

TRANSITING EXOPLANET COMMUNITY EARLY RELEASE SCIENCE PROGRAM

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TRANSMISSION WORKING GROUP LEAD



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SCIENCE INSTITUTE

DIRECTORS DISCRETIONARY EARLY RELEASE SCIENCE PROGRAMS

Context

STScI Director Ken Sembach has allocated up to 500 hours of Director's Discretionary time for Early Release Science (DD-ERS) to accelerate the diffusion of JWST know-how, and expand early opportunities for the community to gain experience with JWST data and scientific analysis.



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*First Light &
Reionization*



*Assembly of
Galaxies*



*Birth of Stars &
Protoplanetary
Systems*



*Planets &
Origins of Life*

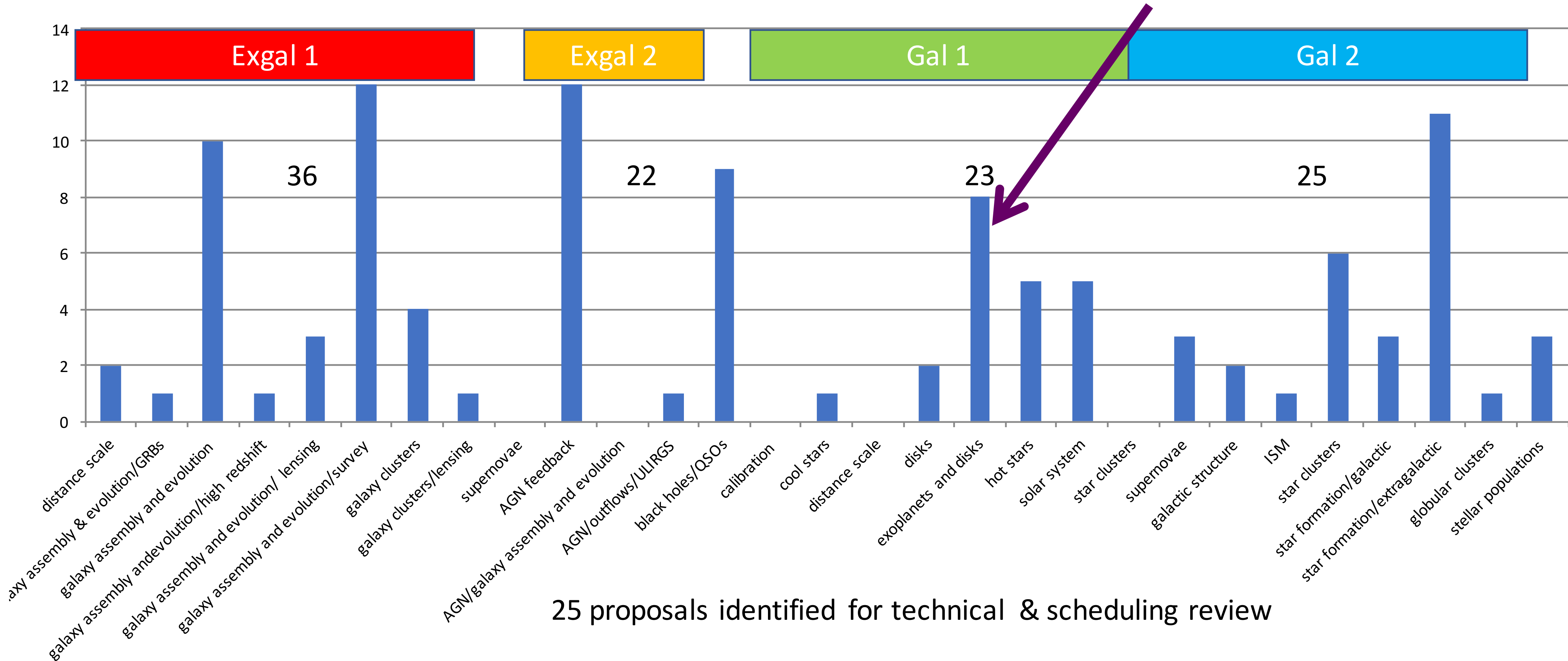
Early resources are allocated to support up to 15 teams. Proposals will be selected in research areas spanning the science themes of JWST :

- ▶ *A multi-disciplinary committee of experts will recommend a suite of proposals that both fulfills the goals of the DD-ERS and makes optimal use of the available time for observation and funding.*
- ▶ *All data will be available immediately with no exclusive access period.*



