



STScI | SPACE TELESCOPE
SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE
ASTRONOMY

The Transiting Exoplanet Community Early Release Science Program

2017 Sagan Fellows Symposium

November 10th, 2017



A Community Effort

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

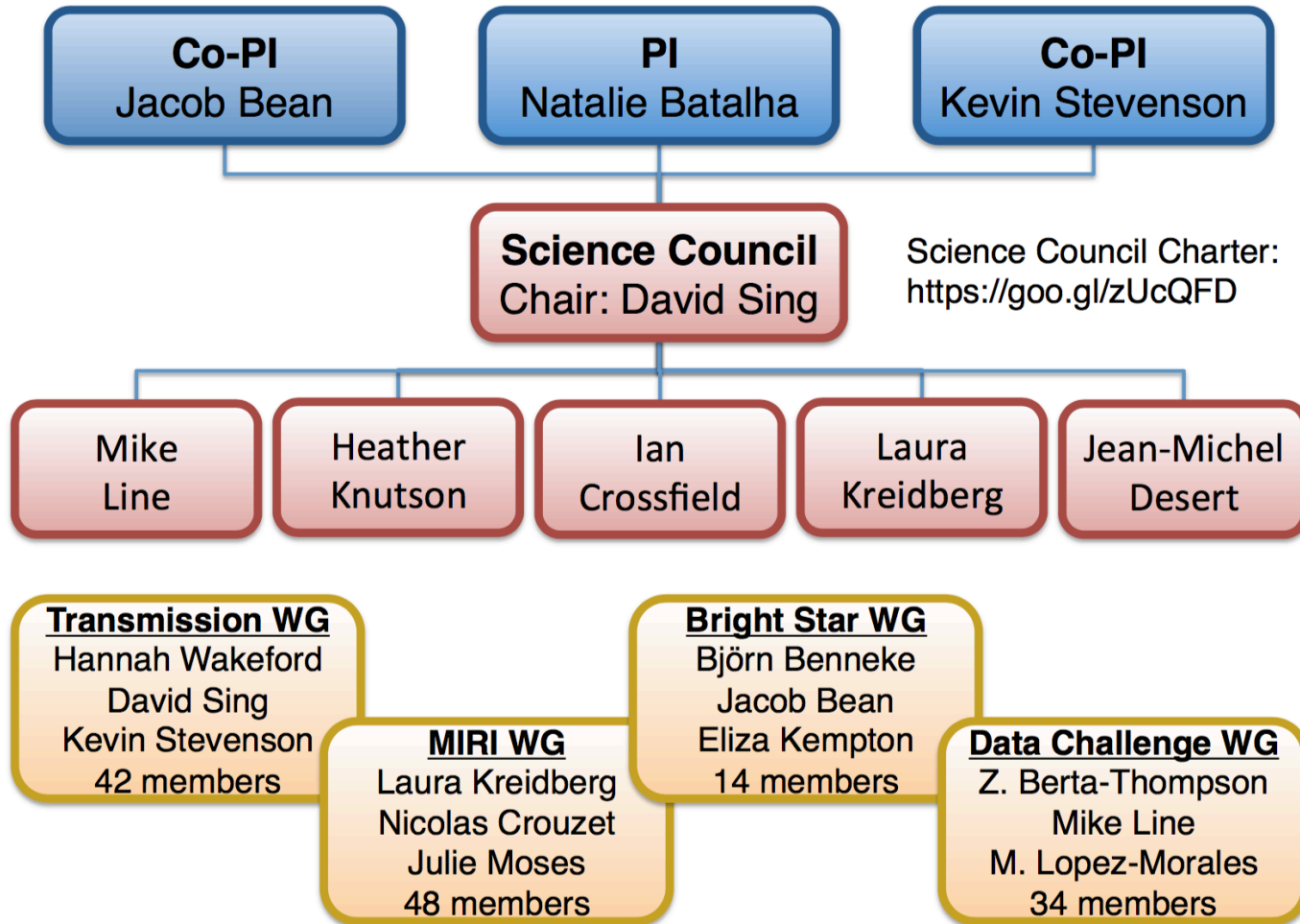
* ESA investigators: 23

! CSA investigators: 1

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 Blecic	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
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* 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



