Ryan J. MacDonald

Department of Astronomy
University of Michigan
1085 S. University Ave.
Ann Arbor, MI 48109, USA

Phone: +1 (607) 262-5035
E-mail: ryanjmac@umich.edu
Website: http://distantworlds.space

CAREER & EDUCATION

NASA Sagan Fellow 2022 –
Department of Astronomy, University of Michigan, USA

Research Associate 2019–2022
Department of Astronomy, Cornell University, USA

PhD. Astronomy 2015–2019
University of Cambridge, Institute of Astronomy, UK
Thesis: *Revealing the Nature of Exoplanetary Atmospheres*

MPhys. Physics 2011–2015
University of Oxford, Department of Physics, UK

SELECTED AWARDS & HONOURS

NASA Sagan Prize Fellowship	2022
Royal Astronomical Society Travel Award	2018
Paul Murdin Prize, University of Cambridge	2017
Kavli Summer Program in Astrophysics Fellowship, UC Santa Cruz	2016
STFC PhD Studentship, UK	2015–2019
Public Outreach Prize, University of Oxford	2014
Gibbs Prize, University of Oxford	2013, 2014
Scholarship, University College, University of Oxford	2012–2014

REFEREED PUBLICATIONS

37 papers: 8 first author, 5 second author, 5 third author, 800+ citations (ADS list)

First author:

1. **MacDonald, R.J.**, 2022, *POSEIDON: A Multidimensional Atmospheric Retrieval Code for Exoplanet Spectra*, JOSS (submitted)
2. **MacDonald, R.J.** & Lewis N.K., 2022, *TRIDENT: A Rapid 3D Radiative Transfer Model for Exoplanet Transmission Spectra*, ApJ, 929, 20
3. ⋆ Kaltenegger, L., ⋆ **MacDonald, R.J.**, Kozakis, T., et al., 2020, *The White Dwarf Opportunity: Robust Detections of Molecules in Earth-like Exoplanet Atmospheres with the James Webb Space Telescope*, ApJL 901, L1 (⋆ = joint first authors)
4. **MacDonald, R.J.**, Goyal, J.M, & Lewis N.K., 2020, *Why Is it So Cold in Here? Explaining the Cold Temperatures Retrieved from Transmission Spectra of Exoplanet Atmospheres*, ApJL, 893, L43
5. **MacDonald, R.J.** & Madhusudhan, N., 2019, *The Metal-Rich Atmosphere of the Exo-Neptune HAT-P-26b*, MNRAS, 486, 1292

6. **MacDonald, R.J.**, Marley, M.S., Fortney, J.J., & Lewis N.K., 2018, *Exploring H_2O Prominence in Reflection Spectra of Cool Giant Planets*, ApJ, 858, 69
7. **MacDonald, R.J.** & Madhusudhan, N., 2017, *Signatures of Nitrogen Chemistry in Hot Jupiter Atmospheres*, ApJL, 850, L15
8. **MacDonald, R.J.** & Madhusudhan, N., 2017, *HD 209458b in New Light: Evidence of Nitrogen Chemistry, Patchy Clouds and Sub-Solar Water*, MNRAS 469, 1979

Co-authored († = student supervised or mentored by **MacDonald, R.J.**):