DD-ERS SUBMITTED PROPOSALS

8 Exoplanets and disks proposals



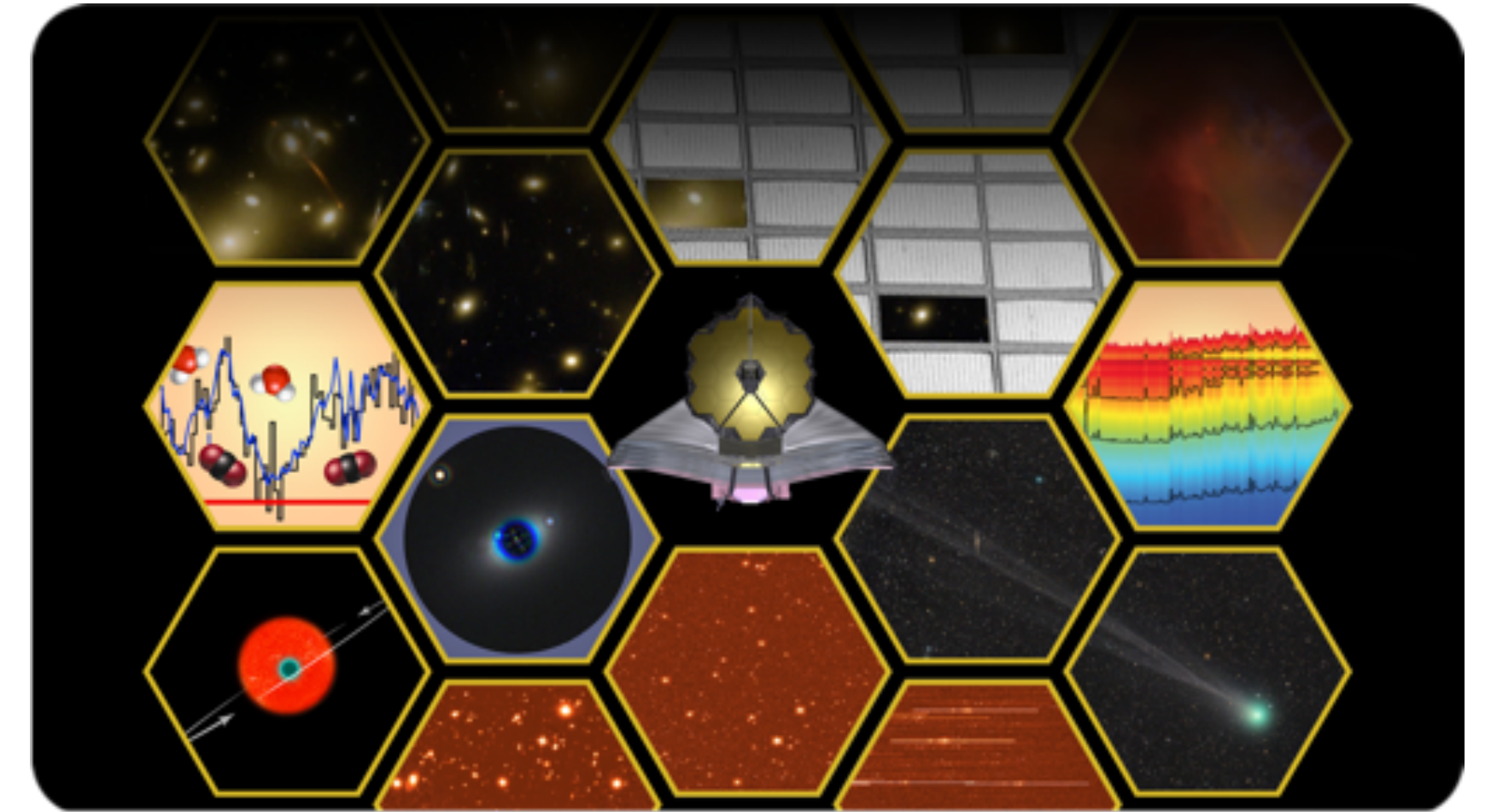
DD-ERS APPROVED PROGRAMS

13 programs, 487 hours

Galaxies, IGM, & black holes (6)

Stellar physics & populations (4)

Solar system, planet formation, & exoplanets (3)



Three largest programs were awarded 78.1, 63.2, and 50.1 “charged” hours

Three largest teams have 138, 105, and 80 investigators/collaborators

Exoplanets represent 8% of the proposals, but awarded ~27% of the time!



THE TRANSITING EXOPLANET COMMUNITY

Investigator	Institution	Country
M Alam	Harvard University	USA/MA
N Batalha	NASA Ames Research Center	USA/CA
N Batalha	Space Telescope Science Institute	USA/MD
J Bean	University of Chicago	USA/IL
! B Benneke	Universite de Montreal	CAN
Z Berta-Thompson	University of Colorado at Boulder	USA/CO
J Blecie	New York University	USA/NY
G Bruno	Space Telescope Science Institute	USA/MD
* A Carter	University of Exeter	GBR
J Chapman	Jet Propulsion Laboratory	USA/CA
I Crossfield	Massachusetts Institute of Technology	USA/MA
* N Crouzet	Instituto de Astrofisica de Canarias	ESP
* L Decin	Katholieke Universiteit Leuven	BEL
* B Demory	University of Bern	CHE
* J Desert	Universiteit van Amsterdam	NLD
D Dragomir	Massachusetts Institute of Technology	USA/MA
* T Evans	University of Exeter	GBR
J Fortney	University of California - Santa Cruz	USA/CA
J Fraine	Space Telescope Science Institute	USA/MD
P Gao	NASA Ames Research Center	USA/CA
* A Garcia Munoz	Technische Universitat Berlin	DEU
* N Gibson	The Queen's University of Belfast	GBR
* J Goyal	University of Exeter	GBR
J Harrington	University of Central Florida	USA/FL
* K Heng	University of Bern	CHE
R Hu	Jet Propulsion Laboratory	USA/CA
E Kempton	University of Maryland	USA/MD
* S Kendrew	ESA-European Space Astronomy Centre	ESP
B Kilpatrick	Brown University	USA/RI
H Knutson	California Institute of Technology	USA/CA
L Kreidberg	Harvard University	USA/MA
J Krick	Caltech/IPAC	USA/CA
* P Lagage	Commissariat a l'Energie Atomique (CEA)	FRA
* M Lendl	Space Research Institute, Austrian Academy of Sciences	AUT
M Line	Arizona State University	USA/AZ
M Lopez-Morales	Smithsonian Institution Astrophysical Observatory	USA/MA
* T Louden	The University of Warwick	GBR
* N Madhusudhan	University of Cambridge	GBR

61 investigators

- 23 ESA participants

Investigator	Institution	Country
A Mandell	NASA Goddard Space Flight Center	USA/MD
M Mansfield	University of Chicago	USA/IL
E May	University of Michigan	USA/MI
* G Morello	University College London	GBR
C Morley	Harvard University	USA/MA
J Moses	Space Science Institute	USA/CO
* N Nikolov	University of Exeter	GBR
V Parmentier	University of Arizona	USA/AZ
S Redfield	Wesleyan University	USA/CT
J Roberts	University of Colorado at Boulder	USA/CO
E Schlawin	University of Arizona	USA/AZ
A Showman	University of Arizona	USA/AZ
* D Sing	University of Exeter	GBR
* J Spake	University of Exeter	GBR
K Stevenson	Space Telescope Science Institute	USA/MD
M Swain	Jet Propulsion Laboratory	USA/CA
* K Todorov	Universiteit van Amsterdam	NLD
* A Tsiaras	University College London	GBR
* O Venot	Laboratoire Interuniversitaire des Systèmes Atmosphériques	FRA
W Waalkes	University of Colorado at Boulder	USA/CO
H Wakeford	Space Telescope Science Institute	USA/MD
* P Wheatley	The University of Warwick	GBR
R Zellem	Jet Propulsion Laboratory	USA/CA

