@EXOLEMONS

POTENTIAL TARGETS FOR ARIEL

UCL CENTRE FOR SPACE EXOPLANET DATA

erc

ARIEL

BILLY EDWARDS, LORENZO MUGNAI, GIOVANNA TINETTI, ENZO PASCALE AND SUBHAJIT SARKAR

Does Ariel's current design allow us to achieve our science goals?

Ariel Exoplanet Catalogue

Master Catalogue

NASA Exoplanet Catalogue

Supplementary Catalogues

Exoplanet.eu

Open Exoplanet Catalogue

TEPCat

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NASA Exoplanet Catalogue

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Open Exoplanet Catalogue

TEPCat

TESS Exoplanet Yield

Barclay, Pepper & Quintana, 2018

Methodology

Catalogue of target stars

Planetary Occurrence Statistics

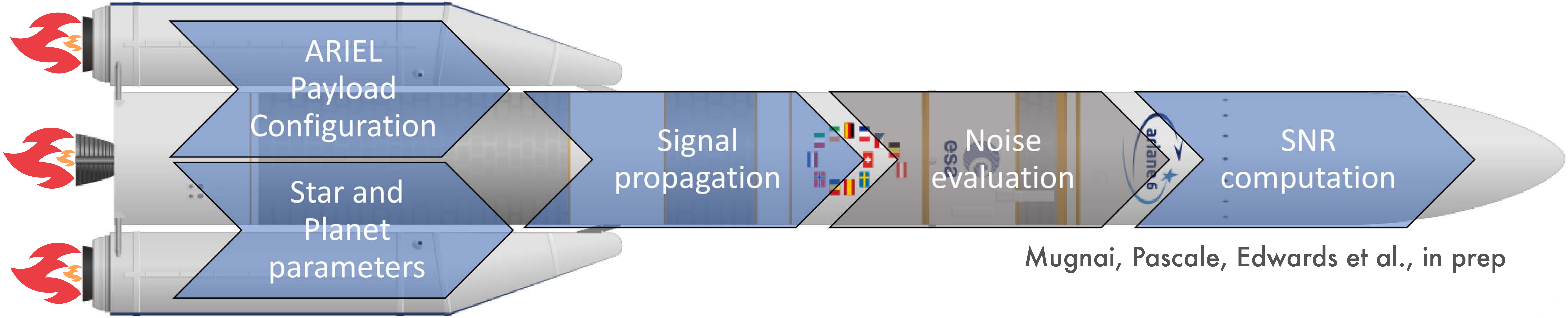
Likelihood of detection with TESS

Ariel Exoplanet Catalogue

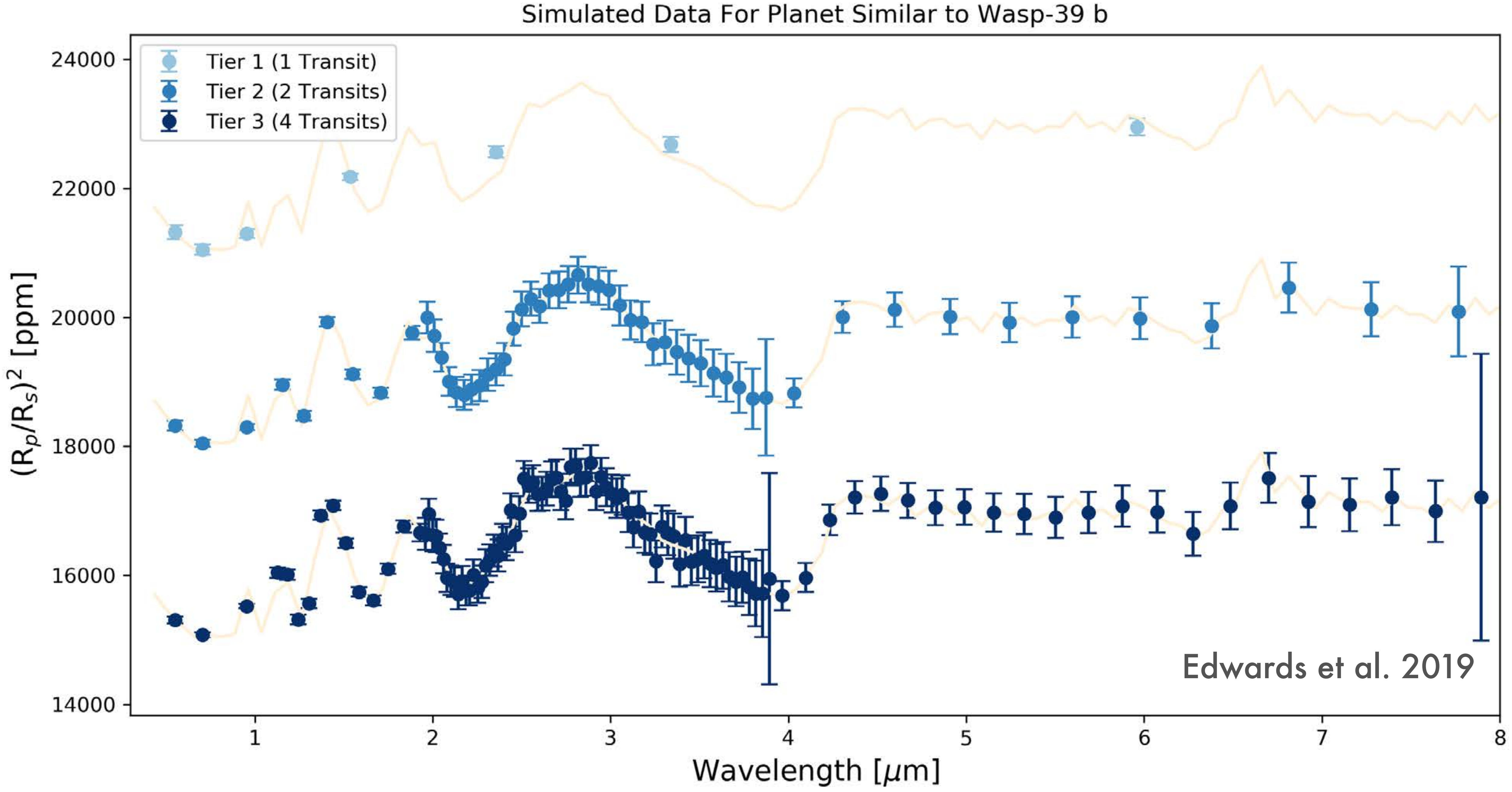
- Many more surveys will provide planets for Ariel to characterise