9. † Gomez Barrientos, J., **MacDonald, R.J.**, Lewis N.K., & Kaltenegger, L., 2022, *In Search of the Edge: A Bayesian Exploration of the Detectability of the Red-Edge in Exoplanet Reflection Spectra*, ApJ (submitted)
10. Feinstein, A., et al. (including **MacDonald, R.J.**), 2022, *Early Release Science of the Exoplanet WASP-39b with JWST NIRISS*, Nature (submitted)
11. Alderson, L., et al. (including **MacDonald, R.J.**), 2022, *JWST Early Release Science: Exoplanet Transit Spectroscopy with NIRSpec G395H*, Nature (submitted)
12. Rustamkulov, Z., et al. (including **MacDonald, R.J.**), 2022, *A Panchromatic Spectrum of the Exoplanet WASP-39b with JWST NIRSpec PRISM*, Nature (submitted)
13. Ahrer, E., et al. (including **MacDonald, R.J.**), 2022, *JWST Early Release Science: Exoplanet Transit Spectroscopy with NIRCam*, Nature (accepted)
14. The JWST Transiting Exoplanet Community Early Release Science Team, et al. (including **MacDonald, R.J.**), 2022, *Identification of Carbon Dioxide in an Exoplanet Atmosphere*, Nature (in press)
15. Ridden-Harper, A., et al. (including **MacDonald, R.J.**), 2022, *High-Resolution Transmission Spectroscopy of the Terrestrial Exoplanet GJ 486b*, AJ (submitted)
16. Wong, I., et al. (including **MacDonald, R.J.**), 2022, *The Hubble PanCET Program: A Featureless Transmission Spectrum for WASP-29b and Evidence of Enhanced Atmospheric Metallicity on WASP-80b*, AJ, 164, 30
17. Alderson, L., Wakeford, H.R, **MacDonald, R.J.**, et al., 2022, *A Comprehensive Analysis of WASP-17b's Transmission Spectrum from Space-Based Observations*, MNRAS, 512, 4185
18. Barstow, J.K., et al. (including **MacDonald, R.J.**), 2022, *A Retrieval Challenge Exercise for the Ariel Mission*, Experimental Astronomy
19. Foote, T.O, et al. (including **MacDonald, R.J.**), 2022, *The Emission Spectrum of the Hot Jupiter WASP-79b from HST/WFC3*, AJ, 163, 7
20. Goyal, J.M., Lewis, N.K., Wakeford, H.R., **MacDonald, R.J.**, & Mayne, N.J., 2021, *Why is it So Hot in Here? Exploring Population Trends in Spitzer Thermal Emission Observations of Hot Jupiters using Planet-Specific Self-Consistent Atmospheric Models*, ApJ, 923, 242
21. Xu, S., ⋆ Diamond-Lowe, H., ⋆ **MacDonald, R.J.**, et al., 2021, *Gemini/GMOS Transmission Spectroscopy of the Grazing Planet Candidate WD 1856+534 b*, AJ, 162, 296 (⋆ = joint second authors)
22. † Mishra, I., et al. (including **MacDonald, R.J.**), 2021, *A Comprehensive Revisit of Select Galileo/NIMS Observations of Europa*, PSJ, 2, 183
23. Deibert, E.K, et al. (including **MacDonald, R.J.**), 2021, *Detection of Ionized Calcium in the Atmosphere of the Ultra-Hot Jupiter WASP-76b*, ApJL, 919, L15
24. Rathcke, A.D., **MacDonald, R.J.**, Barstow, J.K., et al., 2021, *HST PanCET Program: A Complete Near-UV to Infrared Transmission Spectrum for the Hot Jupiter WASP-79b*, AJ, 162, 138

