# TRANSITING EXOPLANETS WITH JWST:

## *Community Efforts for Early Release Science*

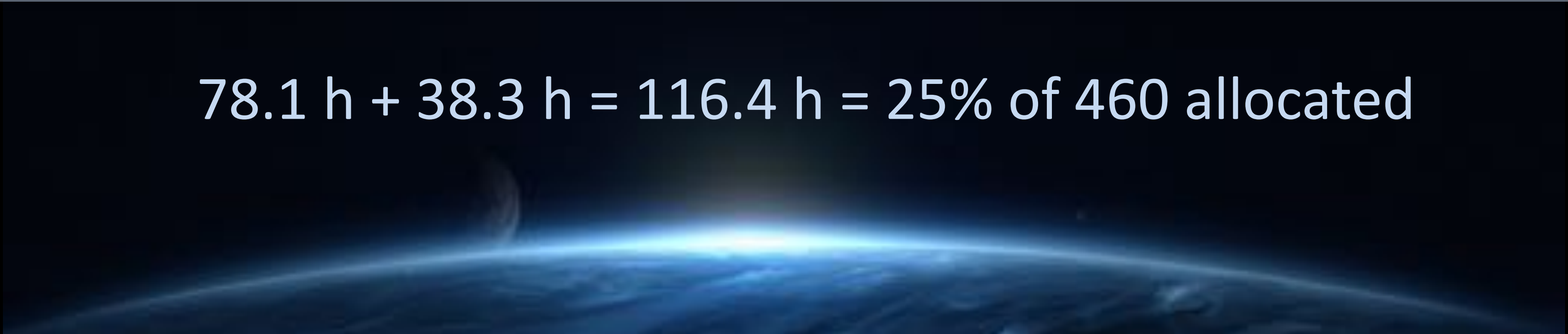
Natalie Batalha, on behalf of the ERS Community

# JWST Early Release Science Awards

| | | | |
|---|---|---|---|
| 1309 | IceAge: Chemical Evolution of Ices during Star Formation | McClure (Amsterdam) | Stellar Physics |
| 1324 | Through the Looking GLASS: A JWST Exploration of Galaxy Formation and Evolution from Cosmic Dawn to Present Day | Treu (UCLA) | Galaxies and the IGM |
| 1328 | A JWST Study of the Starburst-AGN Connection in Merging LIRGs | Armus (CalTech) | Galaxies and the IGM |
| 1334 | The Resolved Stellar Populations Early Release Science Program | Weisz (UC Berkeley) | Stellar Populations |
| 1335 | Q-3D: Imaging Spectroscopy of Quasar Hosts Analyzed with a Powerful New PSF Decomposition & Spectral Analysis | Wylezalek (ESO) | Massive Black Holes and their Galaxies |
| 1345 | The Cosmic Evolution Early Release Science (CEERS) Survey | Finkelstein (Austin) | Galaxies and the IGM |
| 1349 | Establishing Extreme Dynamic Range with JWST: Decoding Smoke Signals in the Glare of a Wolf-Rayet Binary | Lau (CalTech) | Stellar Physics |
| 1355 | TEMPLATES: Targeting Extremely Magnified Panchromatic Lensed Arcs and Their Extended Star Formation | Rigby (GSFC) | Galaxies and the IGM |
| 1364 | Nuclear Dynamics of a Nearby Seyfert with NIRSpec Integral Field Spectroscopy | Bentz (Georgia State) | Massive Black Holes and their Galaxies |

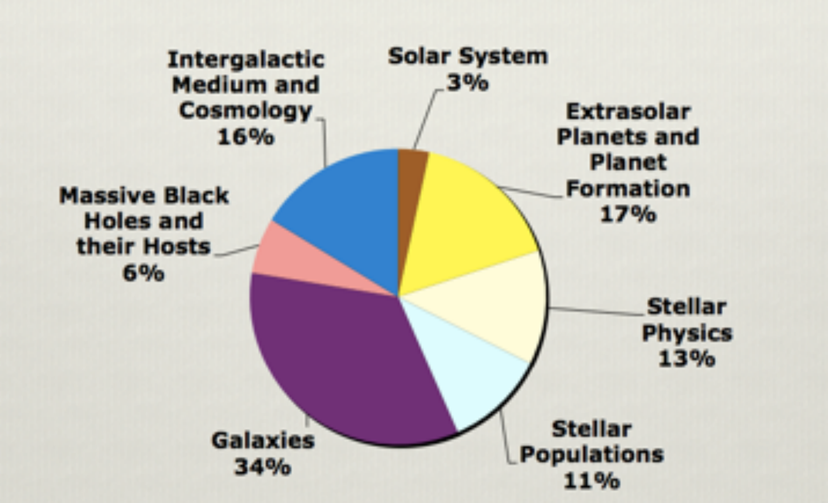
# JWST Early Release Science Awards

| | | | |
|---|---|---|---|
| 1366 | The Transiting Exoplanet Community Early Release Science Program | Batalha (NASA ARC), Bean (Chicago), Stevenson (STScI) | Planets and Planet Formation |
| 1373 | ERS observations of the Jovian System as Demonstration of JWST's Capabilities for Solar System Science | de Pater (Berkeley) | Solar System |
| 1386 | High Contrast Imaging of Exoplanets and Exoplanetary Systems with JWST | Hinkley (Exeter), Skemer (UCSC), Biller (Edinburgh) | Planets and Planet Formation |



78.1 h + 38.3 h = 116.4 h = 25% of 460 allocated

# Improvement Over Past Allocation Levels of 17%


HST Allocations by Science Theme

# 104 Team Members & Open Invitation

Alam Munazza K.
Angerhausen Daniel
Barrado David
Batalha Natalie M.
Batalha Natasha E.
Bean Jacob L.
Benneke Björn
Berta-Thompson Zachory K.
Blecic Jasmina
Bouwman Jeroen
Bruno Giovanni
Carone Ludmila
Carter Aarynn L.
Casewell Sarah L.
Chapman John W.
Crossfield Ian J.M.
Crouzet Nicolas
Cubillos Patricio E.
Decin Leen
Demory Brice-Olivier
Desert Jean-Michel
de Val-Borro Miguel
de Wit Julien
Dragomir Diana
Drummond Benjamin
Endl Michael
Espinoza Nestor
Evans Thomas M.
Fortney Jonathan J.
Fraine Jonathan D.
France Kevin
Gao Peter
García Muñoz Antonio
Garland Ryan
Gibson Neale P.
Gizis John E.
Goyal Jayesh M.
Greene Thomas P.
Harrington Joseph
Heng Kevin
Henning Thomas K.
Hong Yucian
Hu Renyu
Ingalls James G.
Iro Nicolas
Irwin Patrick G. J.
Kataria Tiffany
Kendrew Sarah
Kempton Eliza M.-R.
Kilpatrick Brian M.
Knutson Heather A.
Kreidberg Laura
Krick Jessica
Lagage Pierre-Olivier
Lahuis Fred
Leconte Jeremy
Lendl Monika
Lillo-Box Jorge
Line Michael R.
Lines Stefan
Lopez-Morales Mercedes
Lothringer Joshua D.
Louden Tom
Madhusudhan Nikku
Mancini Luigi
Mandell Avi M.
Mansfield Megan
Marchis Franck
Marley Mark S.
May Erin M.
Mayne Nathan
Molliere Paul
Morello Giuseppe
Morley Caroline V.
Moses Julianne I.
Nikolov Nikolay
Palle Enric
Parmentier Vivien
Rauscher Emily
Redfield Seth
Roberts Jessica E.
Rocchetto Marco
Rogers Leslie A.
Roudier Gaël
Schlawin Everett
Shkolnik Evgenya L.
Showman Adam P.
Sing David K.
Southworth John
Spake Jessica J.
Stevenson Kevin B.
Swain Mark R.
Teske Johanna C.
Todorov Kamen O.
Tremblin Pascal
Tsiaras Angelos
Tucker Gregory S.
Venot Olivia
Waalkes William C.
Wakeford Hannah R.
Waldmann Ingo P.
Weaver Ian
Wheatley Peter J.
Zellem Robert T.
YOUR NAME HERE

**Co-PI**
Jacob Bean

**PI**
Natalie Batalha

**Co-PI**
Kevin Stevenson

**Science Council**
Chair: David Sing

Science Council Charter:
https://goo.gl/zUcQFD

Mike Line

Heather Knutson

Ian Crossfield

Laura Kreidberg

Jean-Michel Desert

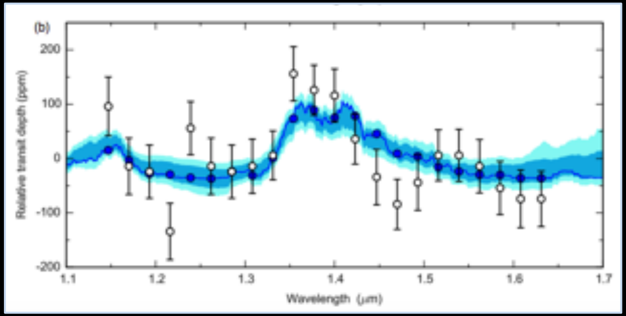
**Transmission WG**
Hannah Wakeford
David Sing
Kevin Stevenson
42 members

