing exoplanet atmospheres from the ground and enabling TESS follow-up.” Magellan 6.5 m, 5 nights; MMT 6.5 m, 2 nights
- 2013A “Exploring the haze in the nearby super-Earth GJ 1214b.” VATT 1.8 m, 6 nights

## SELECTED CO-I TELESCOPE PROPOSALS

- 2013–2019 “ACCESS: The Arizona-CfA-Católica Exoplanet Spectroscopy Survey.” (10+ programs, PIs: M. López-Morales, D. Apai, A. Jordán, D. Osip, N. Espinoza, N. Lewis). Magellan 6.5 m, 61 nights; MMT 6.5 m, 3 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

2014–2019	Kuiper 61”/Mont4k	14 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. Developed and delivered three lectures and led 100+ students in four lab sessions.

Fall 2013      Teaching Assistant for ASTR 202, Life in the Universe, University of Arizona. Developed and delivered three lectures and an in-class lab for 100+ students.

## **MENTORING EXPERIENCE**

2018      Postdoc mentor to senior graduate student Nicolas Garavito

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**

Feb 2019      Developed and co-led activity on transiting exoplanets for 24 high school students as part of NOAO's Teen Astronomy Café. Jupyter notebook, designed to introduce students to exoplanet science and coding with Python, available at: <https://github.com/EDENSurvey/TeenAstroCafeActivity>. Tucson, AZ.

Jun 2018      Developed and led activity as part of Project POEM for 12 middle and high school students with visual impairments, 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 the NOAO Project ASTRO Program. Tucson, AZ.

Jan 2015      Lead astronomy activity at Family Science Night at Senita Valley Elementary School. Tucson, AZ.

Nov 2014      Developed and instructed activity on exoplanets with Dániel Apai for the Osher Lifelong Learning Institute. Tucson, AZ.

Sep 2013      Invited public lecture for the Sonora Astronomical Society. Green Valley, AZ.

Jun 2013      Invited public lecture for the 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.

## PROFESSIONAL REFERENCES

### *Current Advisor*

Dr. Dániel Apai  
Associate Professor  
PI, EOS Team  
Departments of Astronomy  
and Planetary Sciences  
The University of Arizona  
933 N. Cherry Avenue  
Tucson, AZ 85721  
+1 (520) 621-6534  
[apai@arizona.edu](mailto:apai@arizona.edu)

### *Collaborator*

Dr. Mercedes López-Morales  
Astrophysicist  
Center for Astrophysics  
Harvard & Smithsonian  
60 Garden Street  
Cambridge, MA 02138  
+1 (617) 496-7818  
[mlopez-morales@cfa.harvard.edu](mailto:mlopez-morales@cfa.harvard.edu)

### *Collaborator*

Dr. David Osip  
Associate Director  
Las Campanas Observatory  
Carnegie Observatories  
Colina El Pino Casilla 601  
La Serena, Chile  
+56 51-2-207301  
[dosip@carnegiescience.edu](mailto:dosip@carnegiescience.edu)