25. Lin, Z., **MacDonald, R.J.**, Kaltenegger, L., & Wilson, D.J., 2021, *Differentiating Modern and Prebiotic Earth Scenarios for TRAPPIST-1e: High-resolution Transmission Spectra and Predictions for JWST*, MNRAS, 505, 3562
26. Sedaghati, E., **MacDonald, R.J.**, Casasayas-Barris, N., et al., 2021, *A Spectral Survey of WASP-19b with ESPRESSO*, MNRAS, 505, 435
27. Kirk, J., Rackham, B., **MacDonald, R.J.**, et al., 2021, *ACCESS and LRG-BEASTS: A Precise New Optical Transmission Spectrum of the Ultrahot Jupiter WASP-103b*, AJ, 162, 34
28. Weaver, I., et al. (including **MacDonald, R.J.**), 2021, *ACCESS: An Optical Transmission Spectrum of the High-gravity, Hot Jupiter HAT-P-23b*, AJ, 161, 278
29. † Mishra, I., et al. (including **MacDonald, R.J.**), 2021, *Bayesian analysis of Juno / JIRAM's NIR observations of Europa*, Icarus, 357, 114215
30. Alam, M.K., López-Morales, M., **MacDonald, R.J.**, et al., 2021, *Evidence of a Clear Atmosphere for WASP-62b: the Only Known Transiting Gas Giant in the JWST Continuous Viewing Zone*, ApJL, 906, L10
31. Tinetti, G., et al. (including **MacDonald, R.J.**), 2020, *Ariel: Enabling planetary science across light-years*, ESA Ariel Mission Definition Study Report
32. Lewis, N.K., Wakeford, H.R., **MacDonald, R.J.**, et al., 2020, *Into the UV: The Atmosphere of the Hot Jupiter HAT-P-41b Revealed*, ApJL, 902, L19
33. Molaverdikhani, K., Helling, Ch., Lew, B.W.P., **MacDonald, R.J.**, et al., 2020, *Understanding the atmospheric properties and chemical composition of the ultra-hot Jupiter HAT-P-7b: II. Mapping the effects of gas kinetics*, A&A, 635, A31
34. Helling, Ch., et al. (including **MacDonald, R.J.**), 2019, *Understanding the atmospheric properties and chemical composition of the ultra-hot Jupiter HAT-P-7b: I. Cloud and chemistry mapping*, A&A, 631, A79
35. Pinhas, A., Madhusudhan, N., Gandhi, S., & **MacDonald, R.J.**, 2018, *H_2O Abundances and Cloud Properties in Ten Hot Giant Exoplanets*, MNRAS, 482, 1485
36. Kilpatrick, B.M, et al. (including **MacDonald, R.J.**), 2018, *Community Targets of JWST's Early Release Science Program: Evaluation of WASP-63b*, AJ, 156, 103
37. Sedaghati, E., Boffin, H.M.J., **MacDonald, R.J.**, et al., 2017, *Detection of Titanium Oxide in the Atmosphere of a Hot Jupiter*, Nature, 549, 238

AWARDED GRANTS

1. NASA Hubble Fellowship Program (**PI: MacDonald, R.J.**) 2022 –
   A Multidimensional Approach to Exploring Disequilibrium Chemistry in Exoplanet Atmospheres
   Grant Award: **$145,080**
2. NASA ROSES XRP (PI: Faherty, J.) 2022–2025
   Read Between the Lines: Determining Atmosphere and Bulk Compositions for Planetary Mass Objects Using Spectral Retrievals
   Grant Award: **$209,999**
3. JWST Cycle 1, GO 2358 (**PI: MacDonald, R.J.**) 2022–2025
   Revealing the Atmospheric Composition of a White Dwarf Planet
   Grant Award: **$122,930**
4. JWST Cycle 1, GO 1981 (PI: Stevenson, K.) 2022–2025
   Measuring the Prevalence and Diversity of M-Dwarf Planet Atmospheres
   Grant Award: **$23,710**

SELECTED COLLOQUIA, SEMINARS, & CONFERENCE TALKS

JWST's First Six Months of Exoplanet Data, Bavaria, Germany (invited) 2022
Astronomy Colloquium, University of Rochester, USA (invited) 2022
Astronomy Colloquium, University of Michigan, USA 2022
Planetary Lunch Seminar, UC Santa Cruz, USA (invited) 2022
NASA Hubble Fellowship Symposium, Baltimore, USA 2022
ESO Atmo 2021 (invited lecturer) 2021
CloudNineCon (keynote speaker) 2021
Exocoffee, MPIA Heidelberg, Germany (invited) 2021
Exoplanet Modelling in the James Webb Era, RAS, UK 2021
Exoplanets Presentation, Harvard University, USA (invited) 2020
Exoplanet Journal Club Seminar, JPL, USA (invited) 2020
Planetary Science Group Talk, LPL, University of Arizona, USA (invited) 2020
JWST Exo-Webbinar (invited) 2020
BDEXOCON III, University of Delaware, USA 2019
Exoplanets II, University of Cambridge, UK 2018
UK Exoplanet Community Meeting, University of Oxford, UK 2018
Kavli Summer Program in Astrophysics, UC Santa Cruz, USA 2016