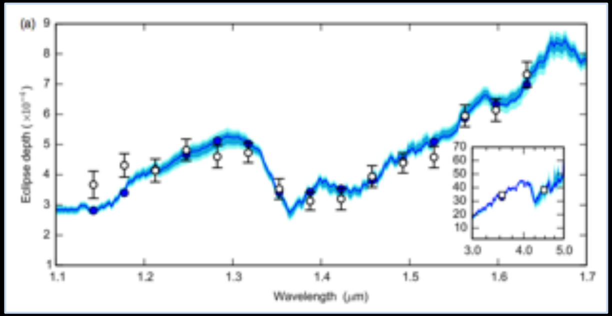
**MIRI WG**
Laura Kreidberg
Nicolas Crouzet
Julie Moses
48 members

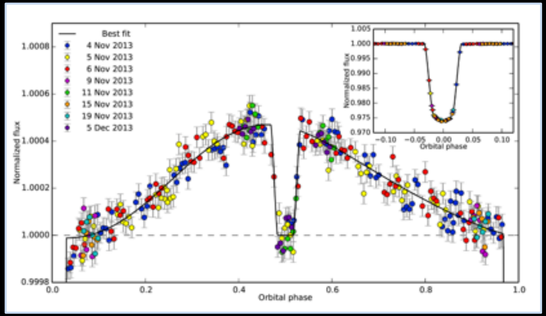
**Bright Star WG**
Björn Benneke
Jacob Bean
Eliza Kempton
14 members

**Data Challenge WG**
Z. Berta-Thompson
Mike Line
M. Lopez-Morales
34 members

# Diversity of Phenomena



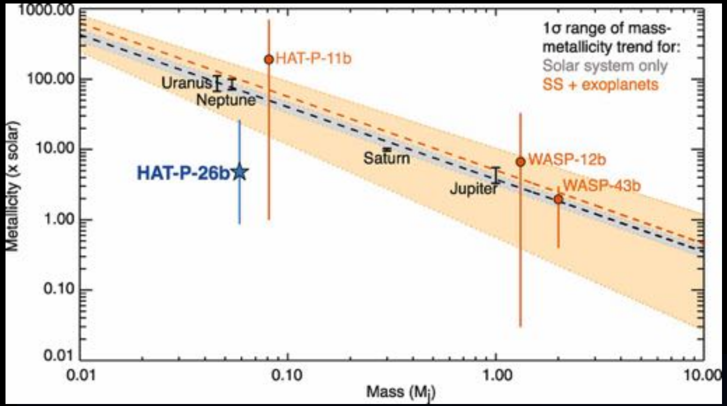




Transmission

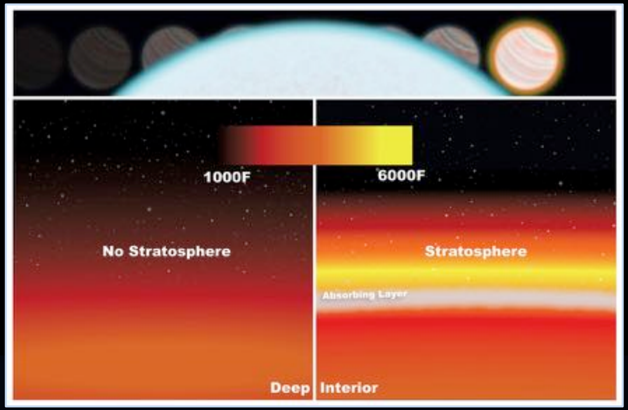
Emission

Phase

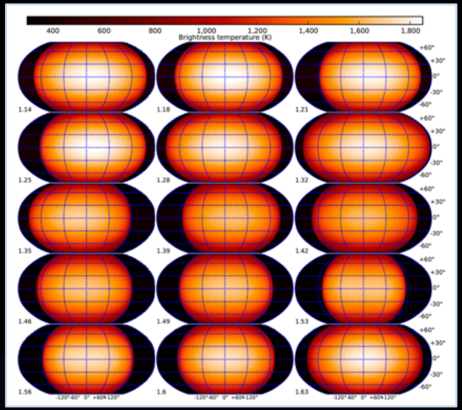
# Diversity of Science




C/O
Metallicity

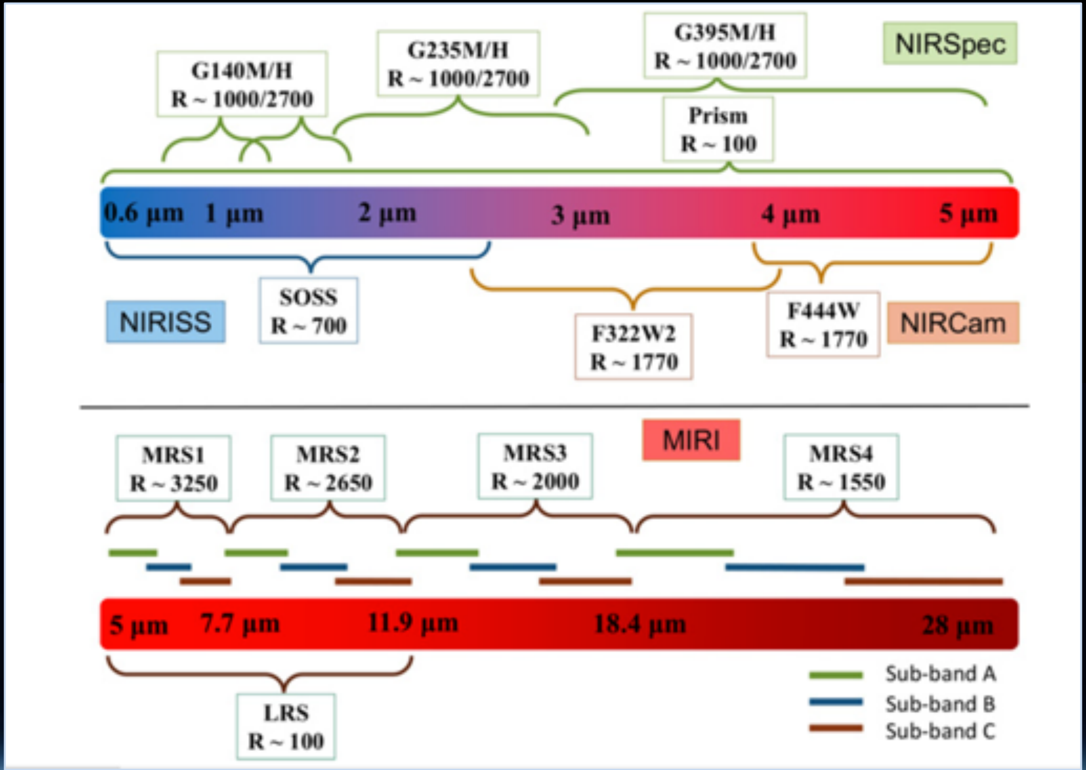



T/P
Profiles




Longitudinal
Maps

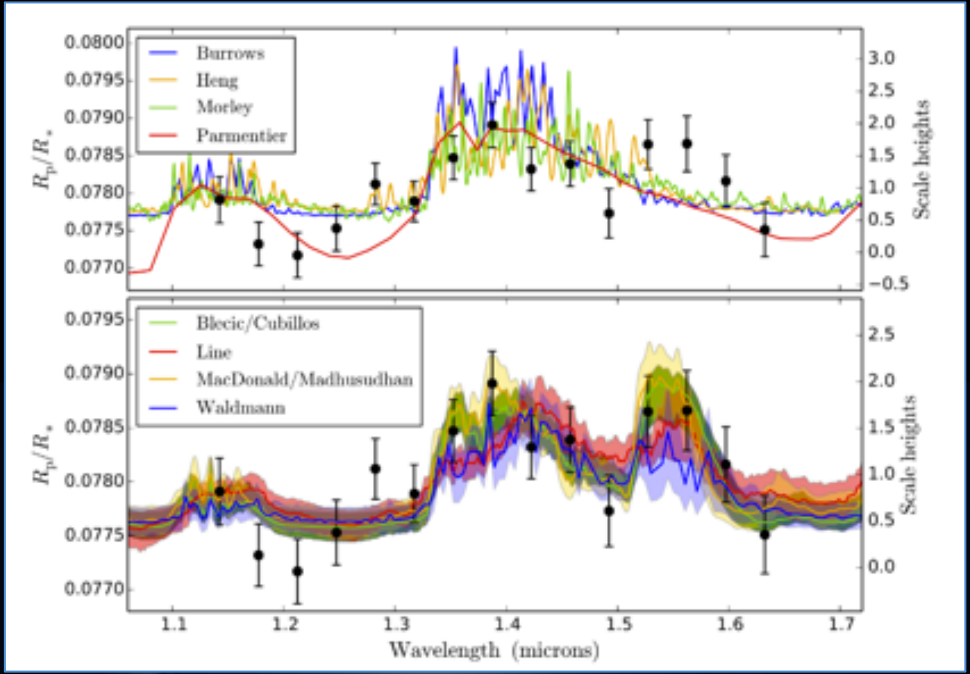
# Diversity of Spectroscopic Observing Modes