Kepler/K2
KELT
HAT-Net
CARMENES
PLATO
KPS
SPIRO
ESPRESSO
CHEOPS
WASP
HARPS
NGTS
MEarth
HAT-South
SPECULOOS

ArielRad



Mugnai, Pascale, Edwards et al., in prep



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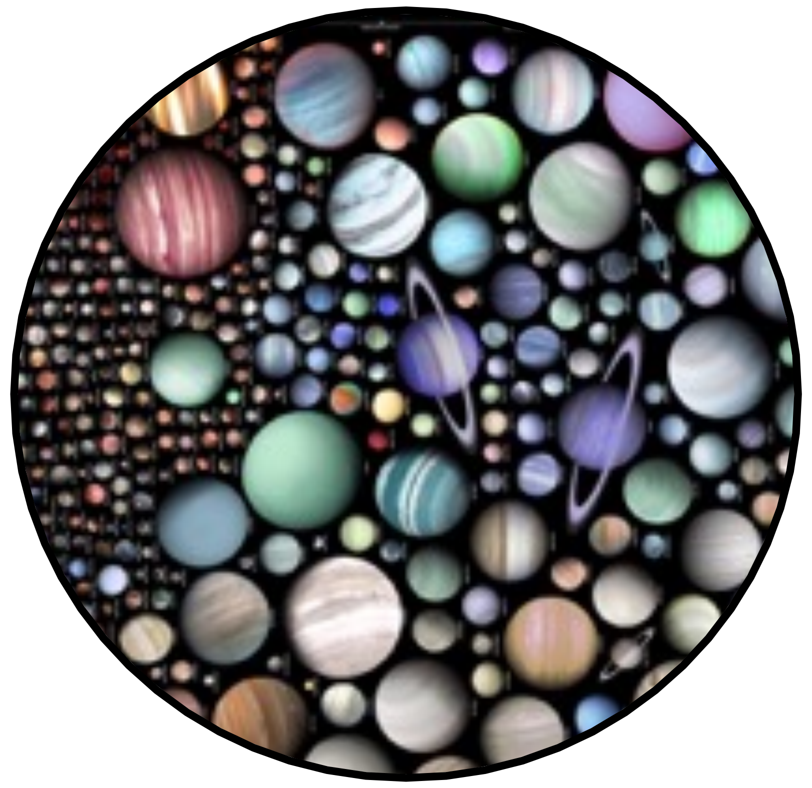
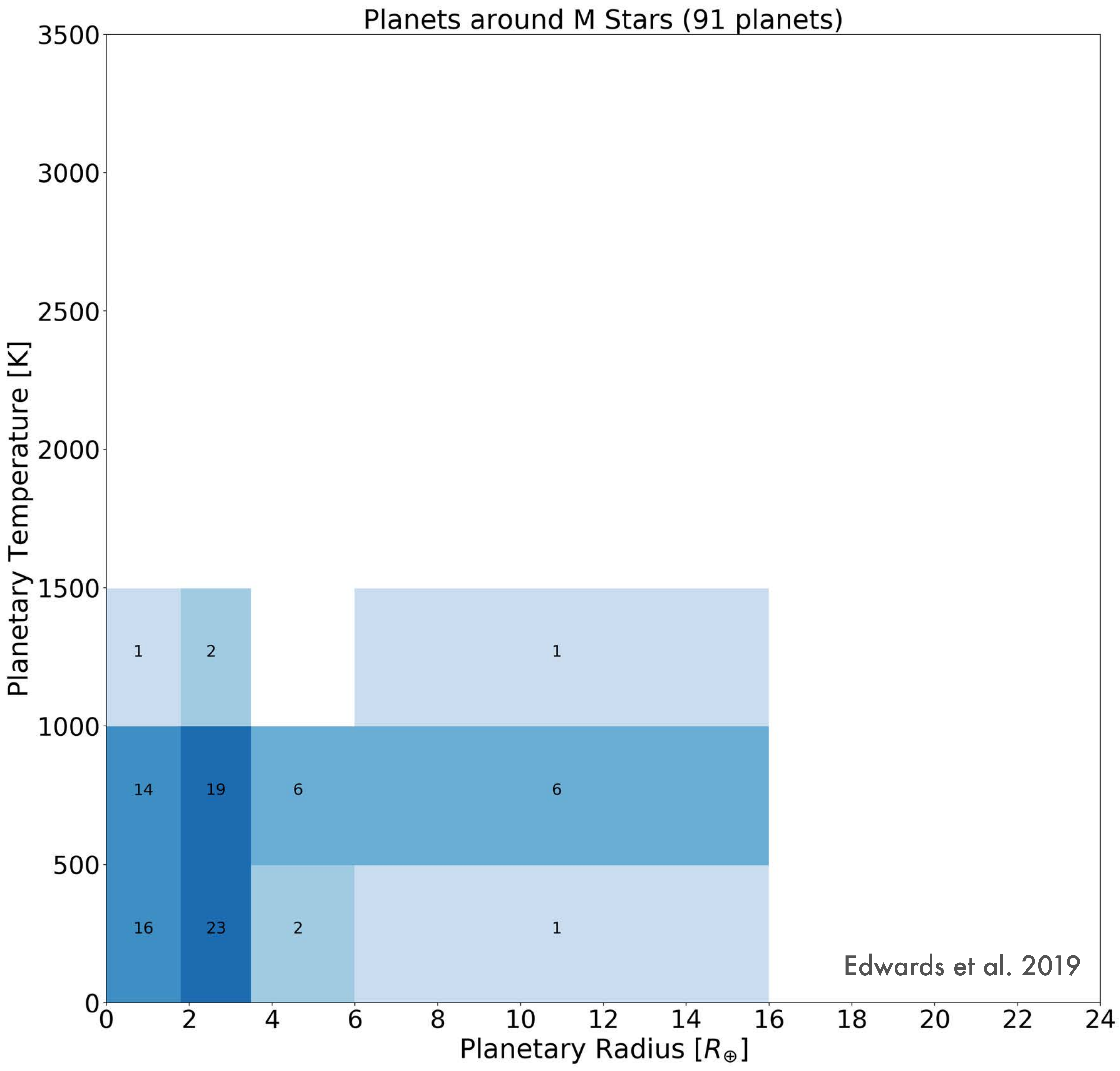
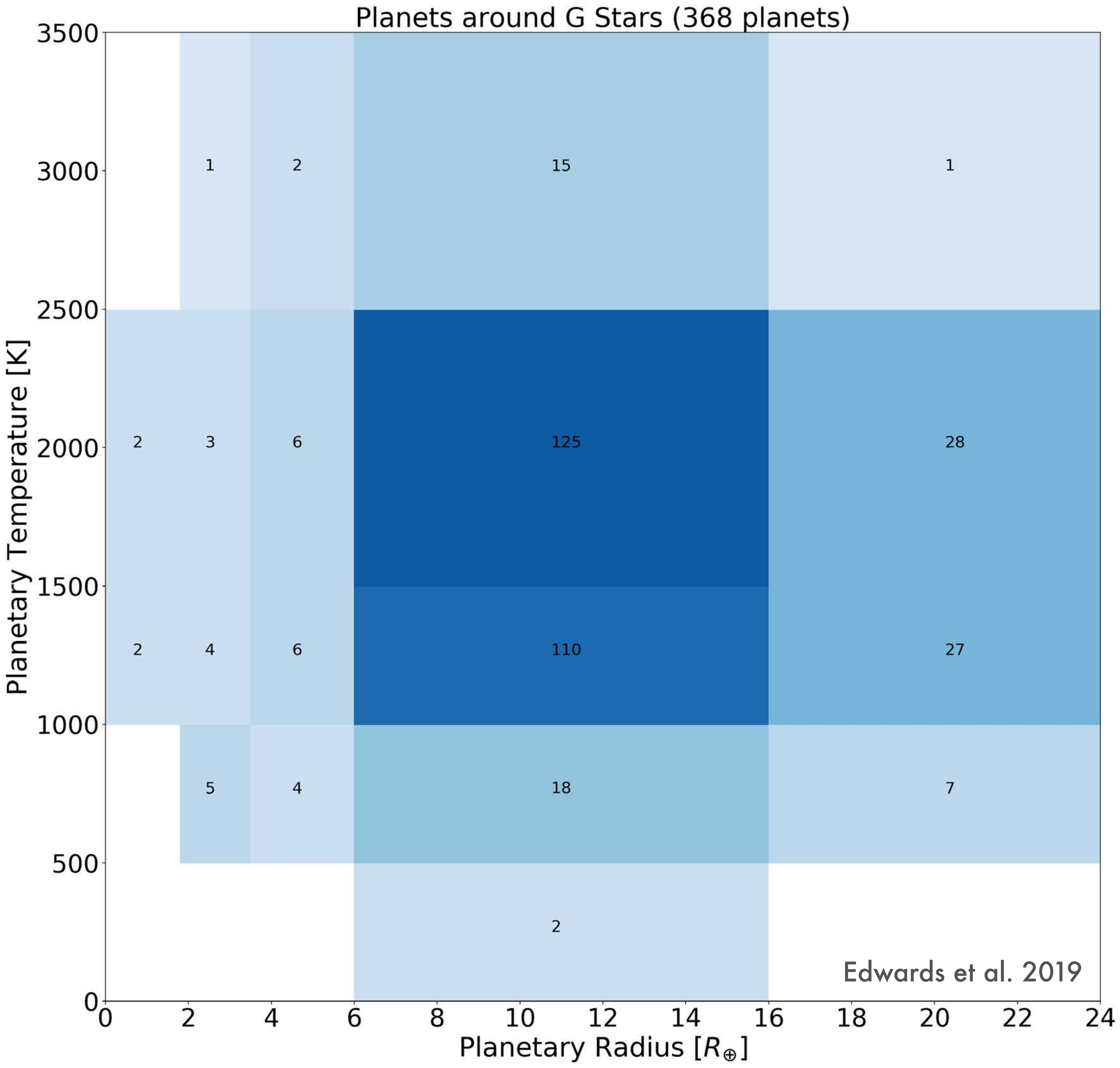
Mission Candiate Sample

- Tier 1:
  - ~2000 planets in ≤ 5 observations
- Tier 2:
  - ~1000 planets in ≤ 20 observations
- Tier 3:
  - ~150 planets in ≤ 2 observations