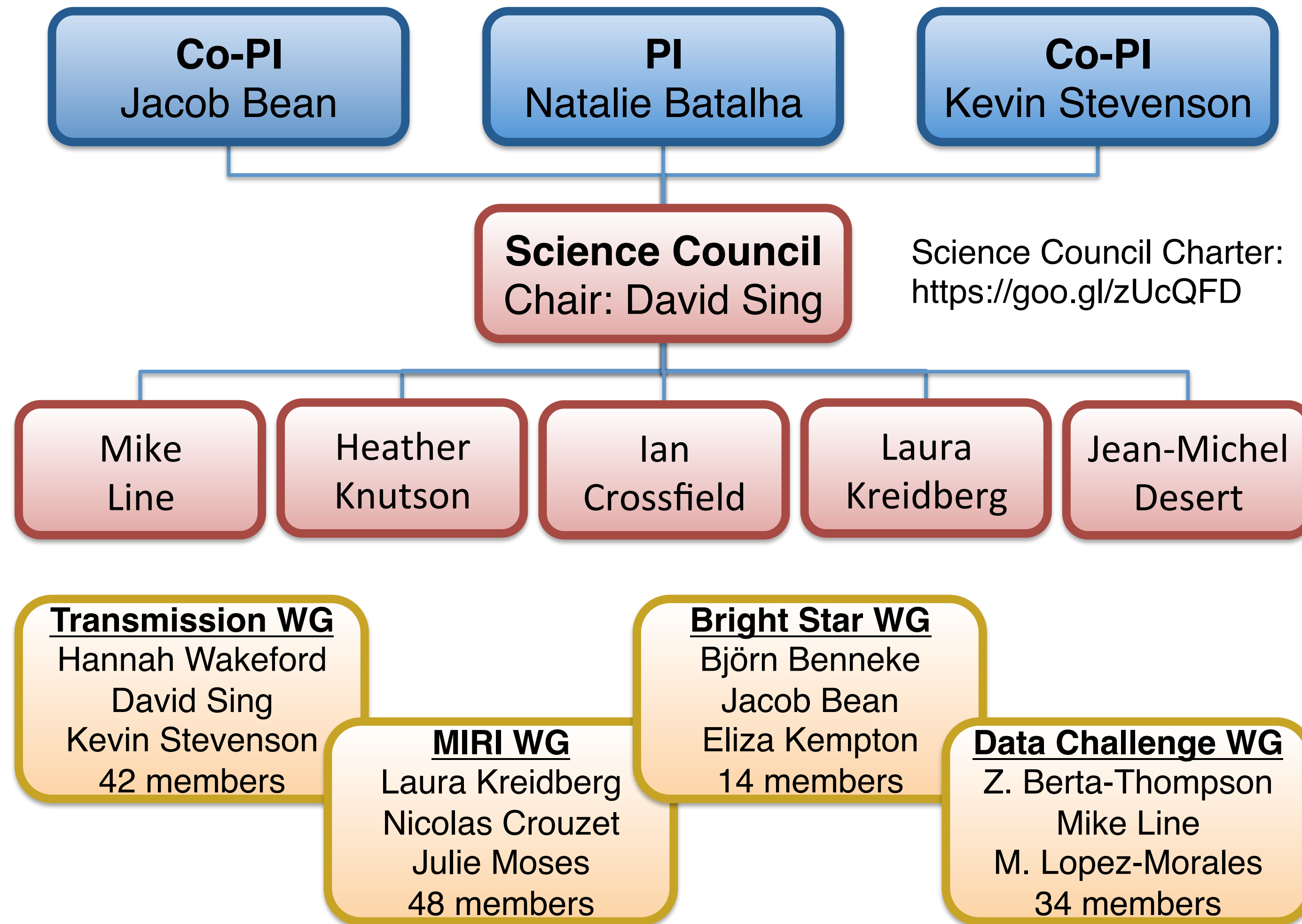
Number of investigators: 61

* ESA investigators: 23

! CSA investigators: 1



MANAGEMENT STRUCTURE



- ▶ **PIs were peer-elected**
- ▶ **Expertise**
 - 58% observers
 - 33% theorists
- ▶ **Geographic locations**
 - 54% US
 - 46% EU & CA
- ▶ **Gender**
 - 23% women (team)
 - 44% women (leadership)



STRATEGIC OBJECTIVE

1. Determine the spectrophotometric time-series performance of key instrument modes on all the relevant timescales and for a representative range of target star brightnesses.
2. Jump-start the process of developing remediation strategies for instrument- specific systematic noise.
3. Provide the community a comprehensive suite of transiting exoplanet data to fully demonstrate JWST's scientific capabilities in this area.



OBSERVING PROGRAM SUMMARY

Panchromatic: 39.6 hours
Phase Curve: 29.4 hours
Bright Star: 6.18 hours

Total : 78.1 hours

Panchromatic Transmission

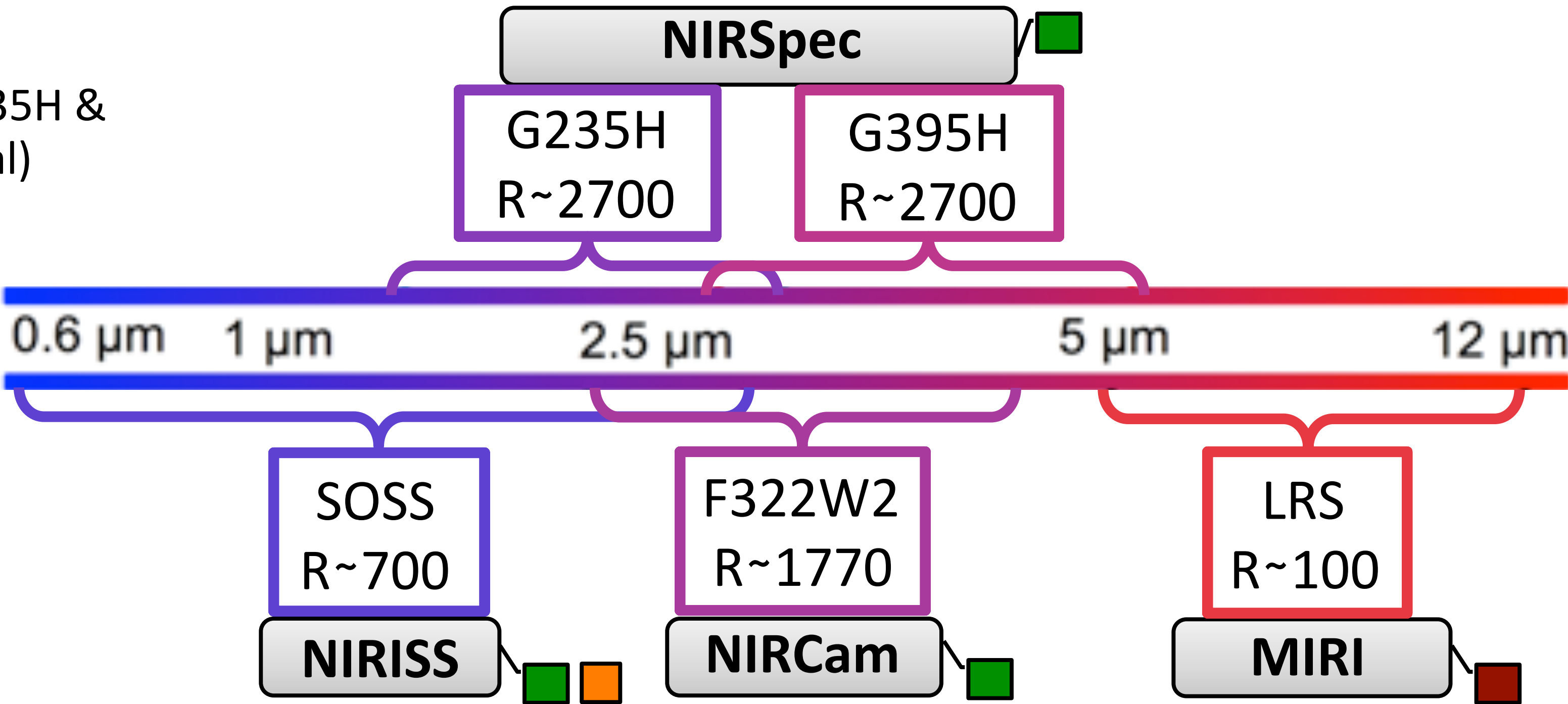
- nominal target: **WASP-79b**
- transits with NIRISS/SOSS, NIRSpec/G235H & G395H, and NIRCам/F322W2 (four total)