# Targets with Previously Measured Features

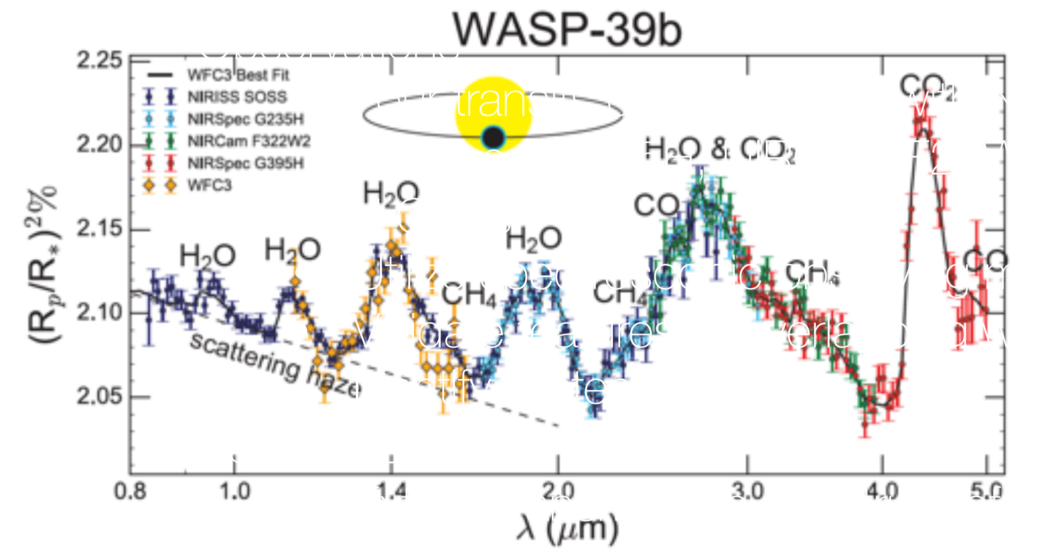
WASP-63 b
WFC3 Transmission
Kilpatrick et al. 2017

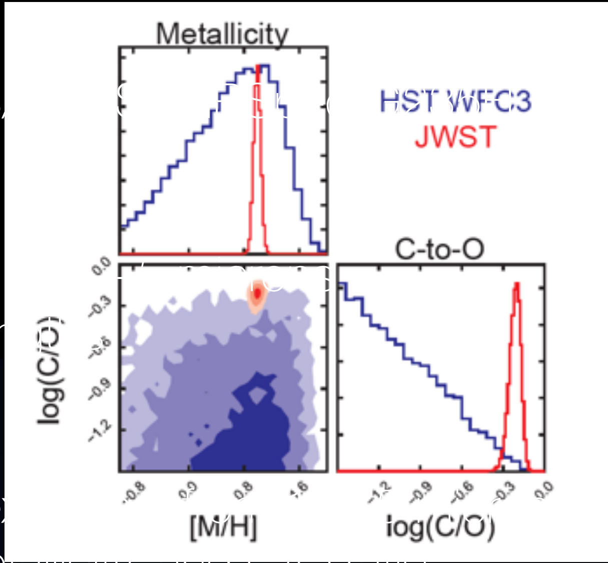
Forward models (top)
Retrieval models (bottom)




"A Preparatory Program to Identify the Single Best Transiting Exoplanet for JWST Early Release Science."