Example Mission Reference Sample





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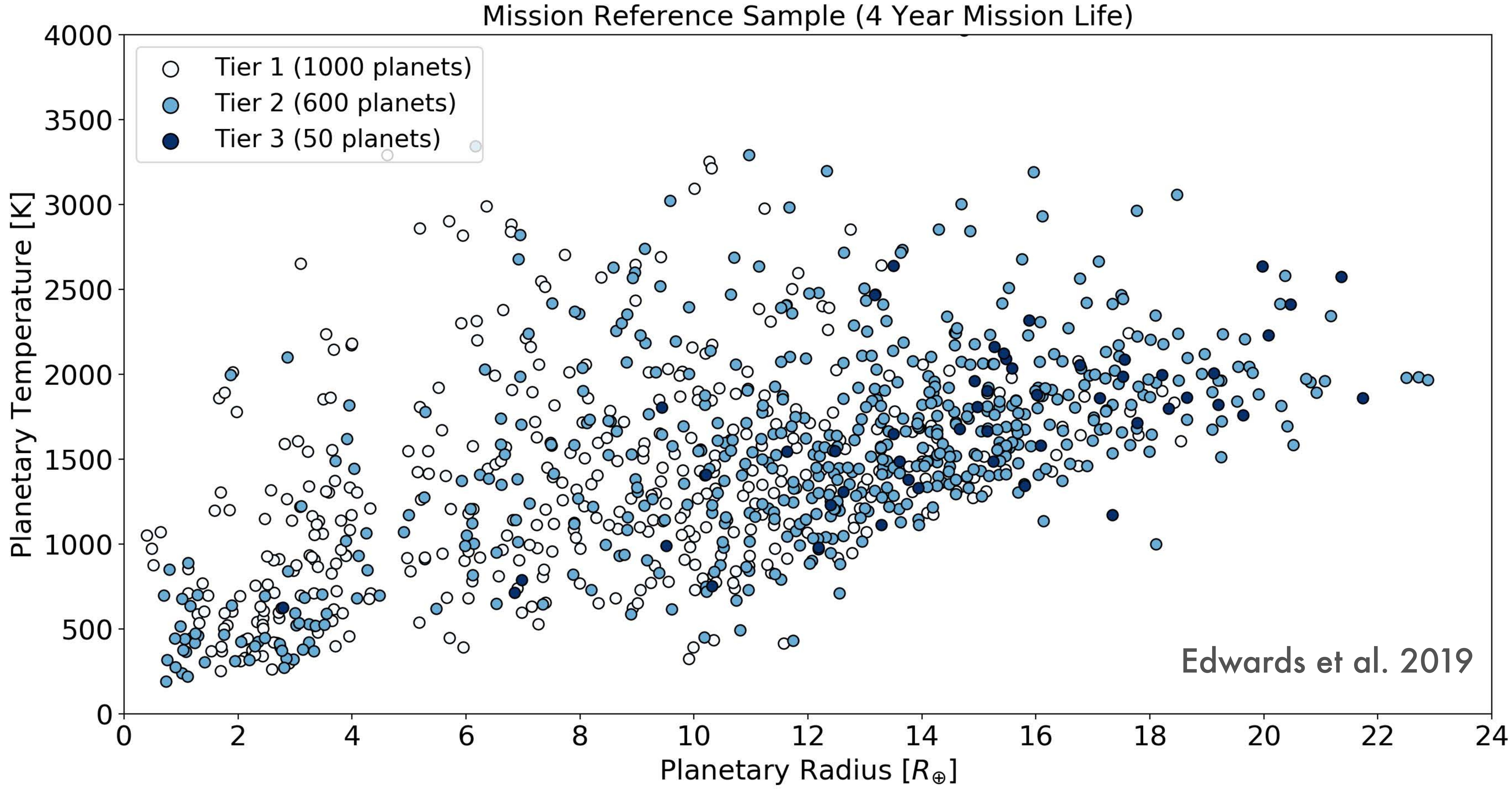
Example Mission Reference Sample

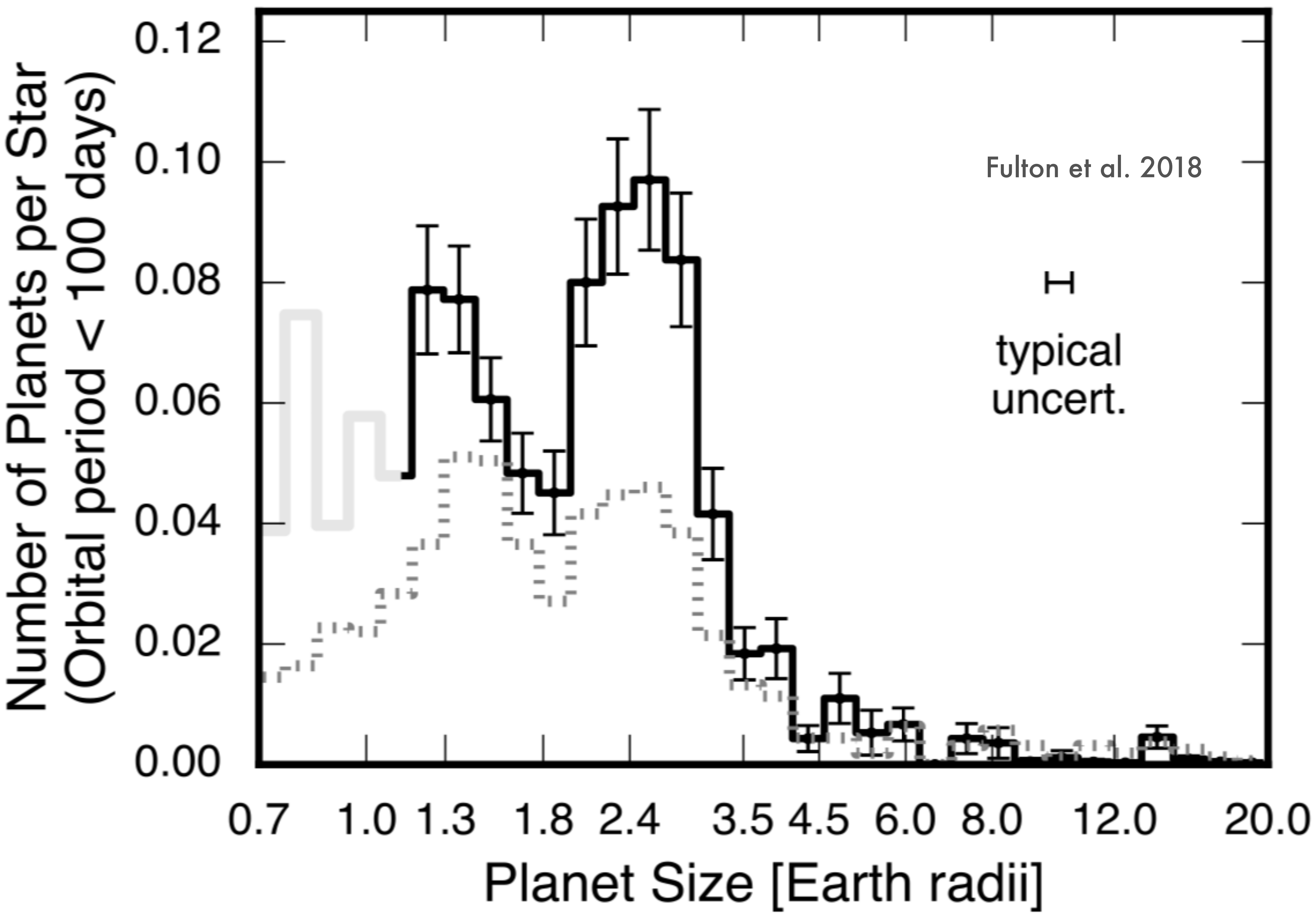


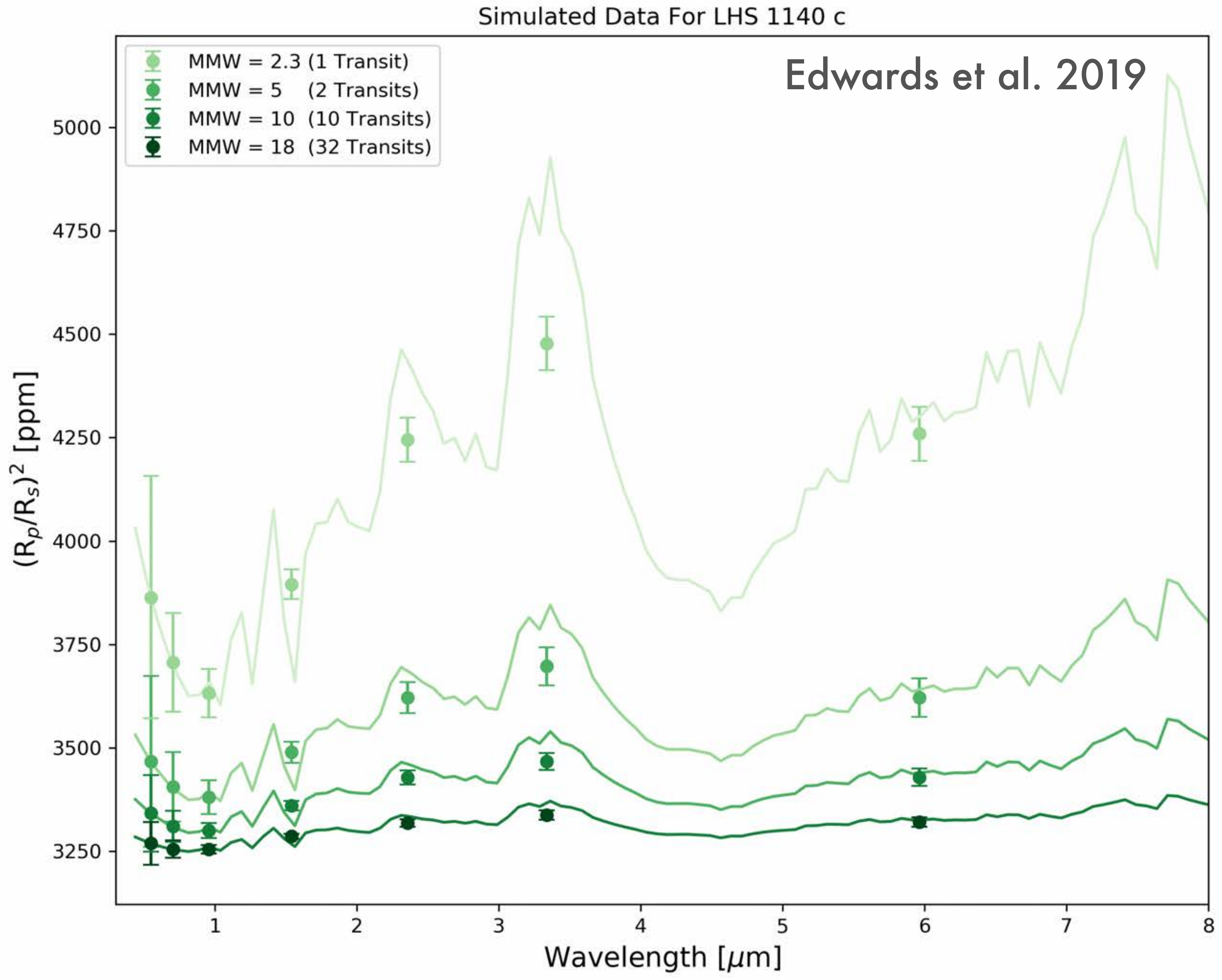
+ 10% mission time for other science (e.g. phase-curves, targets of opportunity)