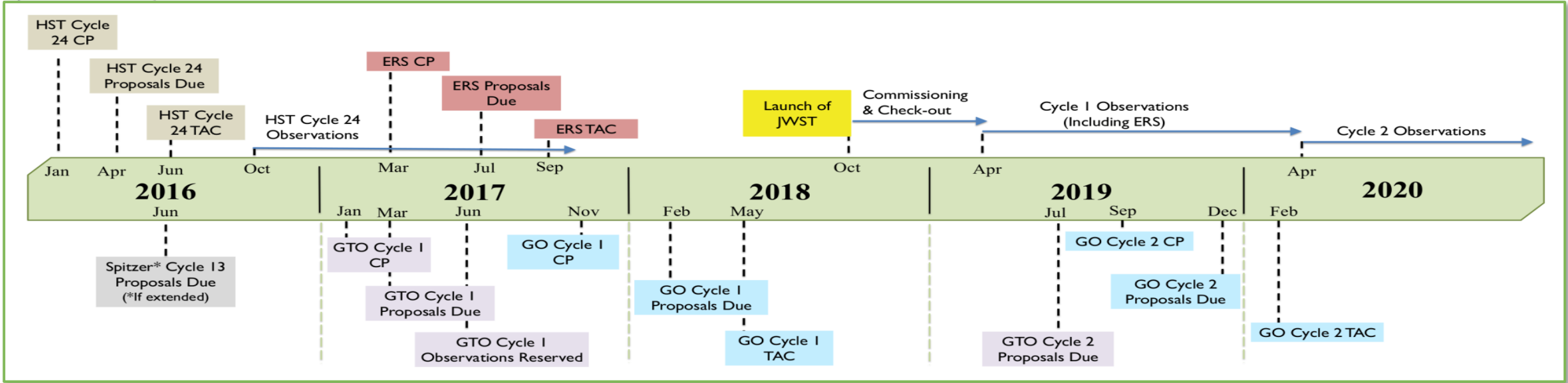
Management Structure



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



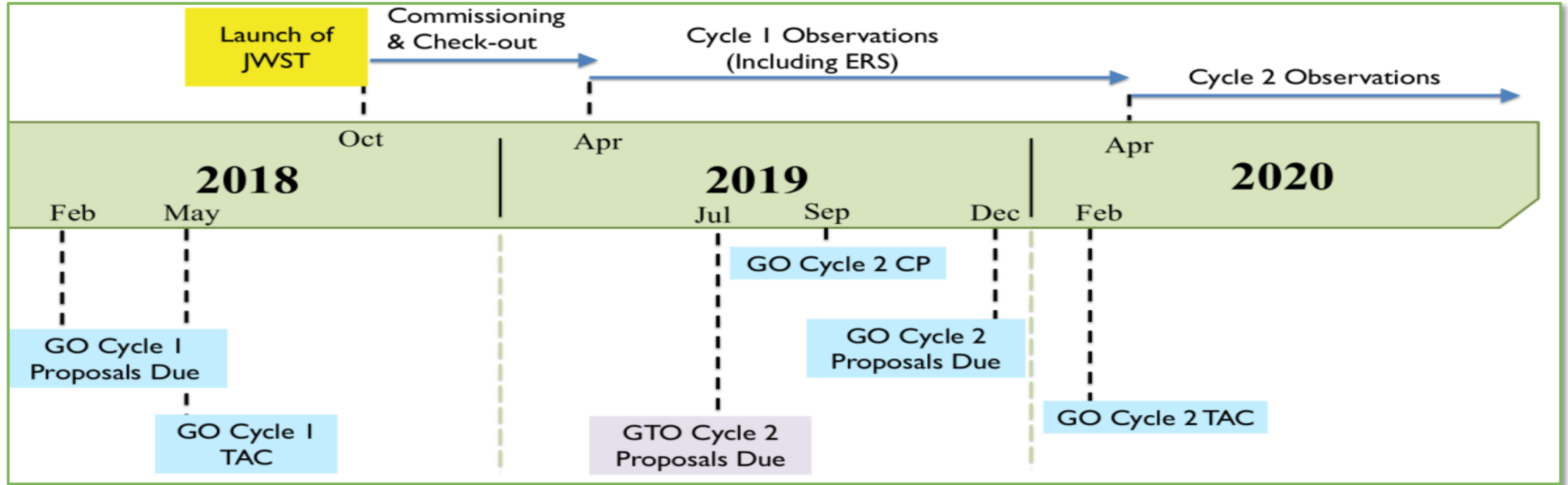
Current JWST Timeline



- ERS results to be announced in “early” November 2017
- GO Cycle 1 proposals due April 2018
- Possible mid-cycle call for proposals in 2019
- Launch of JWST in spring of 2019
- Cycle 1 start in fall of 2019



JWST Timeline Problem



- Data have a 12 month proprietary period
- Cycle 2 proposal deadlines are 3 – 8 months after start of Cycle 1 observations
- Limited/no access to important data sets
- Cannot quickly assess performance of JWST’s instruments and observing modes

Context

STScI Director Ken Sembach will allocate 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.**