MIRI Phase Curve

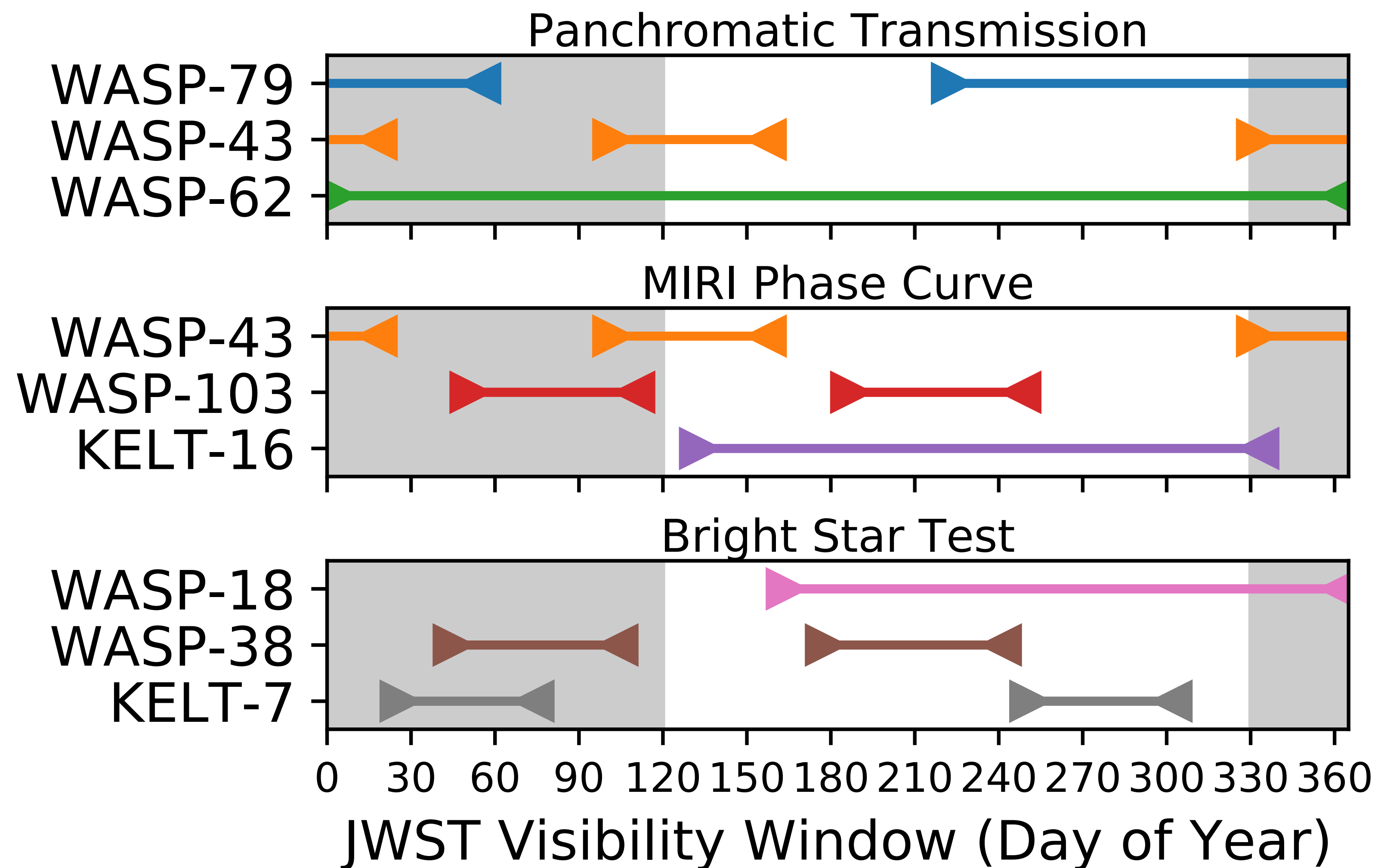
- nominal target: **WASP-43b**
- one continuous, full-orbit observation covering two secondary eclipses and one transit with MIRI/LRS

Bright Star’s Planet Emission

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



PLAN FOR TARGET SELECTION



PANCHROMATIC TRANSMISSION PROGRAM

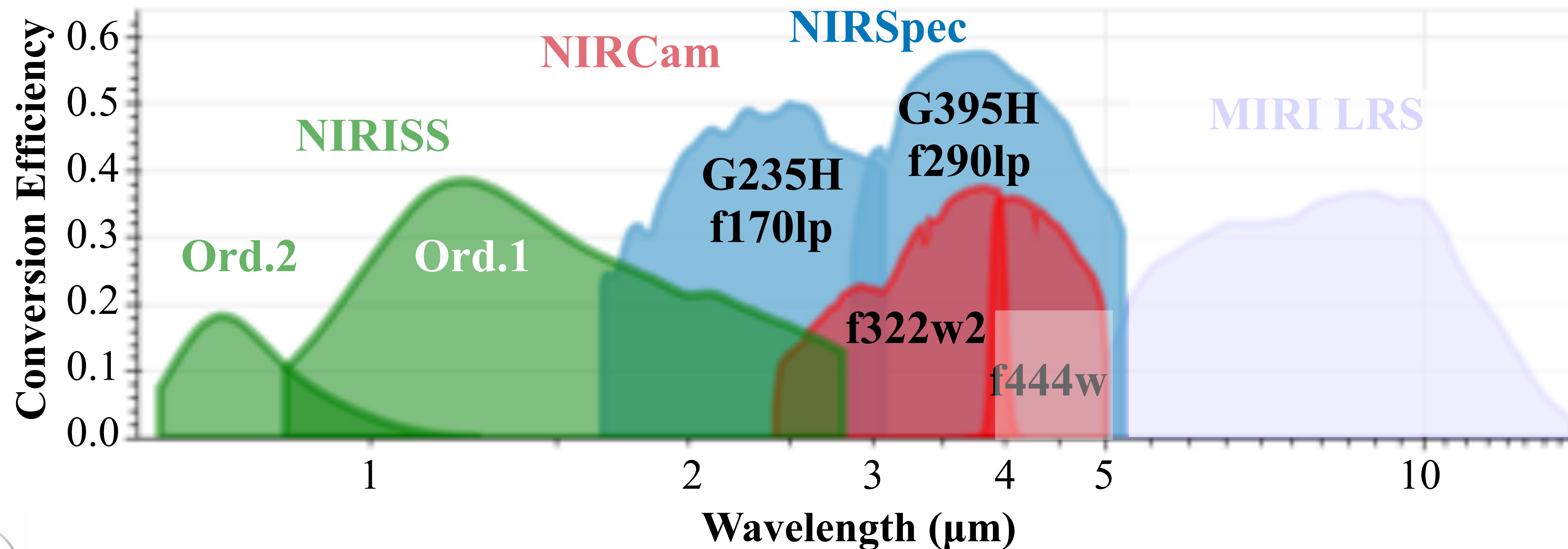
Will test all three near-IR instruments from 0.6-5.0 μm