# 1) Transmission Program (42 h)

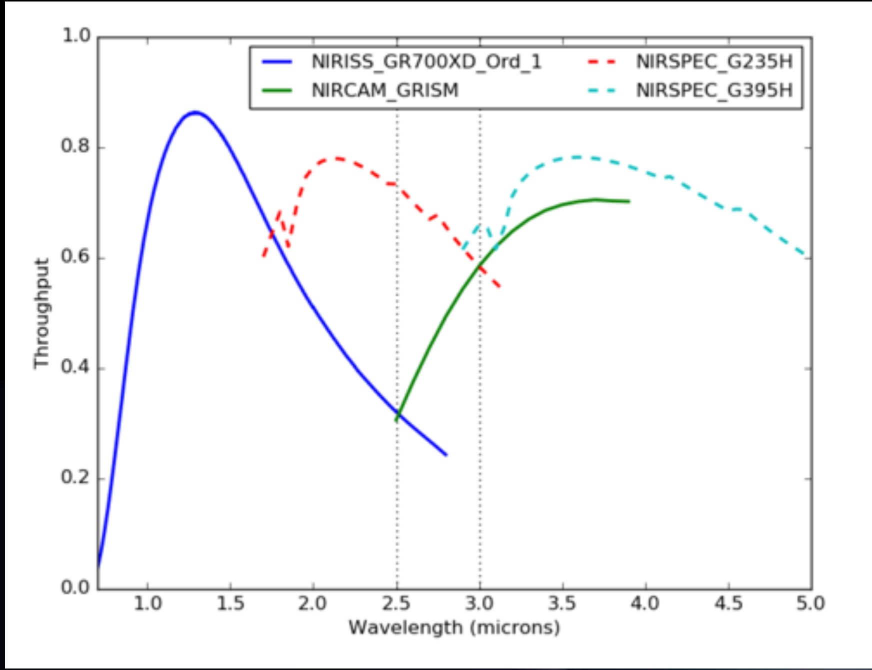



- Measure atmospheric composition, metallicity, and C/O ratio

Wakeford et al. 2018 AJ 155 29

# Transmission Program: 4 Modes

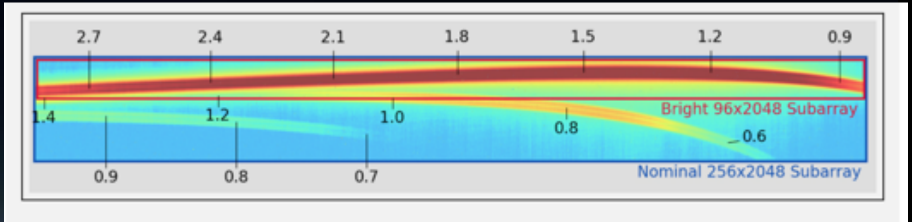



NIRISS SOSS

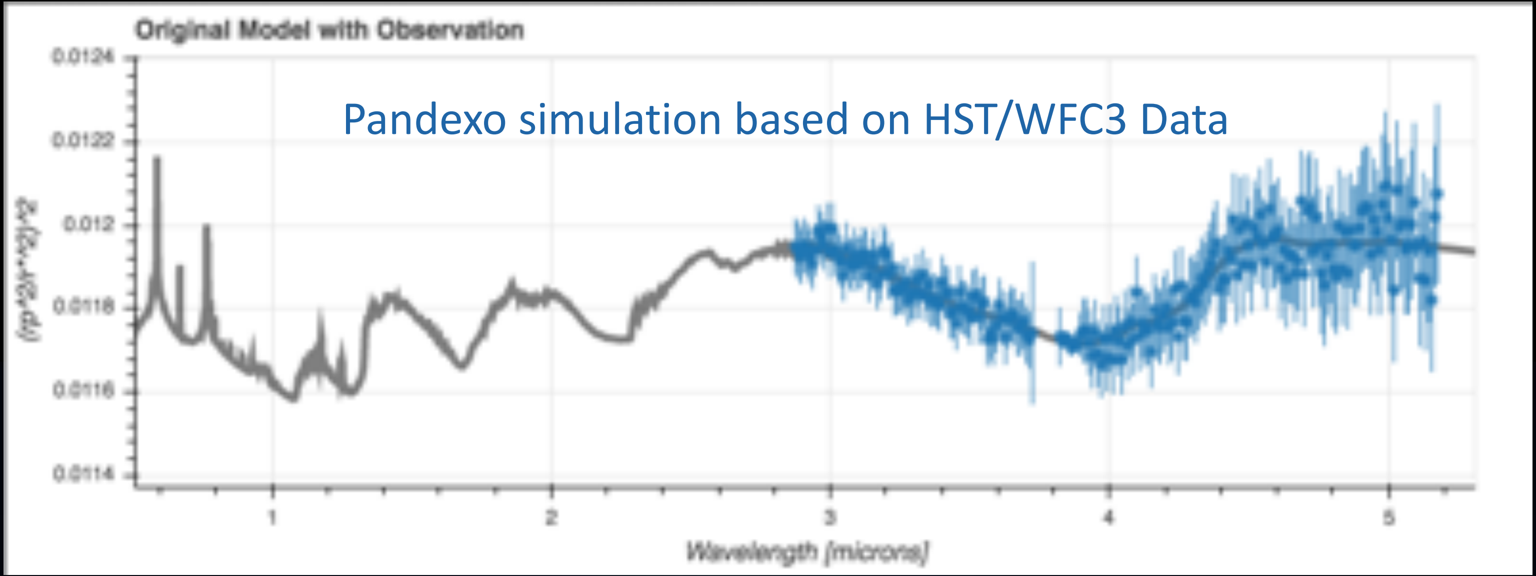
NIRCAM F322W2

NIRSpec G235H

NIRSPEC G395H



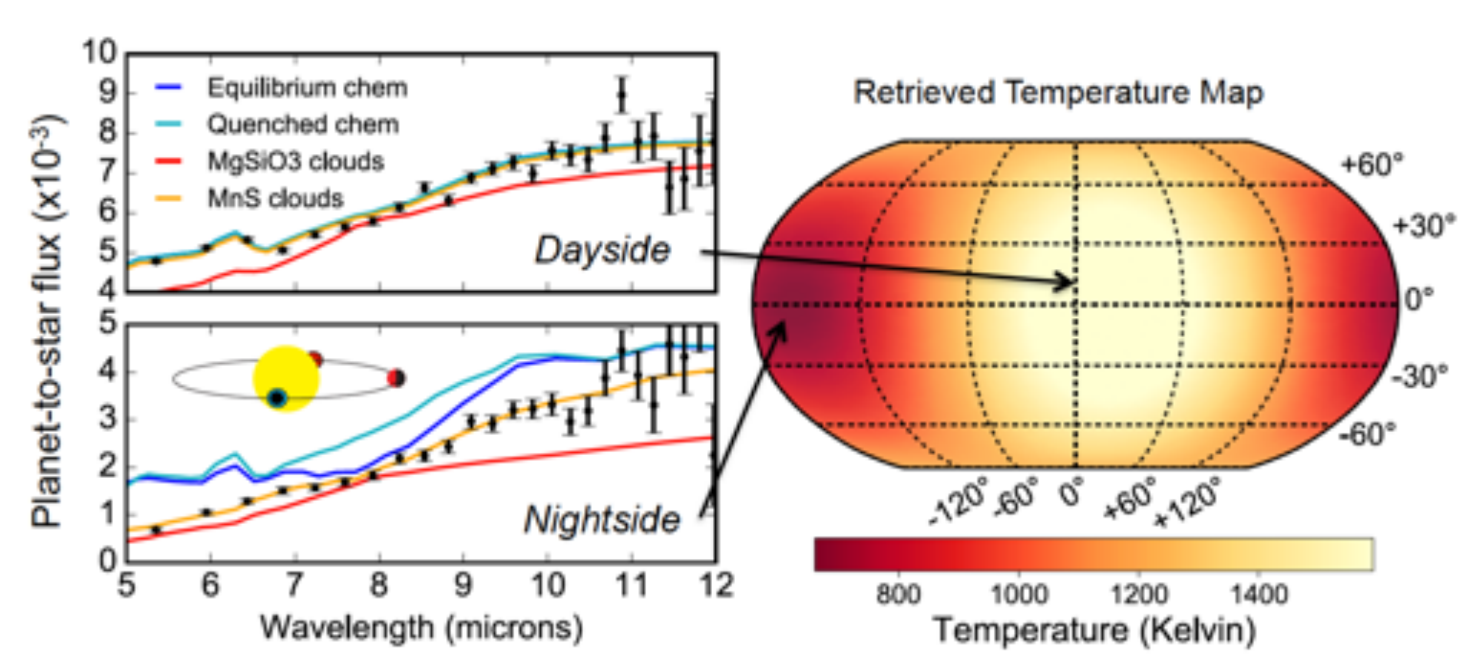
# Launch Slip Requires Target Change: WASP-79b




Credit: Hanna Wakeford

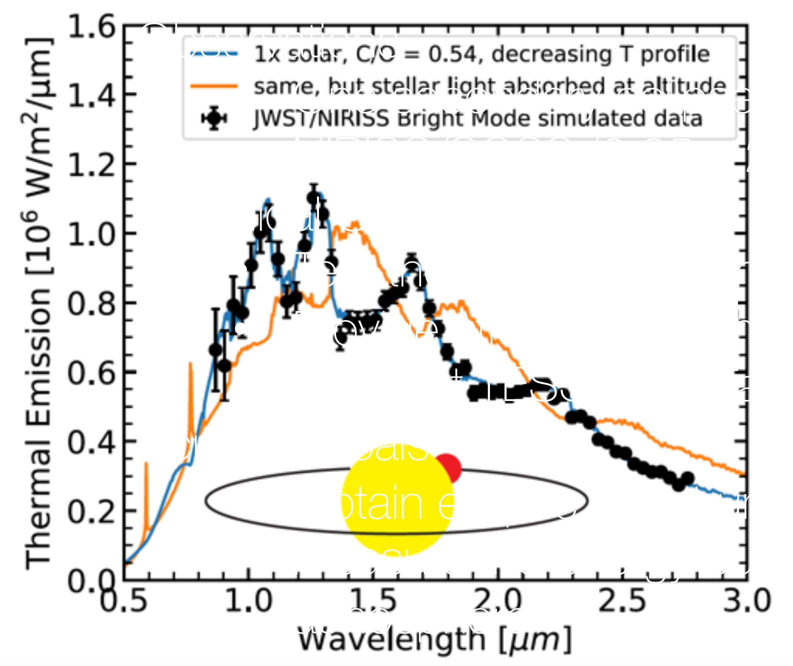
# 2) MIRI Phase Curve Program (29.5 h)

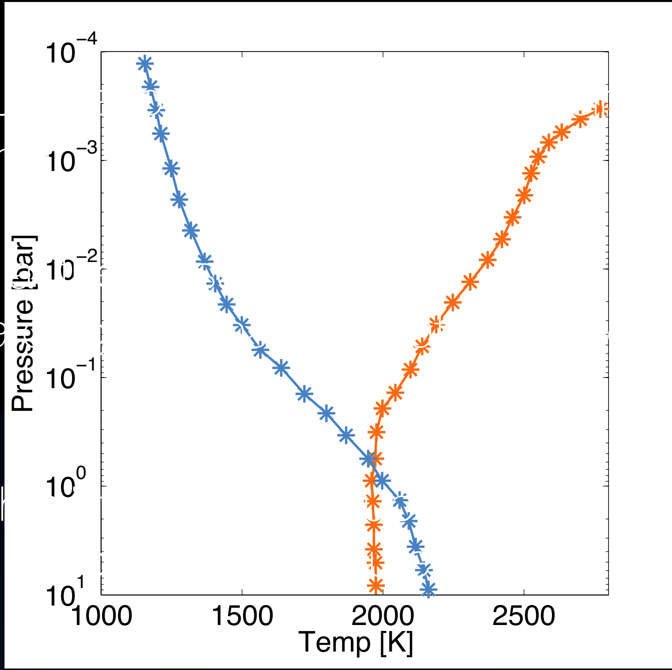
eclipses




WASP-43b: Venot et al. 2018, in prep

# 3) Bright Star Test (8.6 h)

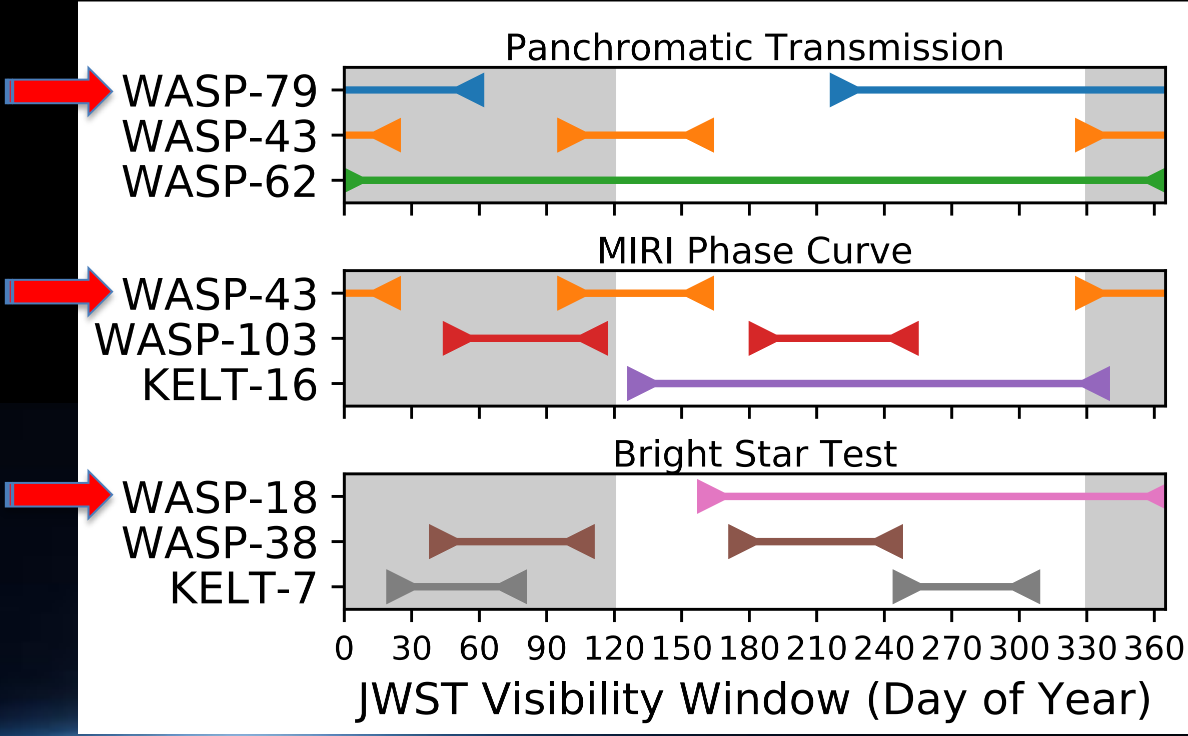



(WASP-18b: See Arcangeli et al. arXiv:1801.02489 & Sheppard et al. 2017 ApJL 850 32)

# Multiple Targets Provide Flexibility

- Mar-Jun 2019 Launch
- 6 Months of Commissioning
- 5 Month (max) Data Take
- Data available Spring 2020
- Multiple targets covering all epochs in case of schedule changes



# Data Challenge & Deliverables

The centerpiece of the ERS work plan is a two-phase Open Data Challenge designed to:

- Engage a broad cross-section of the astronomical community to familiarize them with JWST data and scientific capabilities.
- Design, create, and deliver science-enabling products to help the community understand JWST capailities.
- Foster open-science and compare methodologies for the betterment of all.

# Goals of Data Challenge #1 (Summer 2019)

- Exercise data analysis tools on simulated data for each instrument mode.
- Test performance by internal validation of science results against input properties of simulated data.
- Test consistency of methodologies through cross-comparison of results between different team members.
- Discuss robustness of analysis and vulnerabilities to systematics.
- Identify lessons learned.

# Goals of Data Challenge #2 (Spring 2020)

- Apply tools to real JWST data.
- Present & intercompare independent analyses.
- Compare achieved and predicted performance.
- Generate deliverables for Cycle 2 Call for Proposals.
  a) worked examples from pixels to planetary spectrum (required goal) to planetary properties (desired goal)
  b) documented lessons learned.
- Publish workbooks and documentation on ExoCTK website at STScI.