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



*First Light &
Reionization*



*Assembly of
Galaxies*



*Birth of Stars &
Protoplanetary
Systems*



*Planets & Origins
of Life*

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.





Strategic ERS Objectives

- Determine the spectrophotometric time-series performance of key instrument modes on all the relevant timescales and for a representative range of target star brightnesses.
- Jump-start the process of developing remediation strategies for instrument-specific systematic noise.
- 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

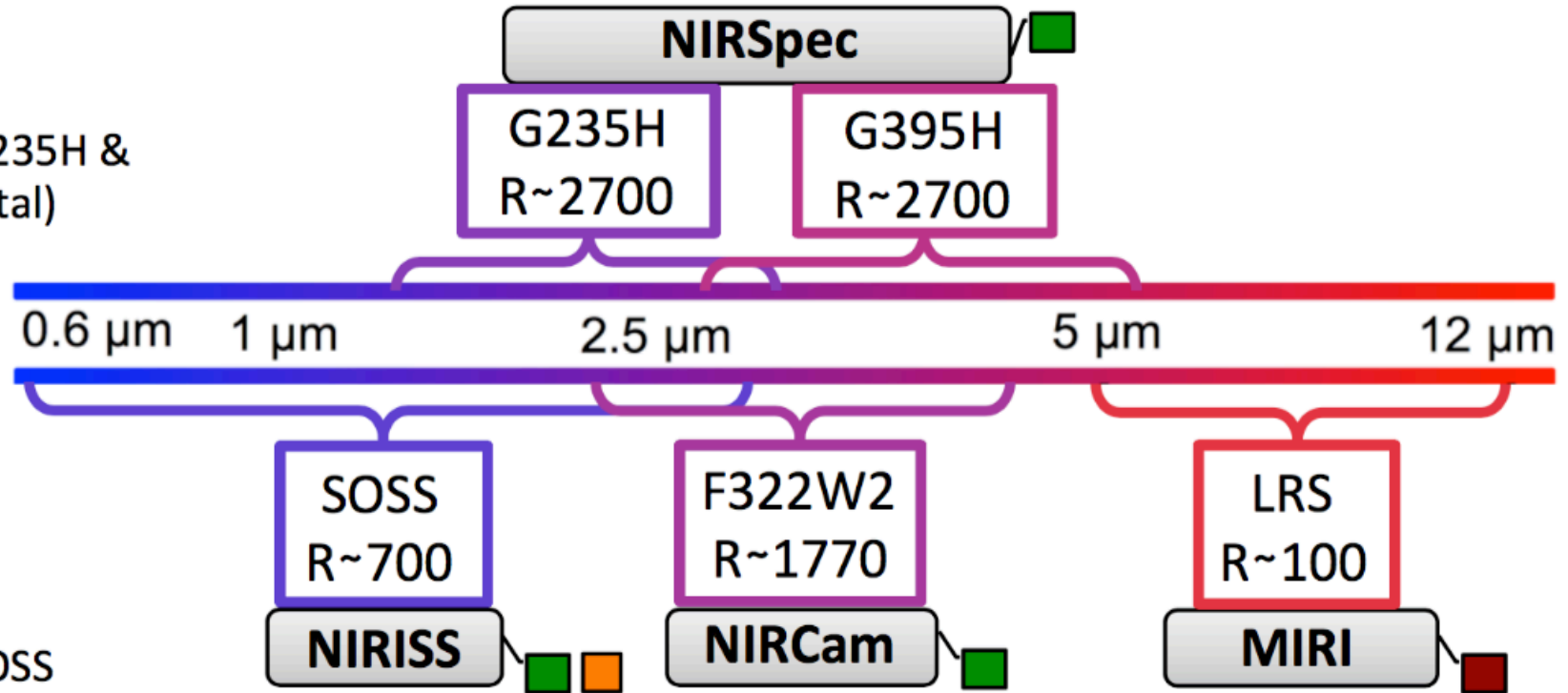
- nominal target: **WASP-39b**
- transits with NIRISS/SOSS, NIRSpec/G235H & G395H, and NIRCам/F322W2 (four total)