Does Ariel's current design allow us to achieve our science goals?

How do we maximise the scientific yield of Ariel?

Exploring Different Samples





Atmospheric Mean Molecular Weight	Number of Planets	Required Science Time [hours]
2.3	All	~1,000 (t_0)
5	50	t_0 + ~360
	All	t_0 + ~3000
8	50	t_0 + ~1,100
	All	t_0 + ~9,200
10	50	t_0 + ~1,900
15	50	t_0 + ~4,400
18	25	t_0 + ~1,700
	50	t_0 + ~6,400
28	25	t_0 + ~4,300
	50	t_0 + ~15,600

Discuss MRS with Community

Phantom Inflated Planets in Occurrence Rate Based Samples

L. C. Mayorga[1,*] and Daniel P. Thorngren[2]

[1] *Harvard University*
[2] *University of California, Santa Cruz*

Keywords: planets and satellites: atmospheres — planets and satellites: physical evolution — planets and satellites: gaseous planets — planets and satellites: detection — methods: statistical — surveys

The recently launched *Transiting Exoplanet Survey Satellite* (*TESS*) is expected to produce many new exoplanet discoveries which will be especially amenable to follow-up study. Assessments of the planet discovery yield of TESS, such as Sullivan et al. (2015) and Barclay et al. (2018), will be important for planning follow-up work. Analyzing these predicted planet samples, however, we find that giant planet radii derived from the current bulk transiting planet sample have been used at all potential orbits without accounting for the temperature dependence of radius inflation. The radii of these phantom inflated planets (PIPs) are too large, i.e. beyond the limit of inflation for their equilibrium temperatures. PIP radii should be decreased in accordance with the degree of inflation of the underlying population, however, this may lead to some planets no longer meeting the detectability criteria imposed by yield estimates.

Discuss MRS with Community

PHANTOM INFLATED PLANETS IN OCCURRENCE RATE BASED SAMPLES

L. C. Mayorga[1,*] and Daniel P. Thorngren[2]

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Keywords: planets and satellites: atmospheres — planets and satellites: physical evolution — planets and satellites: gaseous planets — planets and satellites: detection — methods: statistical — surveys

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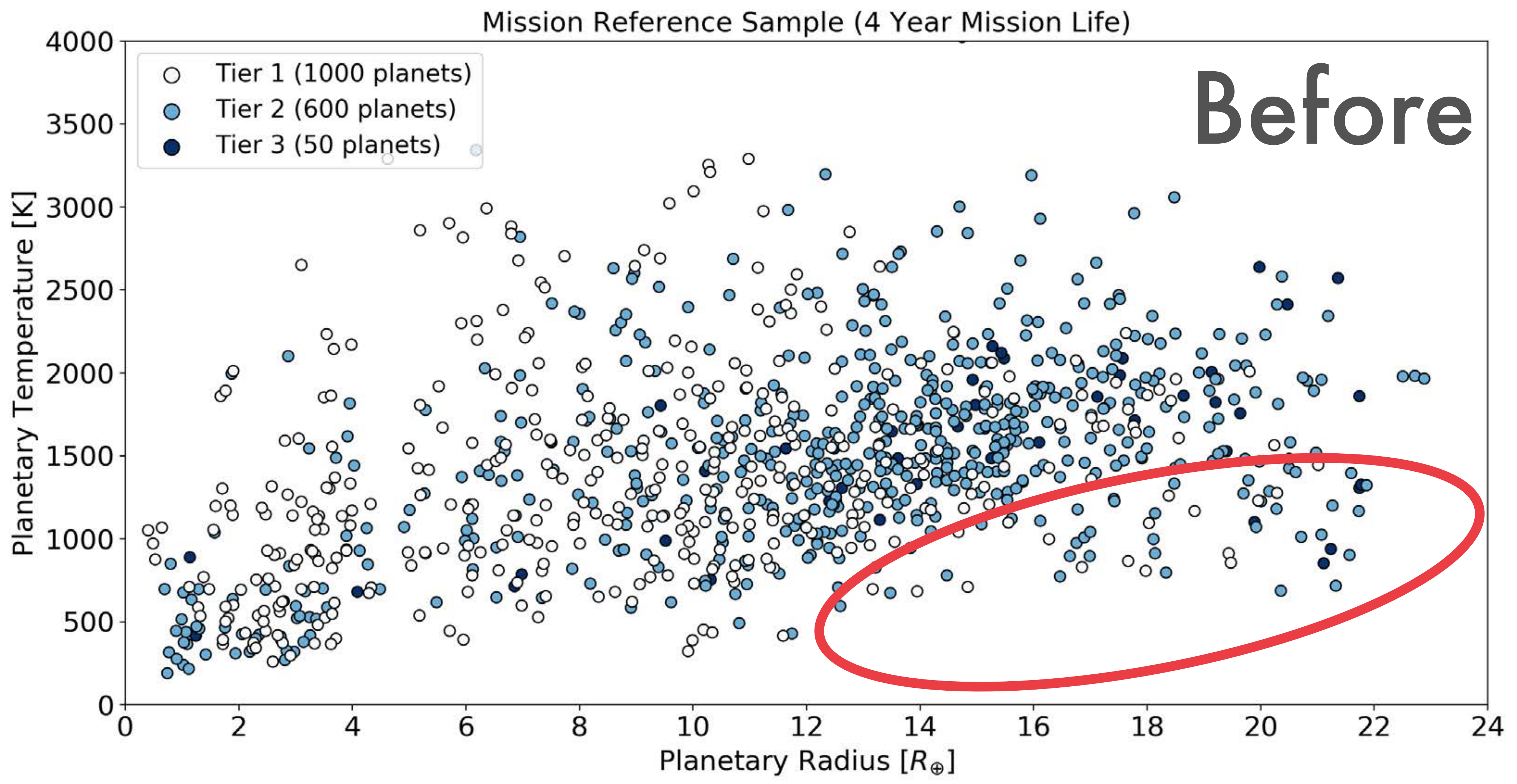