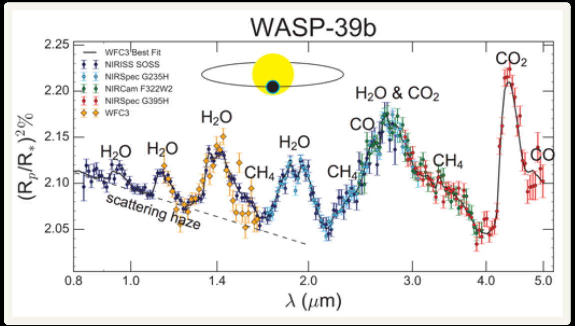
# How to Get Involved

- Get on the mailing list
- Join the team
- Sign up for a working group
- Perform pre-launch studies of the targets
- Submit a complimentary Cycle 1 proposal
- Use the ERS APT file as a working example for independent proposals
- Attend the Data Challenges

Natalie.Batalha@nasa.gov

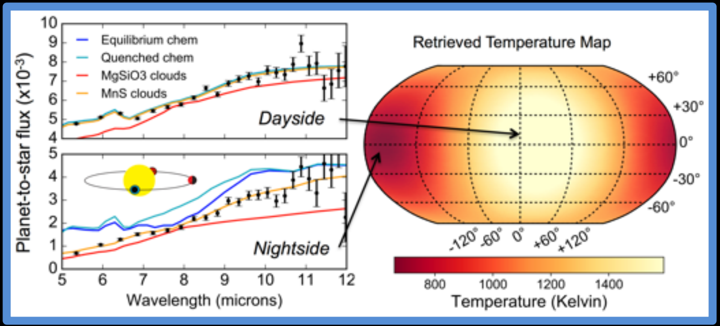
# Transiting Exoplanet Community Early Release Science for Webb

## I. Transmission Spectroscopy
$0.6\ \mu < \lambda < 5\ \mu$
WASP-79b, 42 h



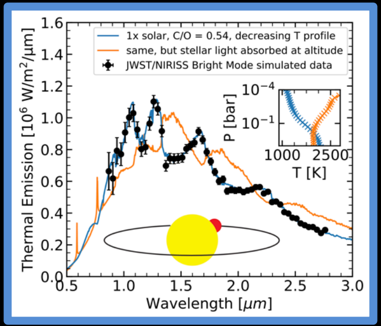

Observe one exoplanet feature (primary transit) with all available instruments (NIRISS, NIRCam, NIRSpec) and overlapping wavelengths to identify reliable modes.

## 2. MIRI Phase Curve
$5\ \mu < \lambda < 10\ \mu$
WASP-43b, 29.5




Observe all exoplanet features (primary transit, secondary eclipse, phase modulation) with the one instrument available at long wavelength & evaluate hour-to-hour stability.

## 3. Bright Star Test
$0.85\ \mu < \lambda < 2.8\ \mu$
WASP-18b, 8.6




Test stability at the photon noise floor by observing the brightest star possible with NIRISS at secondary eclipse.

# Supplemental Slides

# HISTORY OF ERS PROGRAM

UNIVERSITY OF CALIFORNIA, SANTA CRUZ

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO    SANTA BARBARA • SANTA CRUZ


UNIVERSITY OF CALIFORNIA OBSERVATORIES/LICK OBSERVATORY
DEPARTMENT OF ASTRONOMY AND ASTROPHYSICS

SANTA CRUZ, CALIFORNIA 95064


June 21, 2010

Dr. Matt Mountain, Director
Space Telescope Science Institute
3700 San Martin Drive
Baltimore, MD 21218

Dear Dr. Mountain:

At its recent meeting the James Webb Space Telescope Advisory Committee (JSTAC) continued to discuss ways in which the science return from JWST could be optimized and maximized. Meeting this goal requires that the GO and GTO science user community has access to early data demonstrating instrument and telescope performance, and is informed, involved and well-prepared to "hit the ground running" as soon as science observations begin. In particular, the JSTAC began to appreciate the need for the community to be well-informed about JWST's capabilities soon after the 6-month commissioning period ends, since the deadline for Cycle 2 Proposals occurs just a few months later.

Such community involvement and access must continue over the subsequent years. As the JSTAC noted in a previous letter (*JSTAC_Science-Operations_Capabilities.pdf*), the interplay between the short, five-year required lifetime of JWST, the TAC cycles, and a one-year proprietary period for data has a dramatic impact on the ability of the science community to implement follow-up observations. The greatest benefit from observations made by JWST will occur when the delay between initial observations and follow-up observations is minimized. However, Figure 1 in that letter (reproduced below) showed that, for data with a one-year proprietary period, the Call for Proposals for Cycle 4 is the first wherein the full Cycle 1 dataset is public and so can be used as the basis for follow-up proposals by *all members of the science community*. Such a long delay before the community has full access to key observations and datasets, and can carry out follow-up programs, will have a dramatic impact on the overall scientific productivity of JWST.

Given this context and the JSTAC's focus on maximizing the science return from JWST, the JSTAC recommends three approaches that will help develop a sophisticated science user community as quickly as possible, and provide data and results that can be rapidly utilized for subsequent proposals and observations. The three recommendations build on experience with the current three Great Observatories and are a natural extrapolation from TAC procedures and processes that have developed over the lifetime of these missions. In particular, they arose from discussions at our last

two meetings with the Institute, and suggestions based on their experience. They have been developed within the context of the previous JSTAC letter (mentioned above) and its Figure 1 (see below).

The JSTAC's recommendations are:

***First-Look Program*** – *The JSTAC recommends that the Institute develop a "First-Look" program, similar to that carried out by Spitzer in its first year, to obtain images and spectra that would be used to demonstrate key modes of the JWST instruments. The goal of this program is to enable the community to understand the performance of JWST prior to the submission of the first post-launch Cycle 2 proposals that will be submitted just months after the end of commissioning. To meet this goal, science data need to be released as soon as commissioning activities allow. The data from this "First-Look" program would complement the Early Release Observations (ERO) and the Science Verification (SV) datasets. The First-Look data should have no proprietary period. The JSTAC recommends that the First-Look data be released both in raw form and with any initial calibrations as soon as possible; the key aspect is speed. Subsequently processed and calibrated versions of the data should also be made available through the archive, as quickly as practical, as the quality of the relevant calibrations improves. The targets could be chosen initially by the Institute and announced as "preliminary first-look targets", with the understanding that the list may be modified if any of the initial targets were selected by the GTOs in their Cycle 1 science program or in the Cycle 1 GO proposals. This program is expected to utilize part of the Director's Discretionary time for Cycle 1.*

***Open access for data from Large Programs*** – *The trend for large programs at all the Great Observatories has been towards zero or small proprietary periods. This increased emphasis on open access to data has been reinforced on HST where data from programs granted Director's Discretionary time has had zero proprietary period regardless of program size, and on the other Great Observatories where the proprietary period for Director's Discretionary time has been zero or short (<3 months). The first-cycle Spitzer Legacy Science programs were established with zero proprietary periods to help ensure that optimal use was made of Spitzer during its limited life. Since that ground-breaking step, HST Treasury, Chandra VLP and subsequent Spitzer Legacy Science programs have explicitly been non-proprietary, with full and open access. This has benefited the broad science community through increased utilization of unique and costly resources. These open datasets have also provided incentives for timely publication through increased competition.*

*Given these trends, the success of the wholly non-proprietary HST Treasury, Chandra VLP and Spitzer Legacy Science programs, and the value of unrestricted access to large datasets, especially given the limited lifetime of JWST, the JSTAC recommends that all JWST Large programs have zero proprietary period. The JSTAC extensively discussed the issue of proprietary time and recognizes that some classes of observations, even in Large programs, would benefit from a scientifically-justified proprietary period. To accommodate observational programs of this nature, the JSTAC further recommends that proposers of Large programs could request and justify a proprietary period in their proposal to the Time Assignment Committee (TAC). If so recommended by the TAC, the proposing team could be allocated a proprietary period by the Director, consistent with current procedures and policies.*

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2

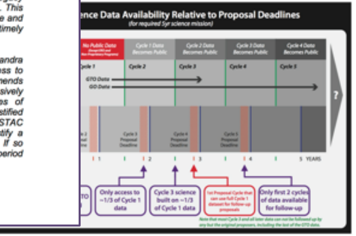

three recommendations are consistent with policies adopted for ervatories, or formalize what has become the increasing trend ccess, particularly for large programs, as reflected through the er-review TAC process. We expect that the implementation of ndations for JWST will enhance the scientific productivity of our y.

half of the Committee,

embers: Roberto Abraham, Neta Bahcall, Stefi Baum, Roger kman, Malcolm Longair, Christopher McKee, Bradley Peterson, Seager, Lisa Storrie-Lombardi, Monica Tosi

esentatives of the space agencies: Luc Brule (CSA), John Mather ghrean (ESA), Eric Smith (NASA HQ)

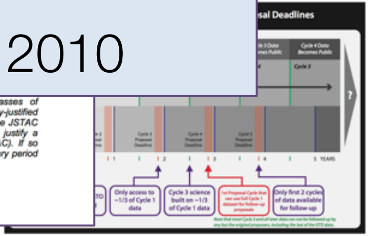
Flanagan, Massimo Stiavelli, Peter Stockman



# HISTORY OF ERS PROGRAM

JSTAC Recommends an Early Release Science Program "… to obtain images and spectra…to demonstrate key modes…to enable the community to understand the performance of JWST prior to submission of…Cycle 2 proposals…"

JWST Advisory Committee (JSTAC), 2010



# Program Principles & Selection Criteria

- Projects should provide representative data sets of broad interest in major sub-disciplines.
- Data must be acquired in first 5 months of operation with flexible starting date.
- Projects must design, create, & deliver science-enabling products by release of Call for Proposals for Cycle 2 in Sep 2019.
- Project should develop products that enrich scientific return of mission.
- No proprietary period for data
- Project should demonstrate scientific merit and significance to major astrophysical sub-disciplines.
- Teams should be diverse and inclusive and promote equitable participation in JWST scientific discovery.