NIRISS SOSS (0.6-2.8 μm)

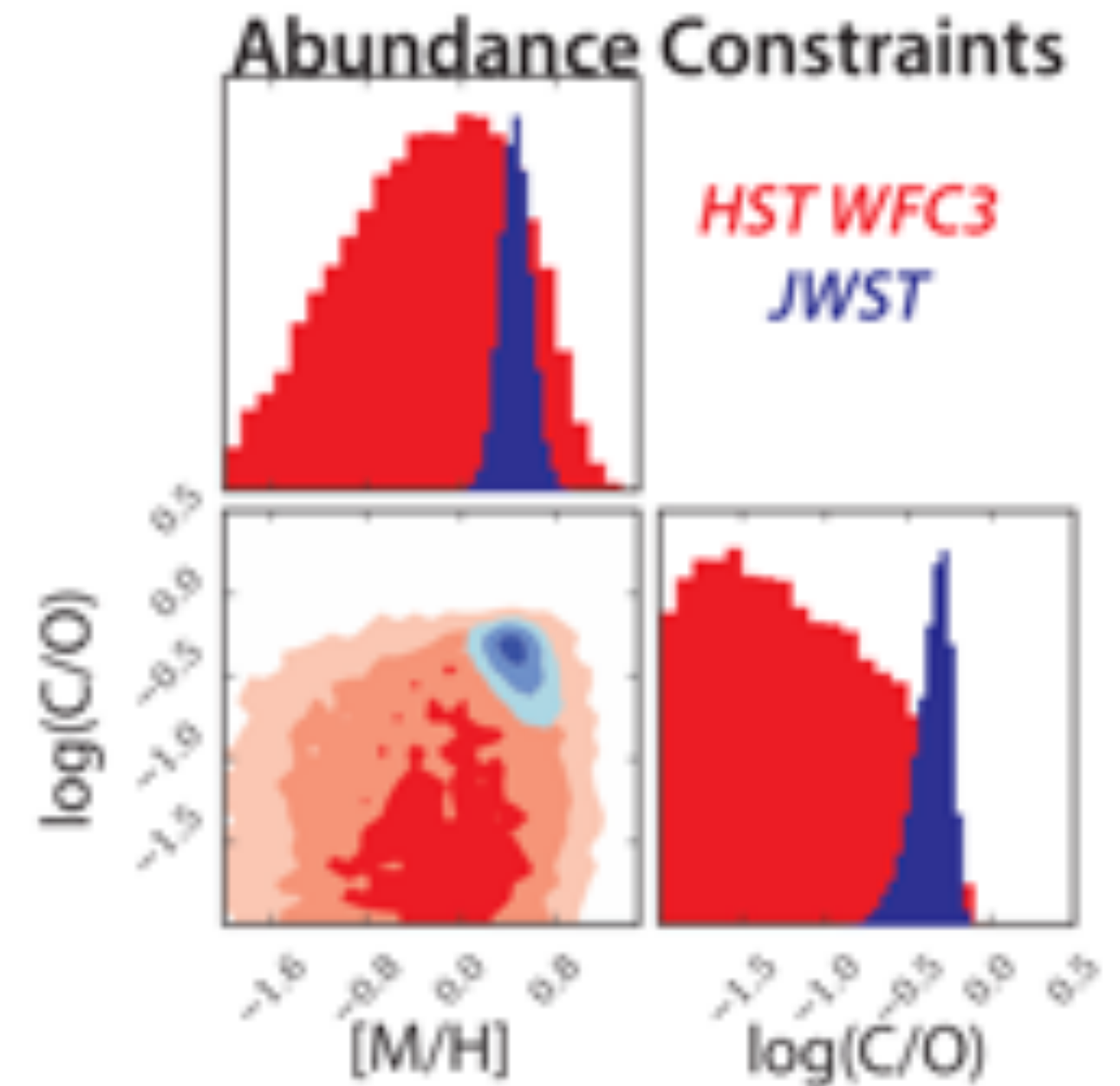
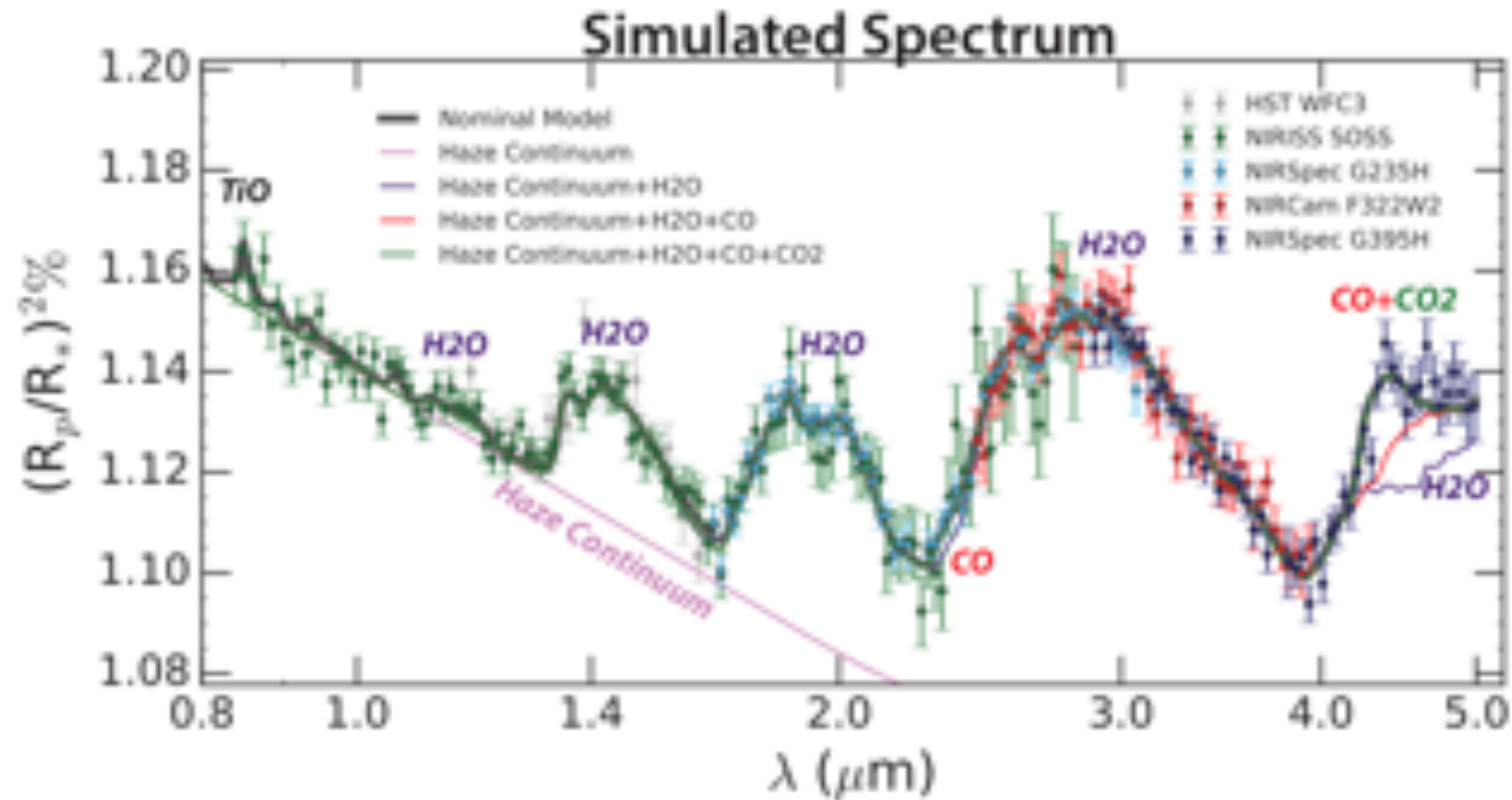
NIRSpec G235H & G395H (1.66-5.1 μm)