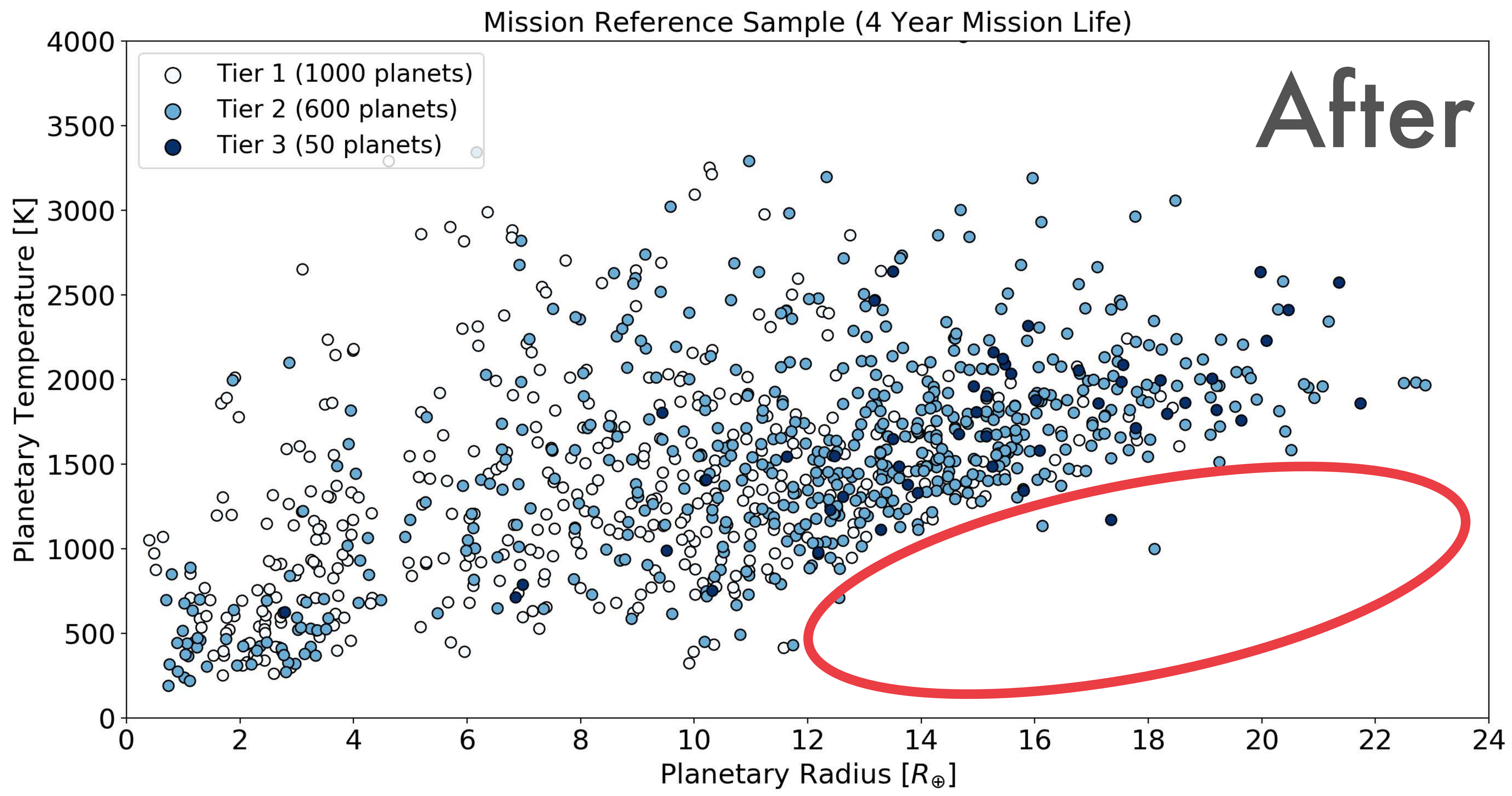

Thanks to Laura Mayorga and Vivien Parmentier!

Continue Finding Planets

UCL

An ultra-short period rocky super-Earth orbiting the G2-star HD 80653

G. Frustagli, E. Poretti, T. Milbourne, L. Malavolta, A. Mortier, Vikash Singh, A. S. Bonomo, L. A. Buchhave, L. Zeng, A. Vanderburg, S. Udry, G. Andreuzzi, A. Collier-Cameron, R. Cosentino, M. Damasso, A. Ghedina, A. Harutyunyan, R. D. Haywood, D. W. Latham, M. López-Morales, V. Lorenzi, A.F. Martinez Fiorenzano, M. Mayor, G. Micela, E. Molinari, F. Pepe, D. Phillips, K. Rice, A. Sozzetti

(Submitted on 7 Jan 2020)

Ultra-short period (USP) planets are a class of exoplanets with periods shorter than one day. The origin of this sub-population of planets is still unclear, with different formation scenarios highly dependent on the composition of the USP planets. A better understanding of this class of exoplanets will, therefore, require an increase in the sample of such planets that have accurate and precise masses and radii, which also includes estimates of the level of irradiation and information about possible companions. Here we report a detailed characterization of a USP planet around the solar-type star HD 80653 ≡ EP 251279430 using the K2 light curve and 108 precise radial

TOI 564 b and TOI 905 b: Grazing and Fully Transiting Hot Jupiters Discovered by TESS

Allen B. Davis, Songhu Wang, Matias Jones, Jason D. Eastman, Maximilian N. Günther, Keivan G. Stassun, Brett C. Addison, Karen A. Collins, Samuel N. Quinn, David W. Latham, Trifon Trifonov, Sahar Shahaf, Tsevi Mazeh, Stephen R. Kane, Xian-Yu Wang, Thiam-Guan Tan, Andrei Tokovinin, Carl Ziegler, René Tronsgaard, Sarah Millholland, Bryndis Cruz, Perry Berlind, Michael L. Calkins, Gilbert A. Esquerdo, Kevin I. Collins, Dennis M. Conti, Phil Evans, Pablo Lewin, Don J. Radford, Leonardo A. Paredes, Todd J. Henry, Hodari-Sadiki James, Nicholas M. Law, Andrew W. Mann, César Briceño, George R. Ricker, Roland Vanderspek, Sara Seager, Joshua N. Winn, Jon M. Jenkins, Akshata Krishnamurthy, Natalie M. Batalha, Jennifer Burt, Knicole D. Colón, Scott Dynes, Douglas A. Caldwell, Robert Morris, Christopher E. Henze, Debra A. Fischer

(Submitted on 21 Dec 2019)

We report the discovery and confirmation of two new hot Jupiters discovered by the Transiting Exoplanet Survey Satellite (TESS): TOI 564 b and TOI 905 b. The transits of these two planets were initially observed by TESS with orbital periods of 1.651 d and 3.739 d, respectively. We conducted follow-up observations of each system from the ground, including photometry in multiple filters, speckle interferometry, and radial velocity measurements. For TOI 564 b, our global fitting revealed a classical hot Jupiter with a mass of $1.463^{+0.10}_{-0.096}\ M_J$ and a radius of $1.02^{+0.71}_{-0.29}\ R_J$. TOI 905 b is a classical hot Jupiter as well, with a mass of $0.667^{+0.042}_{-0.041}\ M_J$ and radius of $1.171^{+0.053}_{-0.051}\ R_J$. Both planets

The First Habitable Zone Earth-sized Planet from TESS. I: Validation of the TOI-700 System

Emily A. Gilbert, Thomas Barclay, Joshua E. Schlieder, Elisa V. Quintana, Benjamin J. Hord, Veselin B. Kostov, Eric D. Lopez, Jason F. Rowe, Kelsey Hoffman, Lucianne M. Walkowicz, Michele L. Silverstein, Joseph E. Rodriguez, Andrew Vanderburg, Gabrielle Suissa, Vladimir S. Airapetian, Matthew S. Clement, Sean N. Raymond, Andrew W. Mann, Ethan Kruse, Jack J. Lissauer, Knicole D. Colón, Ravi kumar Kopparapu, Laura Kreidberg, Sebastian Zieba, Karen A. Collins, Samuel N. Quinn, Steve B. Howell, Carl Ziegler, Eliot Halley Vrijmoet, Fred C. Adams, Giada N. Arney, Patricia T. Boyd, Jonathan Brande, Christopher J. Burke, Luca Cacciapuoti, Quadry Chance, Jessie L. Christiansen, Giovanni Covone, Tansu Daylan, Danielle Dineen, Courtney D. Dressing, Zahra Essack, Thomas J.

NGTS and WASP photometric recovery of a single-transit candidate from TESS

Samuel Gill, Daniel Bayliss, Benjamin F. Cooke, Peter J. Wheatley, Louise D. Nielsen, Monika Lendl, James McCormac, Edward M. Bryant, Jack S. Acton, David R. Anderson, Claudia Belardi, Francois Bouchy, Matthew R. Burleigh, Andrew Collier-Cameron, Sarah L. Casewell, Michael R. Goad, Maximilian N. Gunther, Coel Hellier, James A. G.Jackman, James S. Jenkins, Maximiliano Moyano, Don Pollacco, Liam Raynard, Alexis M. S. Smith, Rosanna H. Tilbrook Oliver Turner, Stephane Udry, Richard G. West

(Submitted on 11 Oct 2019)

The Transiting Exoplanet Survey Satellite (\tess) produces a large number of single-transit event candidates, since the mission monitors most stars for only ~27\,days. Such candidates correspond to long-period planets or eclipsing binaries. Using the \tess\ Sector 1 full-frame images, we identified a 7750\,ppm single-transit event with a duration of 7\,hours around the moderately evolved F-dwarf star \tic\ (Tmag=10.23, \teff=6280±85\,K). Using archival WASP photometry we constrained the true orbital period to one of three possible values. We detected a subsequent transit-event with NGTS, which revealed the orbital period to be 38.20\,d. Radial velocity measurements from the CORALIE Spectrograph show the secondary object has a mass of $M_2 = 0.148 \pm 0.003$\,M$_\odot$, indicating this system is an F-M eclipsing binary. The radius of the M-dwarf companion is $R_2 = 0.171 \pm 0.003$\,R$_\odot$, making this one of the most well characterised stars in this mass regime. We find that its radius is 2.3-σ lower than expected from stellar evolution models.