# Five Criteria for ERS Selection:

1. The extent to which the project will improve community understanding of JWST science capabilities and guide subsequent JWST observations;
2. The effectiveness in providing deliverables that include quantitative, data-related measurements that will support the development of Cycle 2 proposals;
3. The extent to which science-enabling products will be developed to enrich overall scientific return of the mission;
4. The credibility of the management plan for achieving the project goals in a timely manner, particularly the development and delivery of science-enabling products for the community;
5. The overall scientific merit of the program; its significance to major astrophysical sub-disciplines, and to astronomy in general.

The Call also states that STScI places a high value on diverse representation of the community

# Community Efforts Started in 2015

Publications of the Astronomical Society of the Pacific, 128:094401 (11pp), 2016 September
doi:10.1088/1538-3873/128/967/094401


**Transiting Exoplanet Studies and Community Targets for *JWST*'s Early Release Science Program**

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Stevenson et al. 2016 PASP 128 967

Enabling Transiting Exoplanet Science with JWST, 16-18 Nov 2015

# ERS Working Group

- Initiated October 2016
- Initial Executive Committee: Fortney, Lopez-Morales, Line, Knutson, Sing
- Open invitation announced via ExoPAG
- ~90 scientists responded to call
- Re-evaluation of Stevenson et al. 2016
- Solicitation of new ideas
- Pandexo Training
- Target Evaluation
- HST Data Analysis

# 1) Transmission Program (42 hours)

One feature (primary transit), multiple instruments

- Hot Jupiter w/ previously observed spectroscopic features: WASP-63b, WASP-39b, WASP-62b, WASP-79b
- 4 Observing Modes at $\lambda < 5\ \mu$ (NIRISS, NIRSpec, NIRCam)

Technical Goals:

- Identify the best observing mode for $\lambda < 5\ \mu$
- Understand instrument systematics by comparing overlapping spectra
- Explore the 2$^{nd}$ order contamination of NIRISS/SOSS
- Evaluate precision of limb darkening models

# 2) MIRI Phase Curve (29.5 hours)

All features (transit, phase, secondary), one instrument

- One short period (≤ 1 day) giant planet with known phase modulation: WASP-43b or WASP-18b
- 1 transit + 2 eclipses for repeatable baseline
- LRS

Technical Goals

- Provide representative data at $\lambda > 5\ \mu$
- Investigate background-limited noise response
- Quantify stability over longer timescales

# 3) Bright Star Test (8.6 hours)

Science Near the Noise Floor: Day-side Emission

- Single observation of previously measured secondary eclipse of planet orbiting relatively bright ($6 < K < 8$) star.

Technical Goals

- Push photon noise to 20 ppm noise floor to test stability.

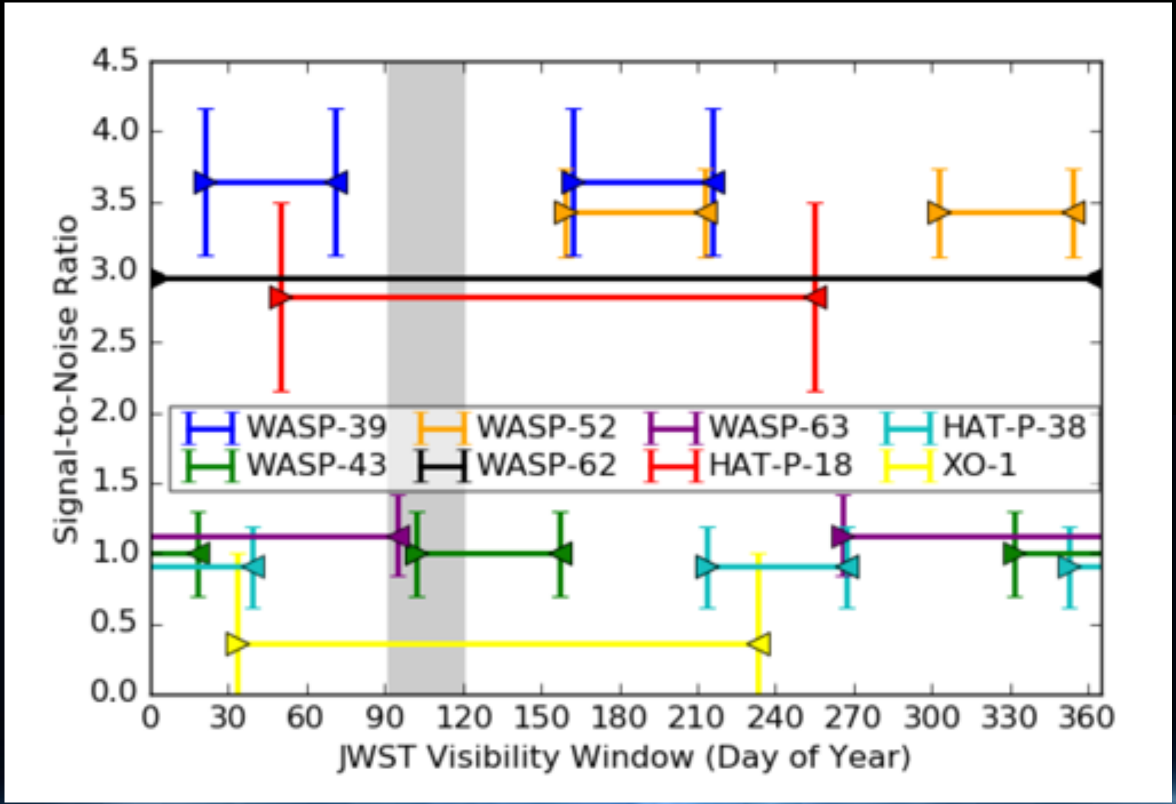
| NAME | Kmag | Teq | Rp/Re | Mp/Me | Tdur | Transit | Eclipse | Phase | NIRISS | NIRCam | NIRSpec | MIRI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GJ 1132b | 9.3 | 580 | 1.16 | 1.6 | ~1 | 5 | | | SOSS | | | |
| GJ 3470b | 8.8 | 600 | 3.8 | 13.7 | 1.9 | 1 | | | SOSS | | | |
| GJ 436b | 6.1 | 700 | 4.2 | 22 | 0.8 | 1 | 8 | | SOSS | F322W2, F444W | | LRS |
| HAT-P-12b | 10.1 | 963 | 10.7 | 67 | 2.3 | 1 | 1 | | | | | LRS |
| HAT-P-19b | 10.5 | 1010 | 12.7 | 93 | 2.84 | | 3 | | | F322W2, F444W | | LRS |
| HAT-P-1b | 9.2 | 1320 | 13.6 | 169 | 2.8 | 1 | 1 | | SOSS | | | |
| HAT-P-26b | 9.6 | 1000 | 6.2 | 19 | 2.46 | 5 | 2 | | SOSS | F322W2, F444W | G395H | LRS |
| HD 149026 | 6.8 | 1630 | 9.1 | 117 | 3.2 | | 2 | | | F322W2, F444W | | |
| HD 189733b | 5.5 | 1190 | 12.5 | 360 | 1.82 | | 2 | | | F322W2, F444W | | |
| HD 209458 | 6.6 | 1450 | 15.2 | 218 | 3 | 1 | 3 | | SOSS | F322W2, F444W | | |
| K2-18b | 9.8 | 270 | 2.2 | N/A | 2.7 | 2 | | | SOSS | | | |
| LHS 1140b | 8.8 | 230 | 1.43 | 6.65 | ~2 | 2 | | | SOSS | | G395H | |
| TRAPPIST-1b | 10.3 | 400 | 1.086 | 0.85 | 0.61 | | Phot | | | | | F1500W |
| TRAPPIST-1e | 10.3 | 251 | 0.918 | 0.62 | 0.95 | X | | | | | Prism | |
| TRAPPIST-1f | 10.3 | 219 | 1.045 | 0.68 | 1.1 | X | | | SOSS | | | |
| TRAPPIST-1g | 10.3 | 199 | 1.127 | 1.34 | 1.1 | X | | | SOSS | | | |
| WASP-107b | 8.6 | 740 | 10.5 | 38 | 2.75 | 5 | | | SOSS | F322W2, F444W | G395H | LRS |
| WASP-121b | 9.6 | 2360 | 20.5 | 376 | 2.9 | | | 1 | SOSS | | | |
| WASP-17b | 10.2 | 1750 | 22 | 154 | 4.4 | 3 | 3 | | SOSS | | G395H | LRS |
| WASP-43b | 9.3 | 1350 | 10.2 | 566 | 1.2 | | | 1 | | | Prism | |
| WASP-52b | 10.1 | 1315 | 14.2 | 146 | 1.8 | | 1 | | | | X | |
| WASP-69b | 8 | 960 | 11.6 | 82 | 2.2 | 1 | | | SOSS | | | |
| WASP-77Ab | 8.4 | 1674 | 13.6 | 560 | 2.2 | | 2 | | | F322W2, F444W | | |
| WASP-80b | 8.4 | 850 | 10.7 | 180 | 2.11 | 4 | 3 | | SOSS | F322W2, F444W | | LRS |