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

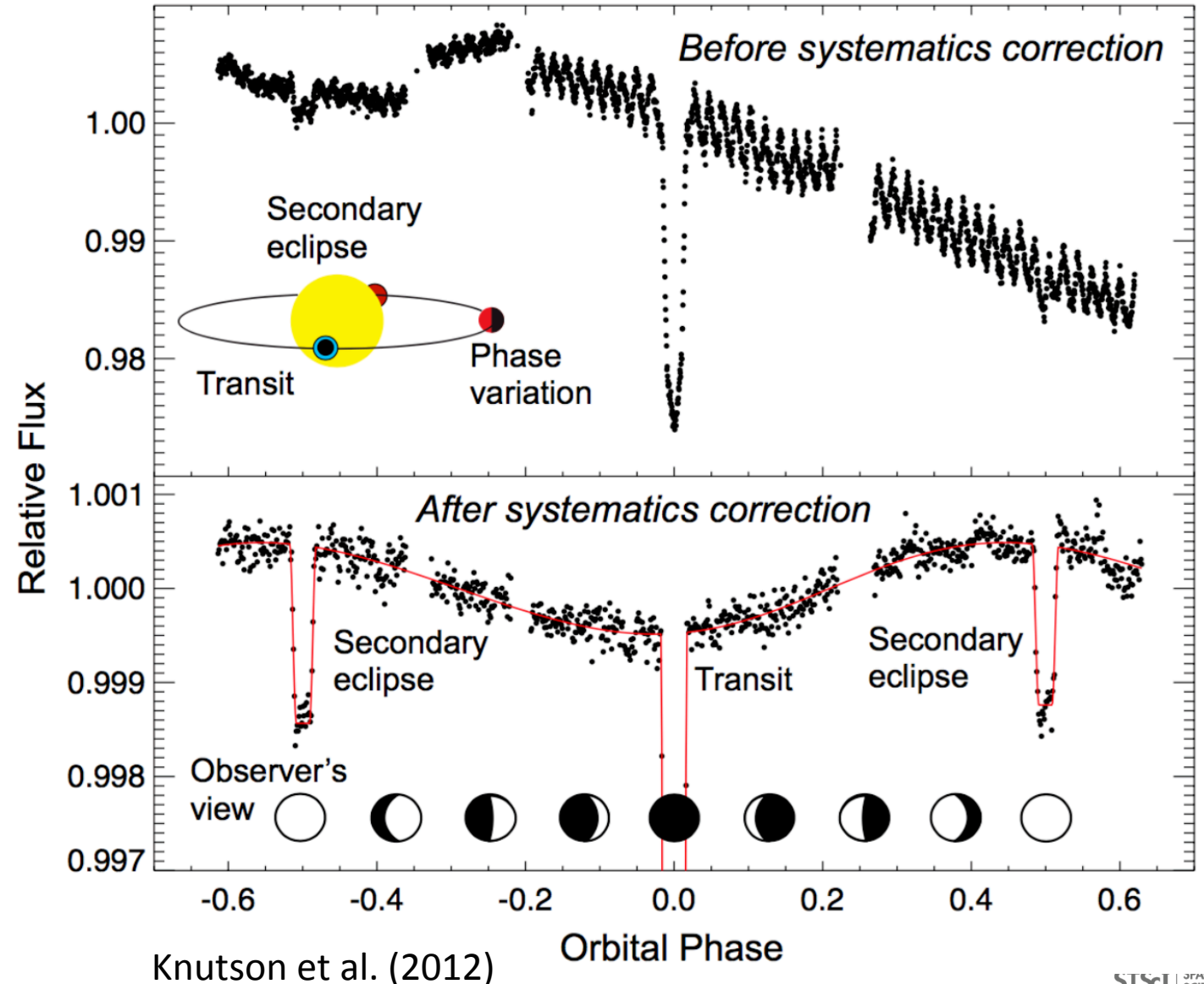
- nominal target: **WASP-18b**
- one secondary eclipse using NIRISS/SOSS