NGTS-8b and NGTS-9b: two non-inflated hot-Jupiters

Jean C. Costes, Christopher A. Watson, Claudia Belardi, Ian P. Braker, Matthew R. Burleigh, Sarah L. Casewell, Philipp Eigmüller, Maximilian N. Günther, James A. G. Jackman, Louise D. Nielsen, Maritza G. Soto, Oliver Turner, David R. Anderson, Daniel Bayliss, François Bouchy, Joshua T. Briegal, Edward M. Bryant, Juan Cabrera, Alexander Chaushev, Szilard Csizmadia, Anders Erikson, Samuel Gill, Edward Gillen, Michael R. Goad, Matthew J. Hooton, James S. Jenkins, James McCormac, Maximiliano Moyano, Didier Queloz, Heike Rauer, Liam Raynard, Alexis M. S. Smith, Andrew P. G. Thompson, Rosanna H. Tilbrook, Stephane Udry, Jose I. Vines, Richard G. West, Peter J. Wheatley

(Submitted on 7 Nov 2019)

We report the discovery, by the Next Generation Transit Survey (NGTS), of two hot-Jupiters NGTS-8b and NGTS-9b. These orbit a V = 13.68 K0V star (Teff = 5241 +/- 50 K) with a period of 2.49970 days, and a V = 12.80 F8V star (Teff = 6330 +/- 130 K) in 4.43527 days, respectively. The transits were independently verified by follow-up photometric observations with the SAAO 1.0-m and Euler telescopes, and we report on the planetary parameters using HARPS, FEROS and CORALIE radial velocities. NGTS-8b has a mass, 0.93 +0.04 -0.03 MJ and a radius, 1.09 +/- 0.03 RJ similar to Jupiter, resulting in a density of 0.89 +0.08 -0.07 g cm-3. This is in

TESS Reveals HD 118203 b to be a Transiting Planet

Joshua Pepper, Stephen R. Kane, Joseph E. Rodriguez, Natalie R. Hinkel, Jason D. Eastman, Tansu Daylan, Teo Mocnik, Paul A. Dalba, Tara Fetherolf, Keivan G. Stassun, Tiago L. Campante, Andrew Vanderburg, Daniel Huber, B. Scott Gaudi, Diego Bossini, Ian Crossfield, George R. Ricker, Roland Vanderspek, David W. Latham, Sara Seager, Joshua N. Winn, Jon M. Jenkins, Joseph D. Twicken Mark Rose, Jeffrey C. Smith, Ana Glidden, Alan M. Levine, Stephen Rinehart, Karen A. Collins, Andrew W. Mann, Jennifer A. Burt, David J. James, Robert J. Siverd

(Submitted on 12 Nov 2019)

The exoplanet HD 118203 b, orbiting a bright (V = 8.05) host star, was discovered using the radial velocity method by da Silva et al. (2006), but was not previously known to transit. TESS photometry has revealed that this planet transits its host star. Five planetary transits were observed by TESS, allowing us to measure the radius of the planet to be $1.133 \pm 0.031 R_J$, and to calculate the planet mass to be $2.173 \pm 0.078 M_J$. The host star is slightly evolved with an effective temperature of $T_{\rm eff} = 5692 \pm 83$ K and a surface gravity of

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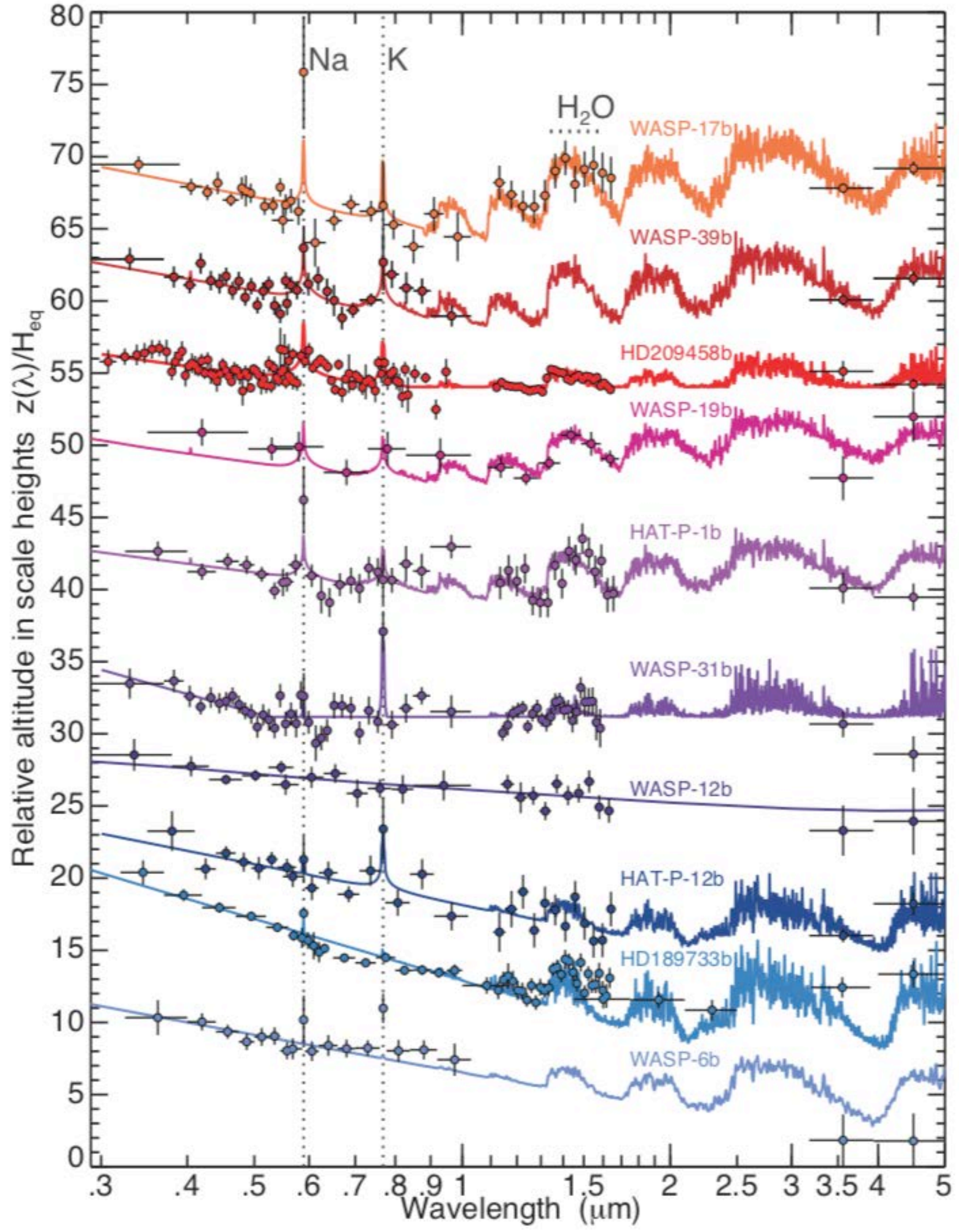
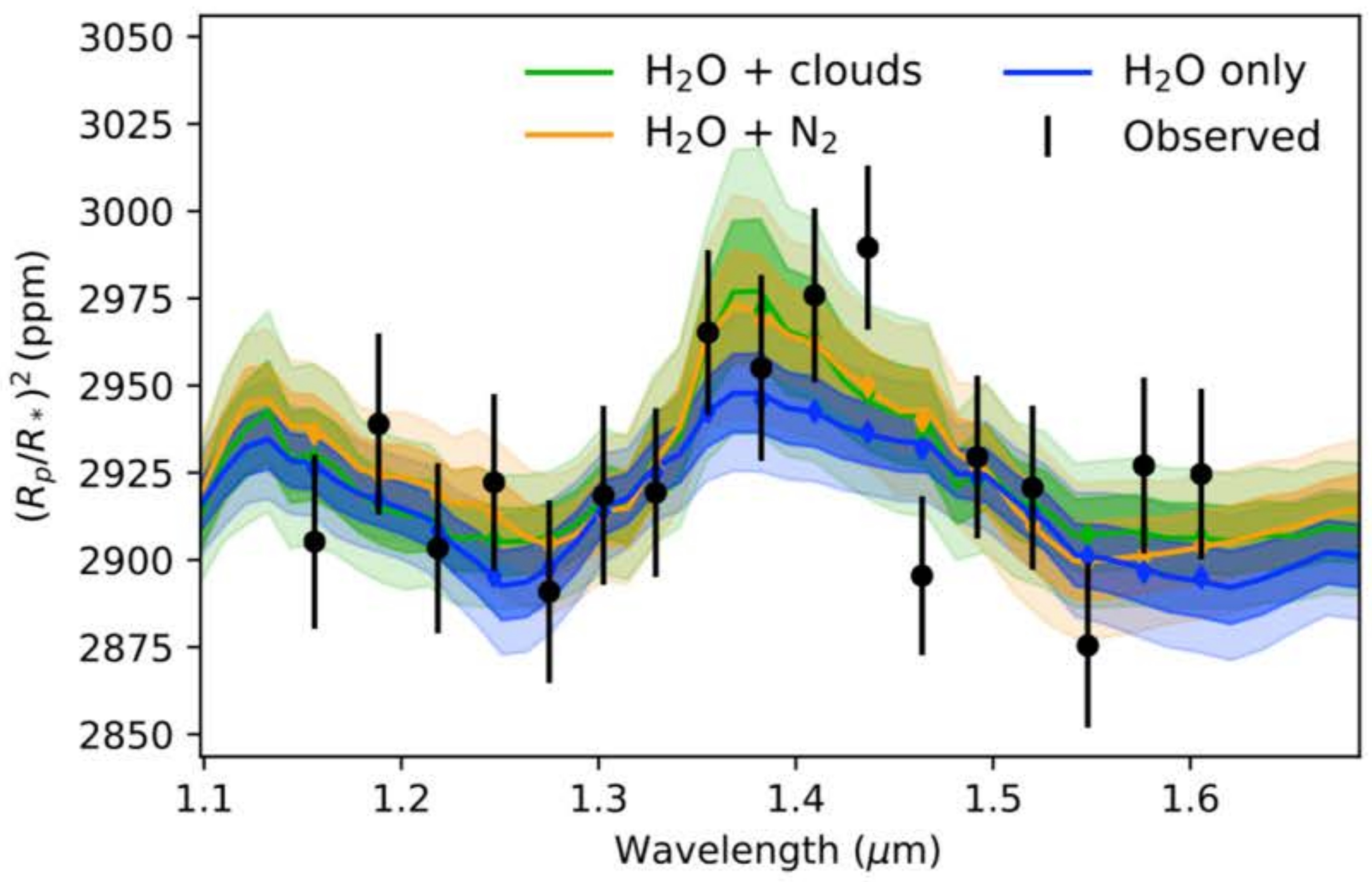
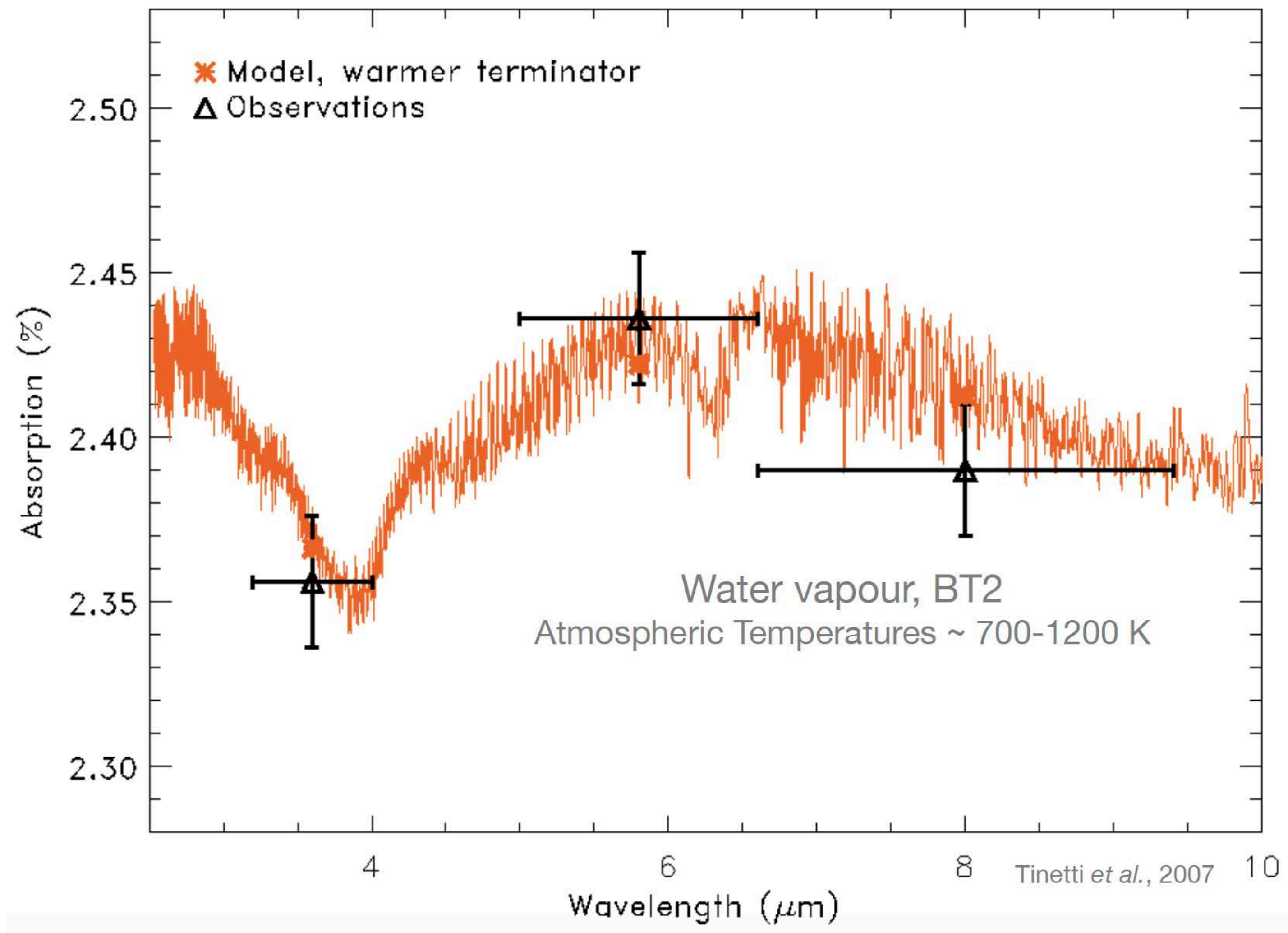
Continue Characterising Atmospheres