# Candidate ERS Targets

| Name | Feature | Kmag | Teff | Rstar | Period | Rplanet | Mplanet | Tr_depth | Tr_dur | Teq |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | [K] | [Rsun] | days | [R_J] | [M_J] | [ppm] | [h] | [K] |
| WASP-39 b | Transit | 10.2 | 5400 | 0.9 | 4.0553 | 1.3 | 0.3 | 21100 | 2.8 | 1092 |
| WASP-43 b | Transit | 9.3 | 4400 | 0.6 | 0.8135 | 0.9 | 1.8 | 25500 | 1.2 | 1344 |
| WASP-52 b | Transit | 10.1 | 5000 | 0.8 | 1.7498 | 1.3 | 0.5 | 27100 | 1.8 | 1266 |
| WASP-63 b | Transit | 9.4 | 5570 | 1.9 | 4.3781 | 1.4 | 0.4 | 6090 | 5.3 | 1498 |
| HAT-P-18 b | Transit | 10.2 | 4803 | 0.8 | 5.508 | 1 | 0.2 | 21790 | 2.7 | 827 |
| HAT-P-38 b | Transit | 10.5 | 5330 | 0.9 | 4.6404 | 0.8 | 0.3 | 8430 | 3 | 1050 |
| XO-1 b | Transit | 9.5 | 5750 | 0.9 | 3.9415 | 1.2 | 0.9 | 17420 | 3 | 1183 |
| WASP-62 b | Transit | 8.9 | 6280 | 1.3 | 4.412 | 1.4 | 0.6 | 12300 | 3.8 | 1402 |
| KELT-7 b | Eclipse | 7.5 | 6789 | 1.7 | 2.7348 | 1.5 | 1.3 | 8280 | 3.5 | 1997 |
| KELT-11 b | Eclipse | 6.1 | 5370 | 2.7 | 4.7365 | 1.4 | 0.2 | 2690 | 7.3 | 1667 |
| WASP-18 b | Eclipse | 8.1 | 6400 | 1.2 | 0.9415 | 1.2 | 10.4 | 8750 | 2.1 | 2343 |
| HAT-P-22 b | Eclipse | 7.8 | 5302 | 1 | 3.2122 | 1.1 | 2.1 | 8894 | 2.9 | 1249 |
| WASP-43 b | Phase | 9.3 | 4400 | 0.6 | 0.8135 | 0.9 | 1.8 | 25500 | 1.2 | 1344 |
| WASP-18 b | Phase | 8.1 | 6400 | 1.2 | 0.9415 | 1.2 | 10.4 | 8750 | 2.1 | 2343 |

Note: new candidate targets for MIRI have been identified and are not represented in this table.

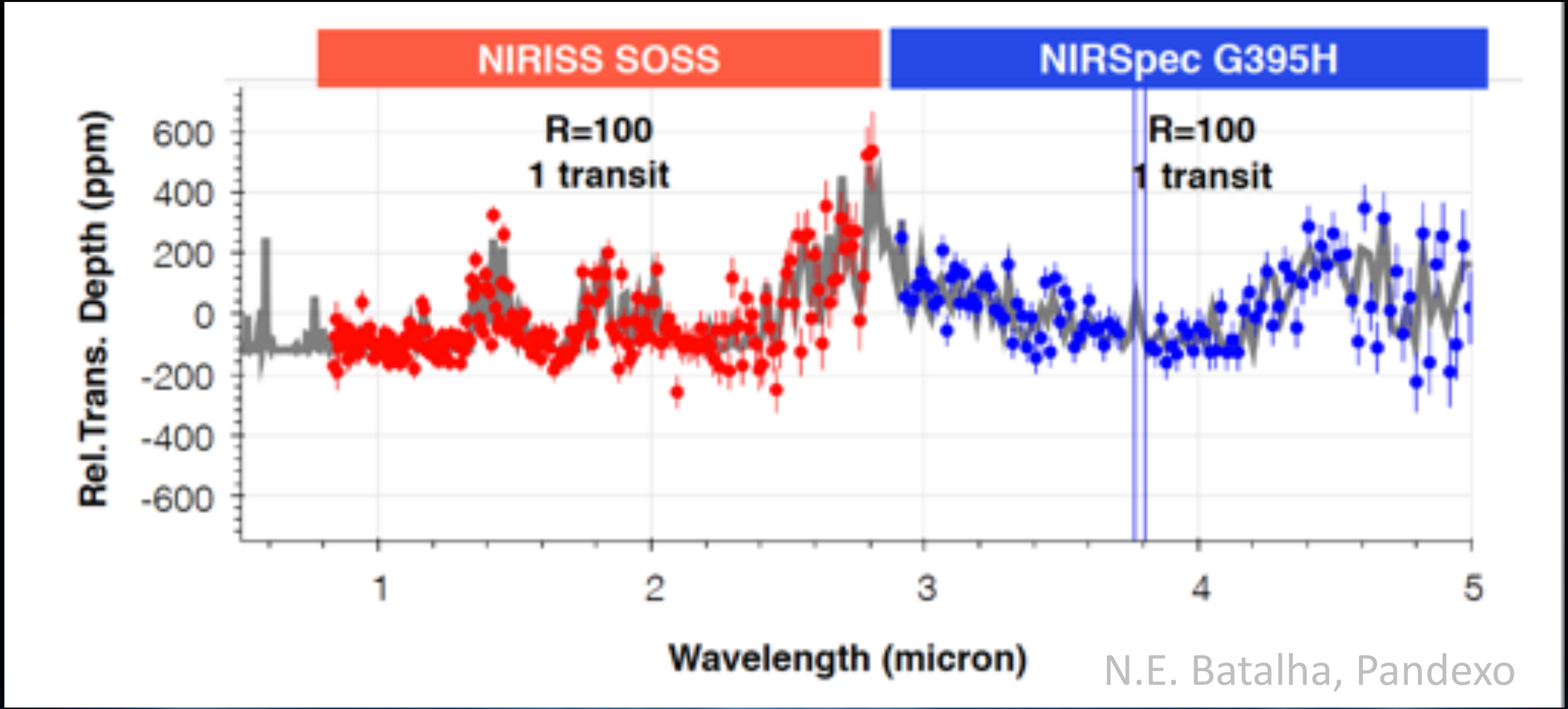
# Transmission Program: Candidate Targets




Per Transit:
7 hours
4-Mode:
28-40 h
3-Mode:
21-30 h

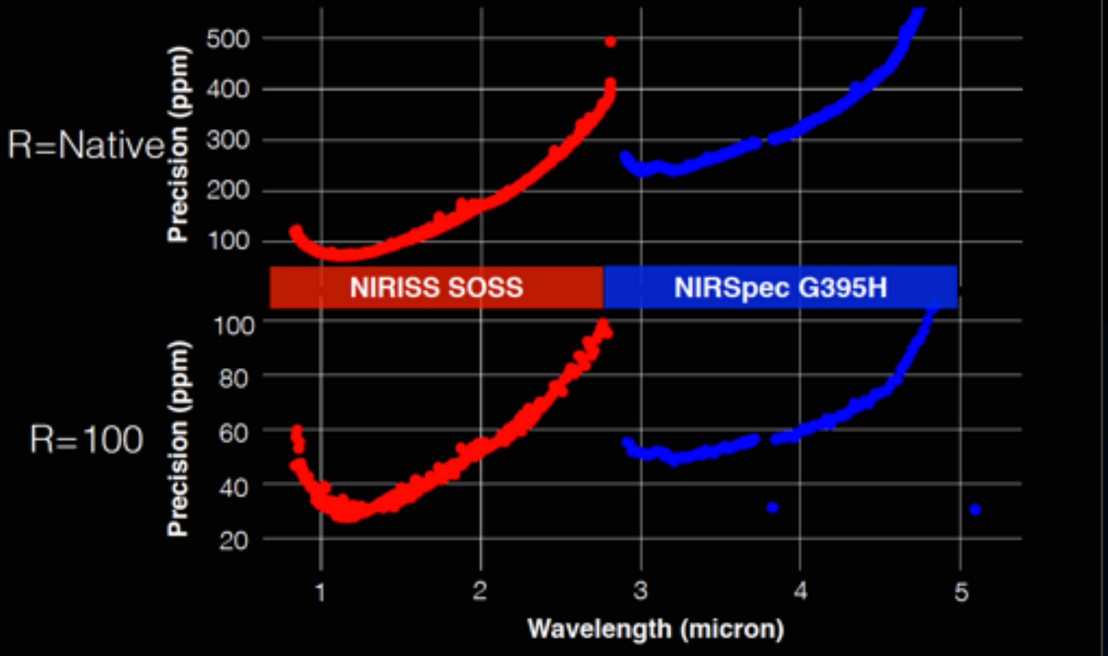
# Transmission Program: Synthetic Spectra