TEACHING & PROFESSIONAL DEVELOPMENT

JWST First Exoplanet Spectrum Workshop, Cornell University, USA 2022
Mentorship Training Program, ScienceBetter Consulting 2022
Guest Lecturer (5 courses), Cornell University, USA 2019–2022
Invited Lecturer, ESO Atmo 2021 Workshop 2021
Postdoctoral Leadership Program, Cornell University, USA 2020
Astronomy Tutor, Weizmann Summer Science School, Cambridge, UK 2018
Undergraduate Tutorials, University of Cambridge, UK 2015–2017
Physics & Mathematics Tutor, Cambridge, UK 2015–2018

STUDENT SUPERVISION & MENTORING

Supervisor, Ruizhe Wang, Undergraduate Student (Cornell) 2022 –
Supervisor, John Kappelmeier, Undergraduate Student (Cornell) 2022 –
Supervisor, Jonathan Gomez Barrientos, Undergraduate Student (Cornell) 2021–2022
Mentor, Ishan Mishra, Graduate Student (Cornell) 2019–2022
Supervisor, Arnav Agrawal, Undergraduate Student (Cornell) 2020–2021
Mentor, Christopher Bambic, Undergraduate Student (Cambridge) 2018–2019

SCIENCE TEAMS

Hubble HUSTLE Treasury Program Team (Member, PI: Wakeford H.) 2022 –
JWST Telescope Scientist GTO Team (Member, PI: Clampin M) 2021 –
JWST Transiting Exoplanet ERS Program (Member, PI: Batalha N.) 2020 –
JWST NIRISS GTO Team (Member, PI: Lafreniere D.) 2020 –
ACCESS Ground-based Exoplanet Survey (Collaborator) 2020 –
Roman Science Investigation Team (Member, PI: Macintosh B.) 2019–2021
Hubble PanCET Treasury Program Team (Member, PI: Sing D.) 2019–2022

ACCEPTED OBSERVING PROPOSALS

1. HST Cycle 30, 122 orbits, GO 17183 (PI: Wakeford, H.) 2022
   Hubble Ultraviolet-optical Survey of Transiting Legacy Exoplanets (HUSTLE) Treasury Program
2. JWST Cycle 1, 13 hrs, GO 2358 (**PI: MacDonald, R.J.**) 2021
   Revealing the Atmospheric Composition of a White Dwarf Planet
3. JWST Cycle 1, 76 hrs, GO 1981 (PI: Stevenson, K.) 2021
   Measuring the Prevalence and Diversity of M-Dwarf Planet Atmospheres
4. JWST Cycle 1, 3 hrs, GO 2507 (PI: Vanderburg, A.) 2021
   Thermal Emission from the First Planet Transiting a White Dwarf
5. HST Cycle 29, 23 orbits, GO 16695 (PI: Rustamkulov, Z.) 2021
   Mapping Atmospheric Dynamics at the Limbs of an Exceptional Hot Saturn
6. WIYN, 10 hrs, 2022A-115052 (PI: Ridden-Harper, A.) 2021
   First Atmospheric Characterization of the Ultra-hot Jupiter KELT-17b
7. Gemini, 224 hrs, N0394/Gemini 2020-LP-10 (PI: Turner, J.) 2020
   Exploring the Diversity of Exoplanet Atmospheres at High Spectral Resolution
8. VLT, 12 hrs, 0102.C-0311 (PI: Sedaghati E.) 2019
   Direct Detection of Molecular Chemistry in Exoplanet Atmospheres with ESPRESSO
9. VLT, 18 hrs, 0101.C-0437 (PI: Sedaghati E.) 2018
   Comparative Planetology of Heavy Metal Chemistry in Hot Jupiter Atmospheres

PRESS RELEASES

* *"An exoplanet atmosphere as never seen before"* (University of Michigan) 2022
* *"NASA's Webb Detects Carbon Dioxide in Exoplanet Atmosphere"* (NASA) 2022
* *"Can life survive a star's death? Webb telescope will explore"* (Cornell) 2020
* *"Researchers use 'hot Jupiter' data to mine exoplanet chemistry"* (Cornell) 2020
* *"Inferno World with Titanium Skies"* (ESO) 2017