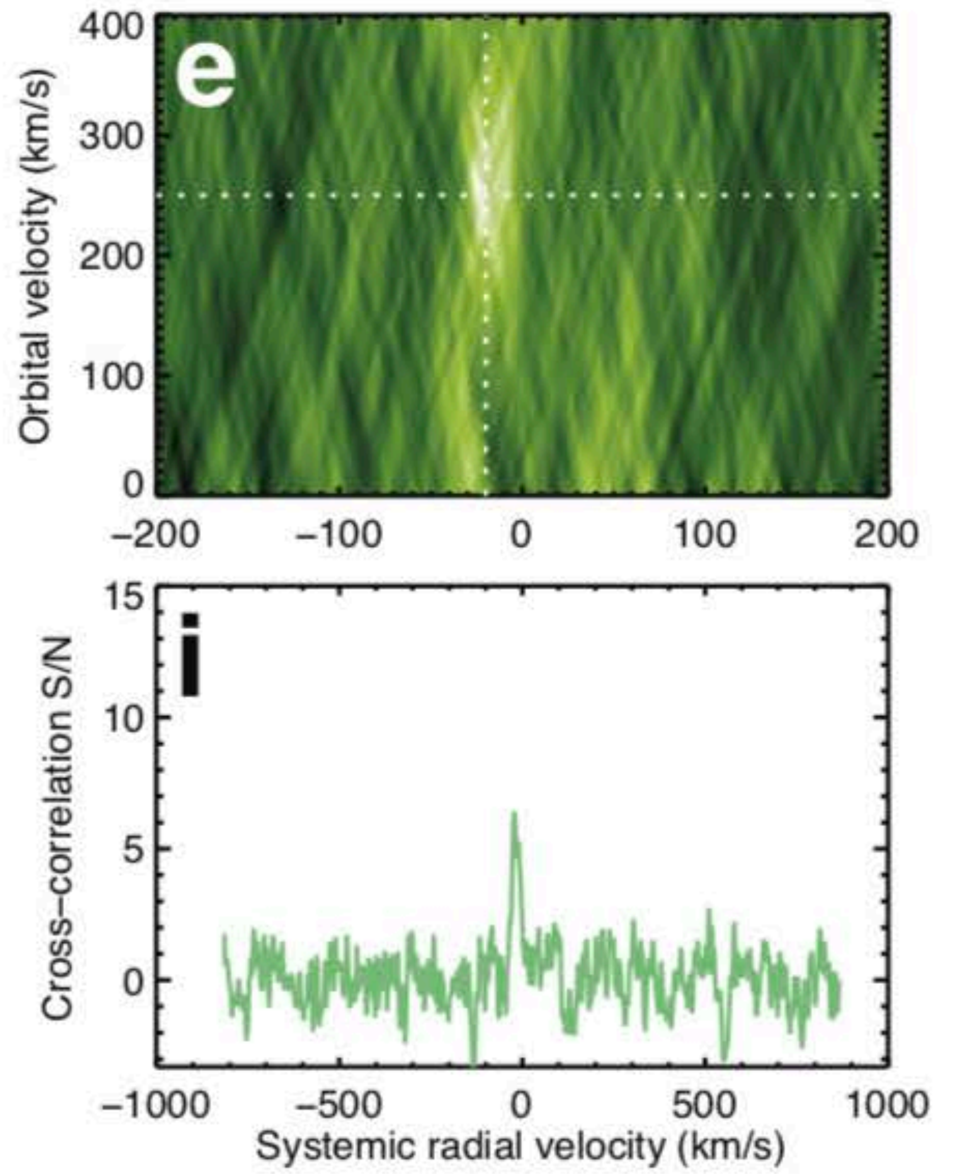
Sing et al. 2017



Tsiaras et al. 2019



Tinetti et al. 2008



Hoeijmakers et al. 2018

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Explore Biases or Oversimplifications

Towards a more complex description of chemical profiles in exoplanet retrievals: A 2-layer parameterisation

Q. Changeat,[1] B. Edwards,[1] I.P. Waldmann,[1] and G. Tinetti[1]

[1] *Department of Physics and Astronomy*
University College London
Gower Street, WC1E 6BT London, United Kingdom

(Accepted ApJ)

ABSTRACT

State of the art spectral retrieval models of exoplanet atmospheres assume constant chemical profiles with altitude. This assumption is justified by the information content of current datasets which do not allow, in most cases, for the molecular abundances as a function of pressure to be constrained.