NIRCam F322W2 (2.5-4.0 μm)

We will have overlap with
multiple instruments from
1.6-4.0 μm



SIMULATED TRANSMISSION SPECTRUM OF WASP-79b

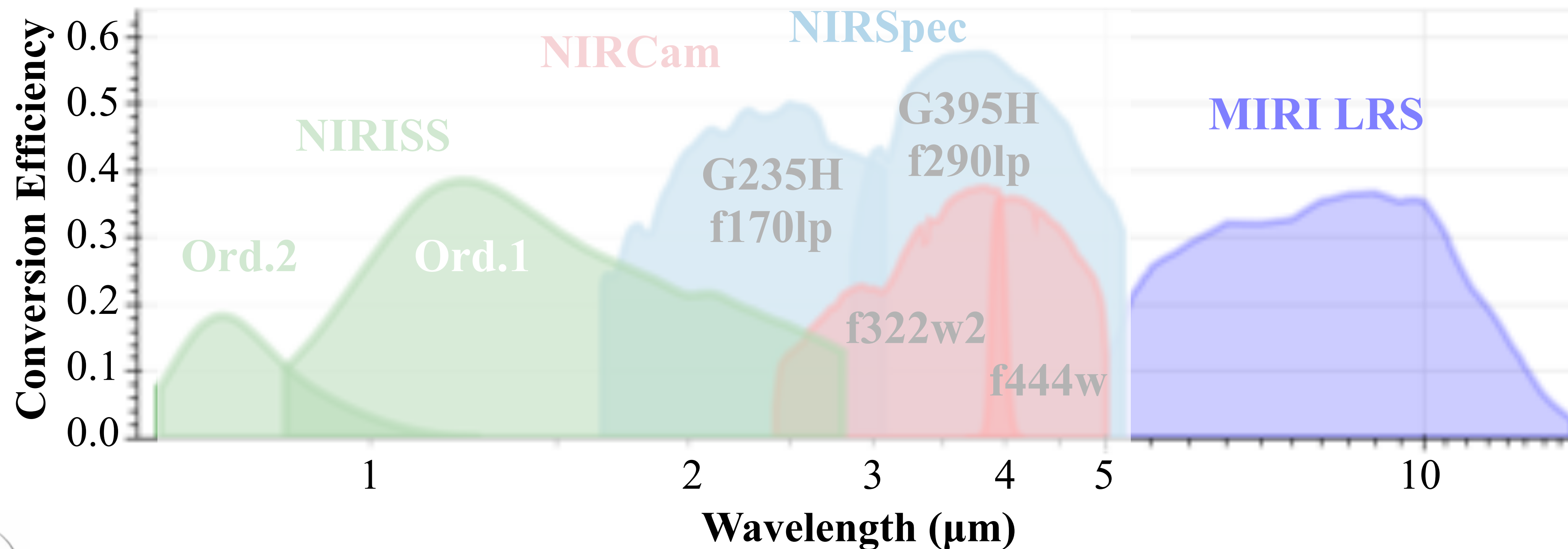


MIRI PHASE CURVE

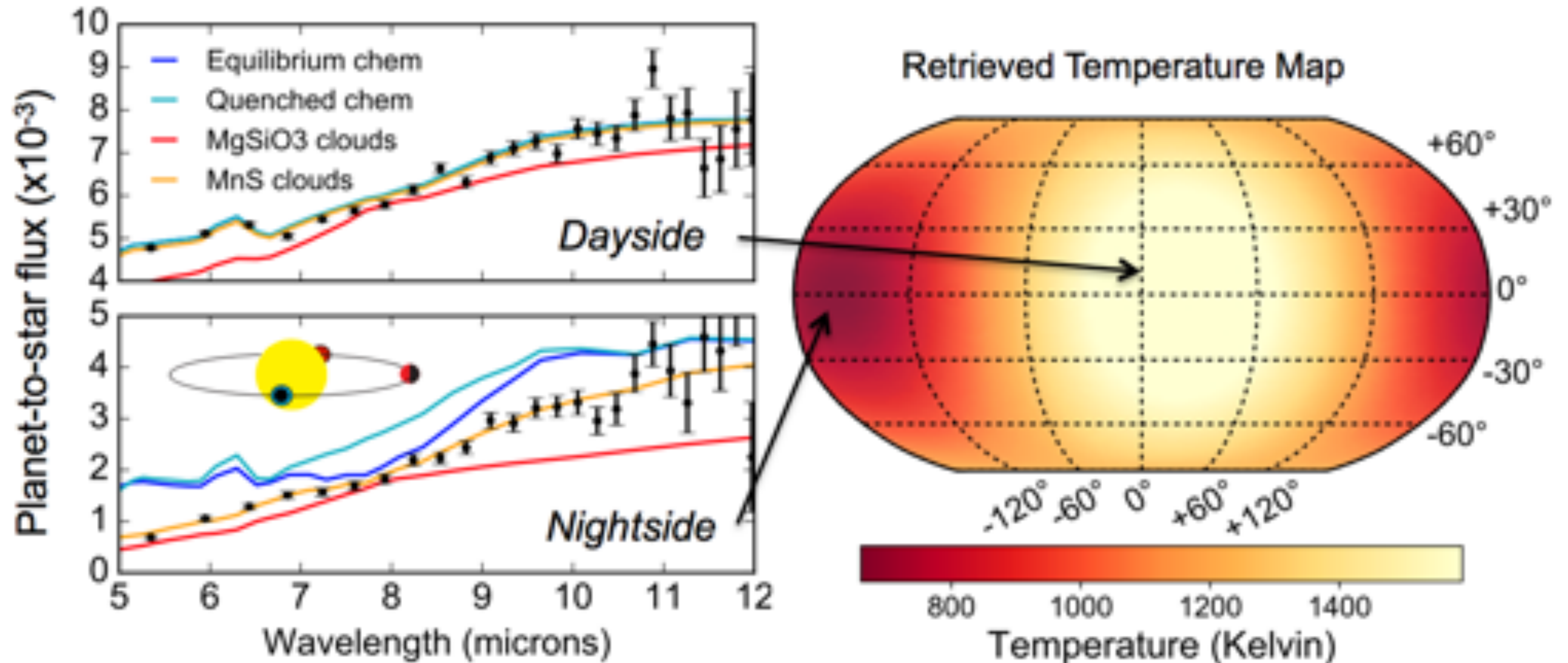
Will test MIRI time series observations

MIRI LRS (5.0-14.0 μm)