SELECTED PUBLIC TALKS

City Club of Ithaca, NY, USA (online) 2022
JWST Cycle 1 Science Sampler, STScI, MD, USA (online) 2021
JWST Pre-Launch Event, Newark Museum of Art, NJ, USA (online) 2021
Warren Astronomical Society, MI, USA (online) 2020
High Energy Physics and Astrophysics Club, Morocco (online) 2020
Kopernik Observatory, NY, USA 2020
Cambridge University Astronomical Society, UK 2019
Seething Observatory, Norwich, UK 2018
Physics and Astronomy Society, University of Aberystwyth, UK 2018
Long Eaton Astronomical Society, Derbyshire, UK 2017
Papworth Astronomy Club, Cambridgeshire, UK 2017
Institute of Astronomy Open Evenings, Cambridge, UK 2016–2018
Edinburgh International Science Festival, UK 2016
Pint of Science, Cambridge, UK 2016
Big Bang Fair East Midlands, Derby, UK 2015
Oxford University Space and Astronomy Society, UK 2015
Department of Physics, University Oxford, UK 2014

ACADEMIC SERVICE & LEADERSHIP

JWST Early Release Science Program Theory Team, Subgroup Co-Lead	2022 –
Referee for AAS Journals, Astronomy & Astrophysics	2019 –
NASA ROSES Review Panelist	Various
NSF Grant Review Panelist	Various
NASA ExoPAG SAG 21, Subgroup Co-Lead	2020–2022
NASA Exoplanet Archive Atmospheres Environment Group	2021
Scientific Organizing Committee, ESO Atmo 2021	2021
ESA Ariel Mission Retrieval Challenge	2019
Local Organising Committee, Exoplanets II	2018
Graduate Student Forum, Institute of Astronomy, Cambridge, UK	2015–2018
Undergraduate Teaching Committee, Department of Physics, Oxford, UK	2013–2015

SCIENCE COMMUNICATION & PUBLIC OUTREACH

JWST Early Release Science Program Communications Team	2022 –
BBC Radio Guest Expert	2015 –
YouTube Channel with 60,000+ Subscribers and 6.2 Million+ Views	2014 –
School Outreach Guest Speaker	2013 –
YouTube - *"Discovery of SO_2 in an Exoplanet Atmosphere"* (10,000+ views)	2022
Carl Sagan Institute Video Outreach Team Leader	2020–2022
Solve It! Podcast - *"Where are the Aliens?"*	2021
Total Space Interview - *"JWST: Looking Forward to the Past"*	2021
ExoCup 2020 Winning Campaign - *WD 1856 b*	2020
Forbes - *"Can Life Outlive Its Host Star? NASA's Webb Telescope Will Find Out"*	2020
YouTube - *"When will Alien Life be Found on Exoplanets?"* (50,000+ views)	2020
The Cosmic Companion - *"Half Planet, Half Star?"*	2020
Centauri Dreams - *"Exoplanet Atmospheres: Recalibrating Our Models"*	2020
Fascinate Pod - *"Earth, Mars, then Beyond."*	2019
New Scientist Freelance Article - *"Weather Forecasts from Alien Worlds"*	2018
Public Observing Evenings, Institute of Astronomy, Cambridge	2015–2018
The Naked Scientists Podcast - *"Exoplanet Atmosphere Explored by Astronomers"*	2017
The Unseen Podcast - *"Exoplanet Atmospheres"*	2017
Stargazing Oxford Stallholder & Demonstrator	2012–2015
Zooniverse Citizen Science Projects, *Higgs Hunters Science Blog Writer*	2014

PROFESSIONAL AFFILIATIONS

Member, American Astronomical Society (AAS)	2021 –
Member, AAS Division for Planetary Sciences (DPS)	2021 –
Fellow of the Royal Astronomical Society	2016 –