2.5-D retrieval of atmospheric properties from exoplanet phase curves: Application to WASP-43b observations

Patrick G. J. Irwin,[1★] Vivien Parmentier,[1] Jake Taylor,[1] Jo Barstow,[2] Suzanne Aigrain,[1] Graham K.H. Lee,[1] and Ryan Garland,[1]
[1] *Department of Physics, University of Oxford, Parks Rd, Oxford, OX1 3PU, UK*
[2] *Department of Physics and Astronomy, University College London, Gower St, London WC1E 6BT, UK*

Accepted XXX. Received YYY; in original form ZZZ

ABSTRACT
We present a novel retrieval technique that attempts to model phase curve observations of exoplanets more realistically and reliably, which we call the

EXPLORING BIASES OF ATMOSPHERIC RETRIEVALS IN SIMULATED *JWST* TRANSMISSION SPECTRA OF HOT JUPITERS

M. Rocchetto[1], I. P. Waldmann[1], O. Venot[2], P.-O. Lagage[3,4], and G. Tinetti[1]
[1] Department of Physics & Astronomy, University College London, Gower Street, WC1E6BT London, UK; m.rocchetto@ucl.ac.uk
[2] Instituut voor Sterrenkunde, Katholieke Universiteit Leuven, Celestijnenlaan 200D, B-3001 Leuven, Belgium
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Received 2016 August 2; revised 2016 September 26; accepted 2016 September 28; published 2016 December 12

ABSTRACT

With a scheduled launch in 2018 October, the *James Webb Space Telescope* (*JWST*) is expected to revolutionize the field of atmospheric characterization of exoplanets. The broad wavelength coverage and high sensitivity of its instruments will allow us to extract far more information from exoplanet spectra than what has been possible with current observations. In this paper, we investigate whether current retrieval methods will still be valid in the era of *JWST*, exploring common approximations used when retrieving transmission spectra of hot Jupiters. To assess

Effects of a fully 3D atmospheric structure on exoplanet transmission spectra: retrieval biases due to day-night temperature gradients

A. Caldas[1], J. Leconte[1], F. Selsis[1], I.P. Waldmann[2], P. Bordé[1], M. Rocchetto[2], and B. Charnay[3]

[1] Laboratoire d'astrophysique de Bordeaux, Univ. Bordeaux, CNRS, B18N, allée Geoffroy Saint-Hilaire, 33615 Pessac, France
[2] Department of Physics and Astronomy, University College London (UCL), United Kingdom
[3] LESIA, Observatoire de Paris, PSL Research University, CNRS, Sorbonne Université, Univ. Paris Diderot, Sorbonne Paris Cité, 92195, Meudon, France

January 30, 2019

THE INFLUENCE OF STELLAR CONTAMINATION ON THE INTERPRETATION OF NEAR INFRARED TRANSMISSION SPECTRA OF SUB-NEPTUNE WORLDS AROUND M-DWARFS

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Arizona State University
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(Received TBD; Revised TBD; Accepted TBD)

Submitted to ApJ

ABSTRACT

The impact of unocculted stellar surface heterogeneities in the form of cool spots and hot faculae on the spectrum of a transiting planet has been a daunting problem for the characterization of exoplanet

Alfnoor: A Retrieval Simulation of the Ariel Target List.

Quentin Changeat (1), Ahmed Al-Refaie (1), Lorenzo V. Mugnai (2), Billy Edwards (1), Ingo Waldmann (1), Enzo Pascale (2) and Giovanna Tinetti (1)
(1) Department of Physics and Astronomy, University College London, UK
(2) Sapienza Rome, Italy

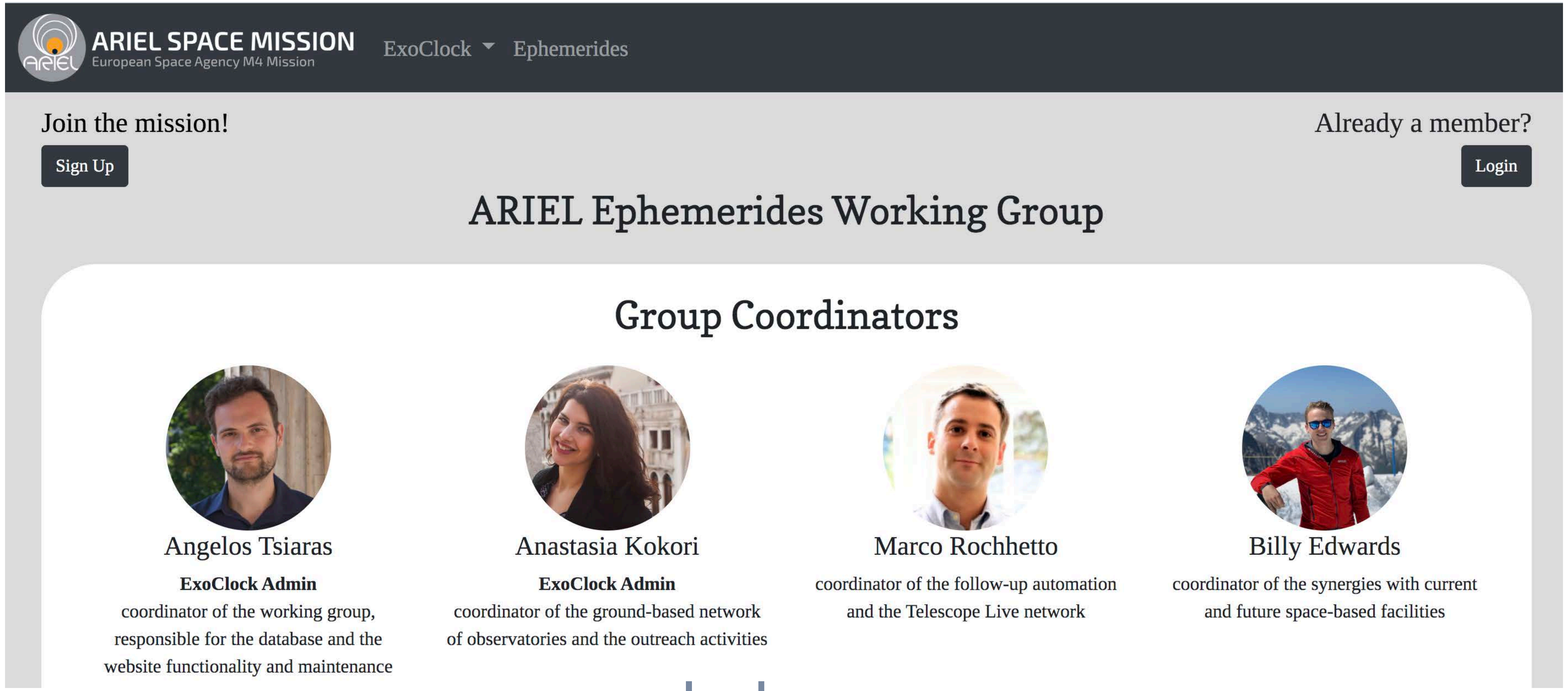
Abstract

In this work, we present Alfnoor, a dedicated tool for the study of exoplanet atmosphere populations. This

consequences, most atmospheric retrieval studies focus on single planet analysis [7, 8, 9, 5] and only a few papers have described consistent spectra analysis of multiple targets [10, 11, 12, 13]. In the next few

Refinement of Orbital Parameters

- Ephemeris knowledge degrades over time
- A ground and space-based campaign required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European Space Agency M4 Mission
ExoClock Ephemerides

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ARIEL Ephemerides Working Group

Group Coordinators

Angelos Tsiaras
ExoClock Admin
coordinator of the working group, responsible for the database and the website functionality and maintenance

Anastasia Kokori
ExoClock Admin
coordinator of the ground-based network of observatories and the outreach activities

Marco Rochhetto
coordinator of the follow-up automation and the Telescope Live network

Billy Edwards
coordinator of the synergies with current and future space-based facilities

www.exoclock.space

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Conclusions

- Ariel will spectroscopically characterise a population of exoplanets
- Ariel MRS will be selected from a diverse list of potential targets
- Many ways to get involved to help maximum science yield

THE ASTRONOMICAL JOURNAL

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An Updated Study of Potential Targets for Ariel

Billy Edwards[1], Lorenzo Mugnai[2], Giovanna Tinetti[1], Enzo Pascale[2,3], and Subhajit Sarkar[3]

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The Astronomical Journal, Volume 157, Number 6

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www.exoclock.space

www.arielmission.space/target-list