Full orbit phase curve of
WASP-43b including two
eclipses and one transit.



SIMULATED MIRI LRS PHASE CURVE OF WASP-43b



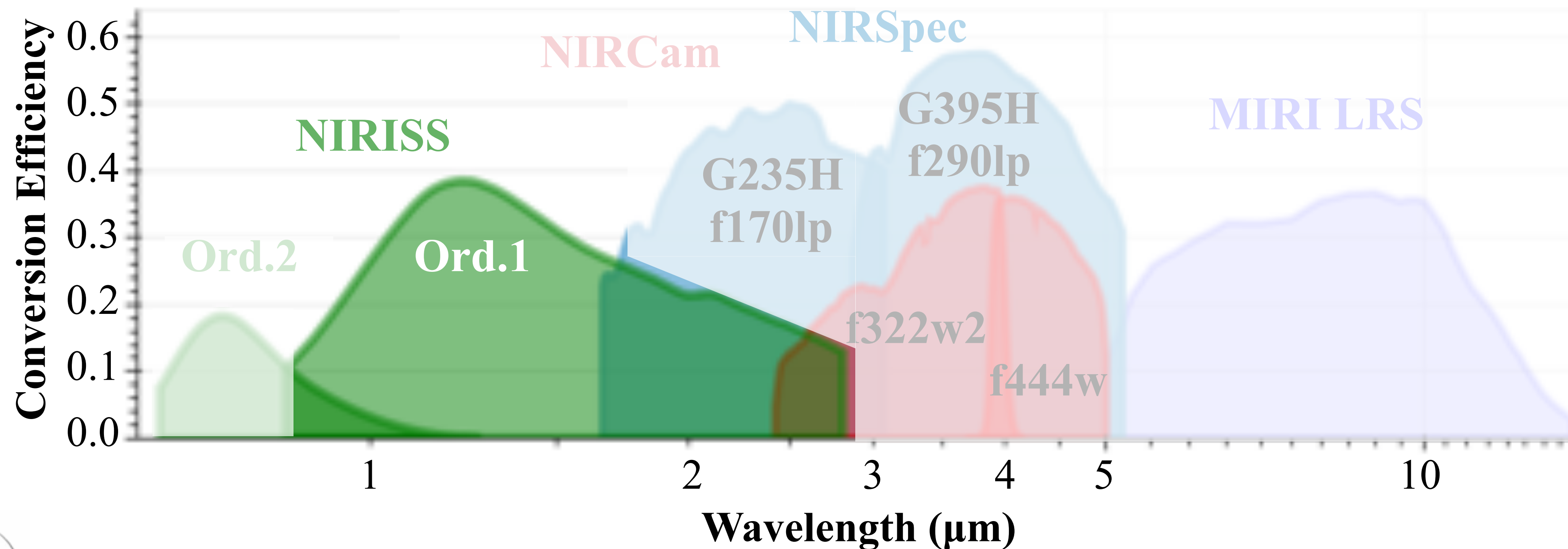
BRIGHT STAR PROGRAM

Testing the brightness limits of JWST

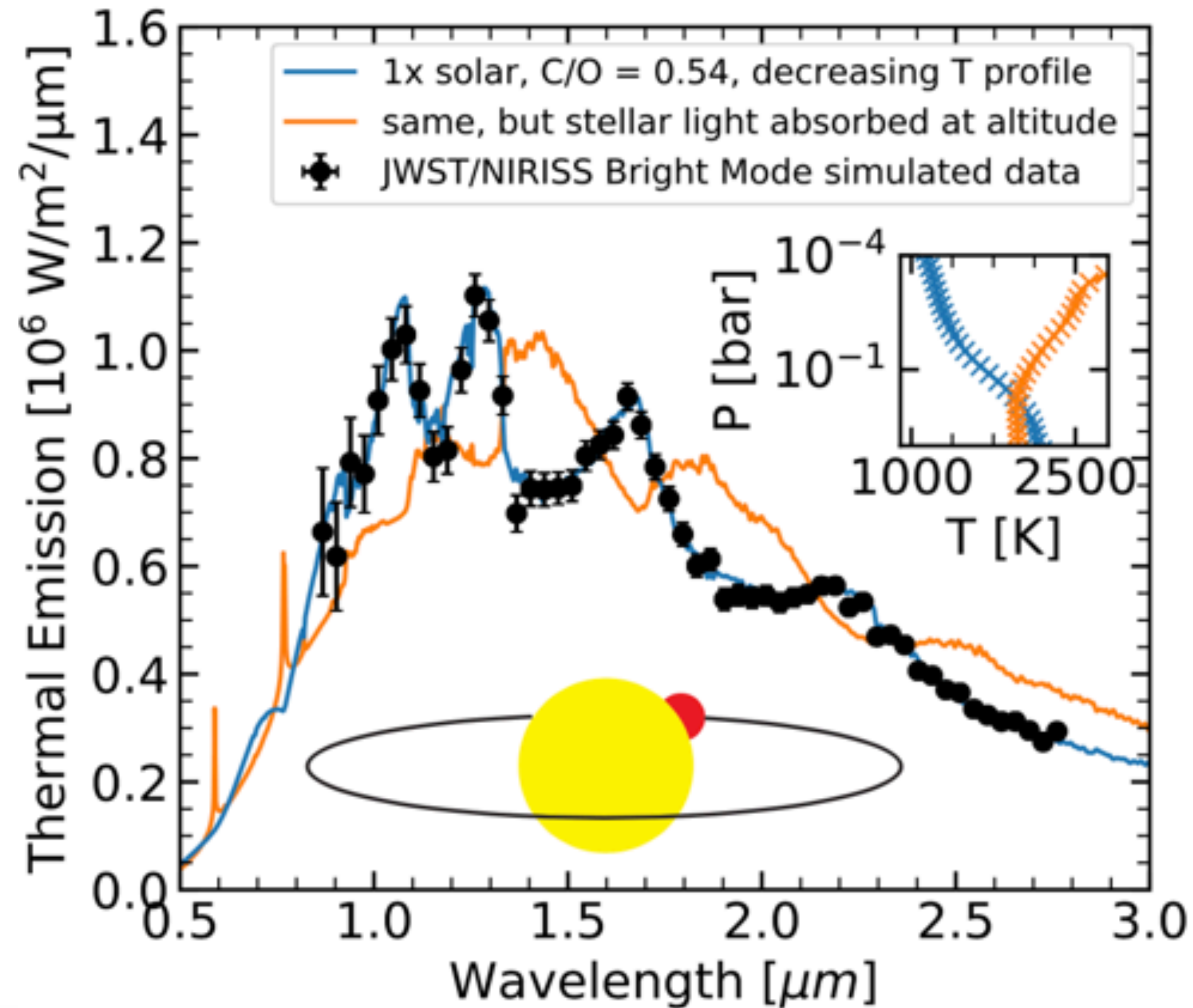
NIRISS SOSS (0.85-2.8 μ m)