WASP-62 J=9.3

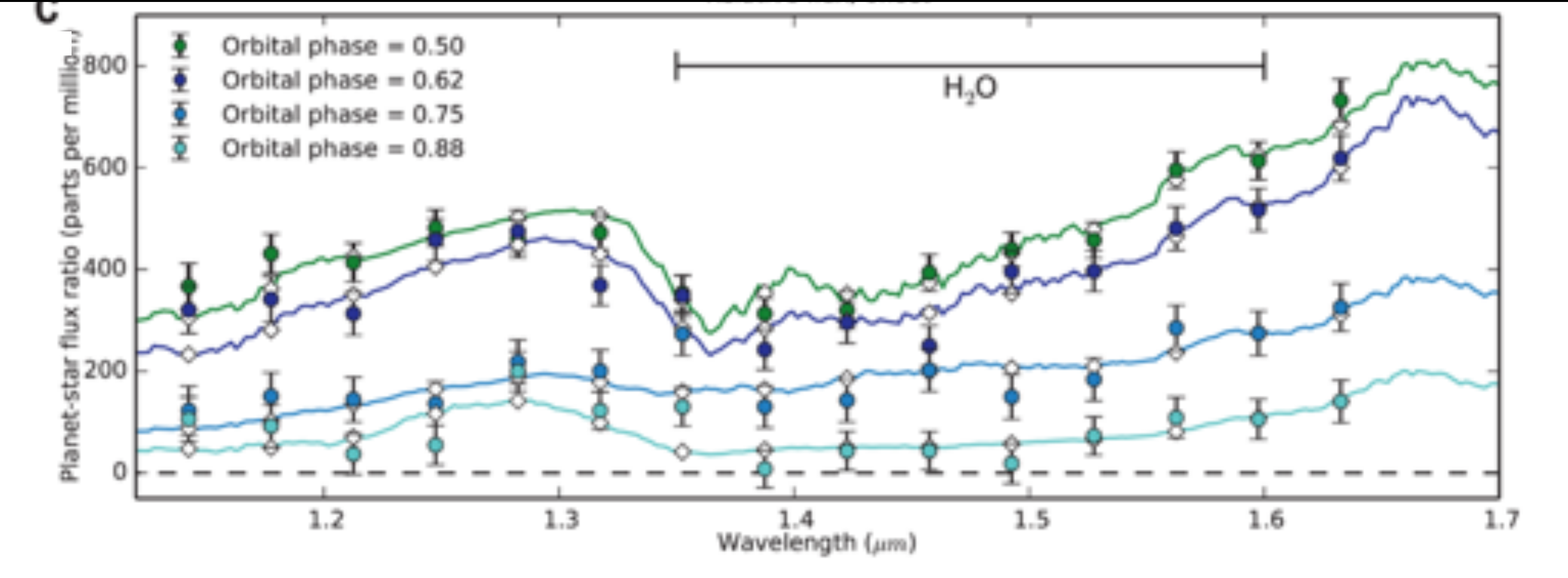


# Transmission Program: Expected Precision

WASP-62 J=9.3



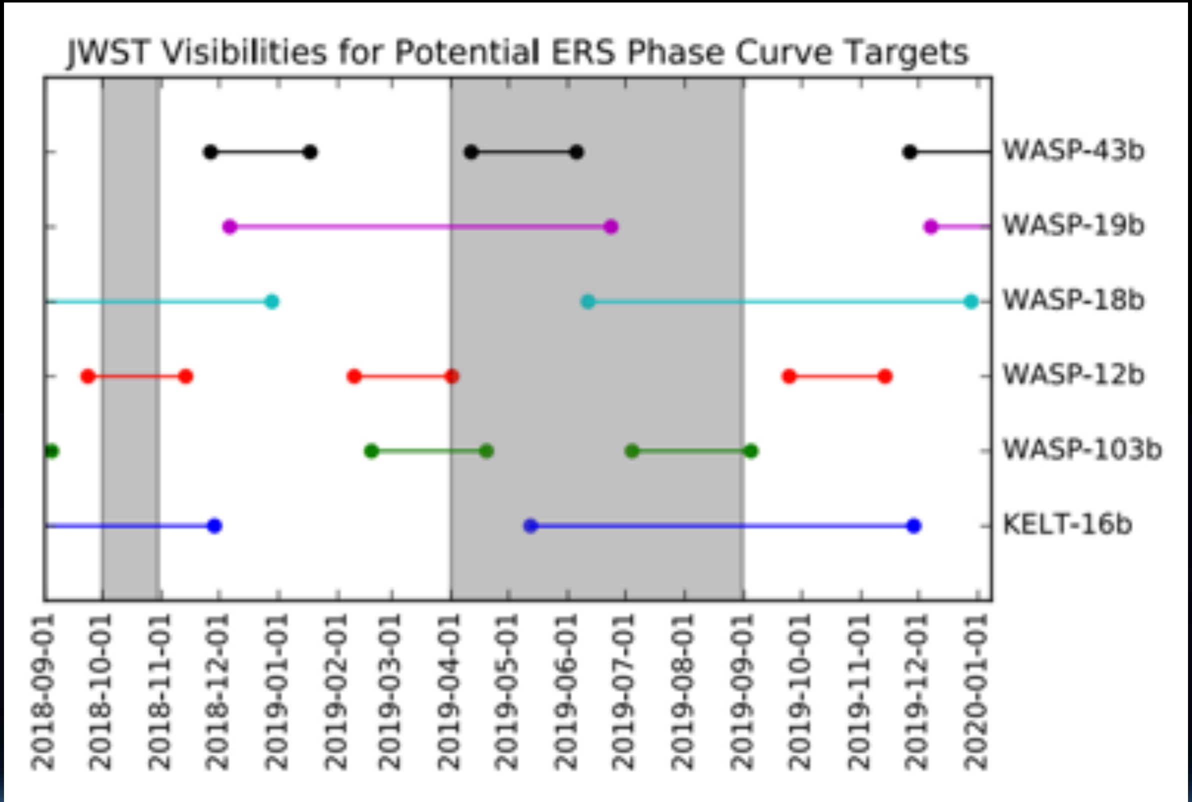
# MIRI Phase Curve: Candidate Targets




WASP-43 b, WFC3 Phase-Resolved Spectra

Stevenson et al. 2014

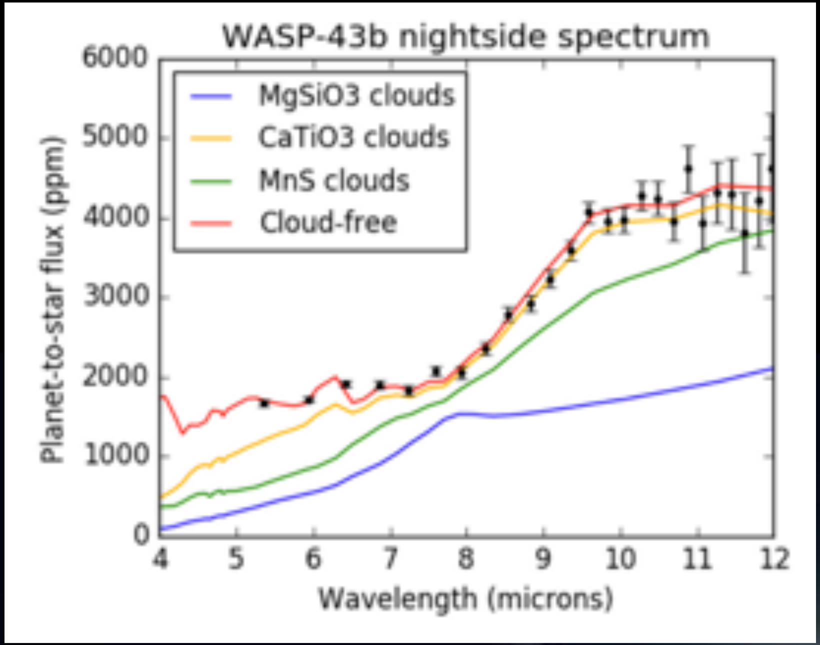
# MIRI Phase Curve: Target Visibility



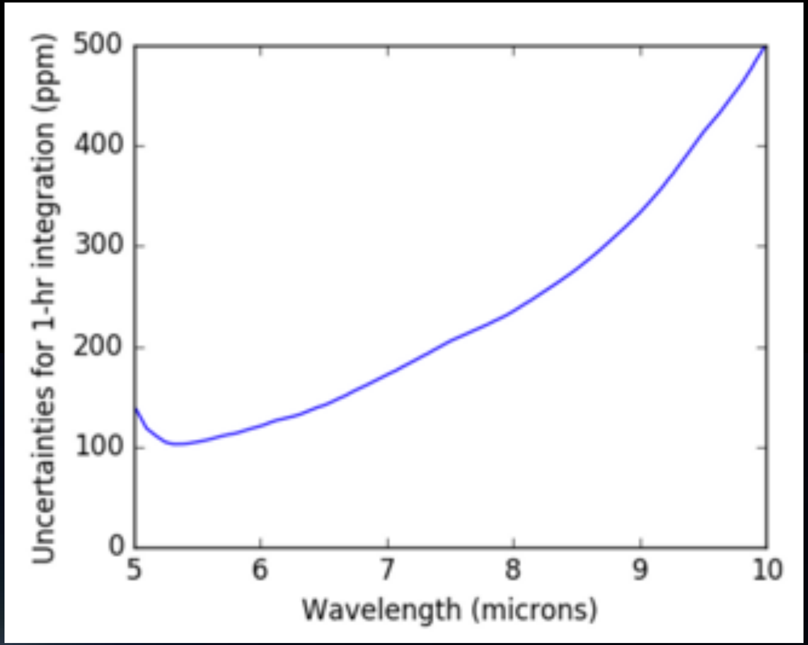

c/o Kamen Todorov & Jonathan Fraine

# MIRI Phase Curve: LRS Simulated Data

1-hour relative precision at native resolution




Models from Vivien Parmentier




Pandexo Simulations

# Program Overview

## Panchromatic **Transmission**

- nominal target: **WASP-79b**
- transits with NIRISS/SOSS, NIRSpec/G235H & G395H, and NIRCam/F322W2 (four total)

## MIRI **Phase Curve**

- nominal target: **WASP-43b**
- one continuous, full-orbit observation covering two secondary eclipses and one transit with MIRI/LRS

## Bright Star's Planet **Emission**

- nominal target: **WASP-18b**
- one secondary eclipse using NIRISS/SOSS