Eclipse observation of
WASP-18b a bright target.

$$K_{\text{mag}} = 8.3$$



SIMULATED NIRISS/SOSS EMISSION SPECTRUM OF WASP-18B



- ▶ Insights into energy budget and thermal structure
 - Thermal inversion
- ▶ Test JWST's achievable precision
 - noise floor



DATA CHALLENGE

- ▶ Science-Enabling Products
 - Data analysis recipe for each dataset
 - Field guide to instrument systematics
- ▶ Data Challenge
 - Phase 1: gain experience with simulated data
 - Phase 2: analyze real ERS data



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L+2 months
1st Data
Challenge:
simulated
datasets

L+3
Readiness
Review,
community
briefing

L+10
2nd Data
Challenge:
actual
datasets

L+11
Results Review,
science-enabling
products delivered,
community briefing

L+16
special journal issue
publishing results
and lessons learned

2019

2020

2021

April 2018
Cycle 1 GO
proposals
due

0 years from launch

1 year after launch

= L+0 months
JWST launch
and start of
commissioning

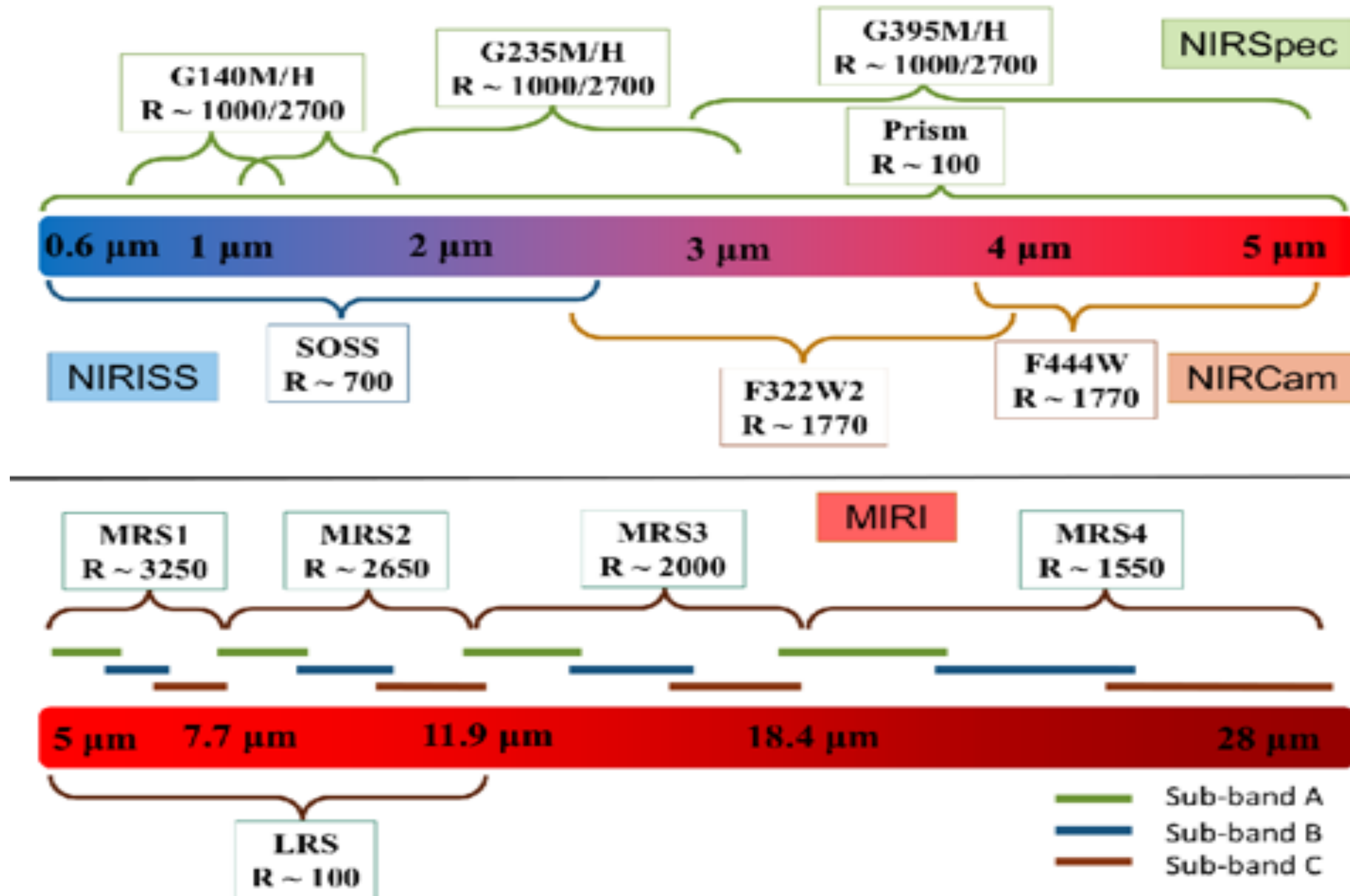
L+6
ERS/Cycle 1
observing
begins

L+11
Cycle 2
call for
proposals

L+14
Cycle 2
proposals
due



JWST SPECTROSCOPIC OBSERVING MODES



JWST NEEDS



TRANSITING EXOPLANET COMMUNITY ERS PROGRAM