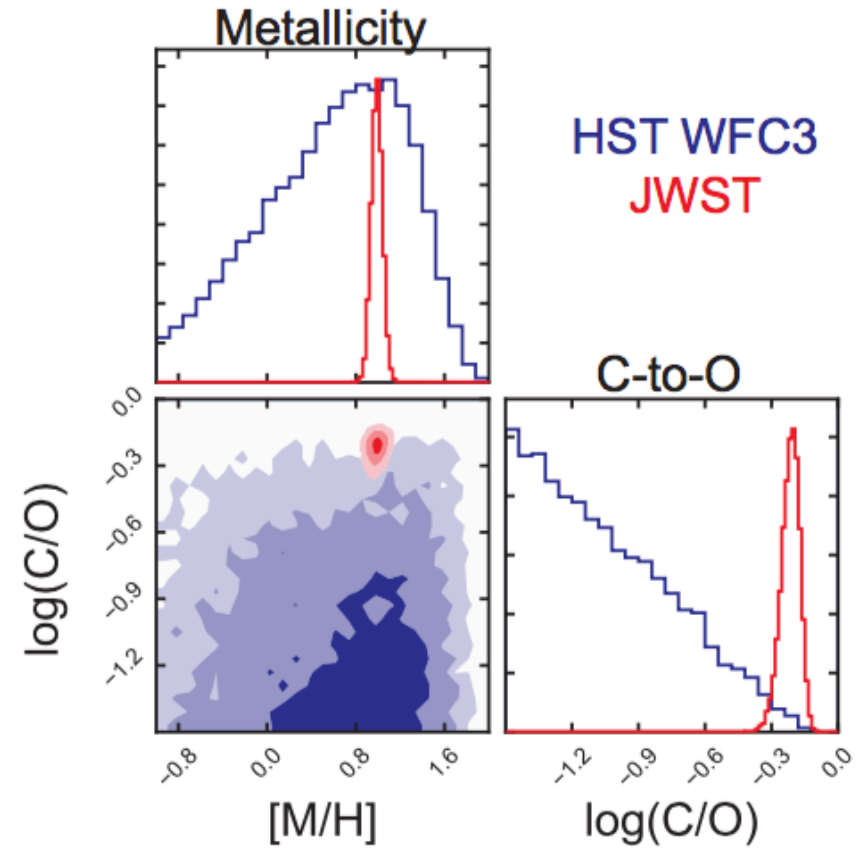
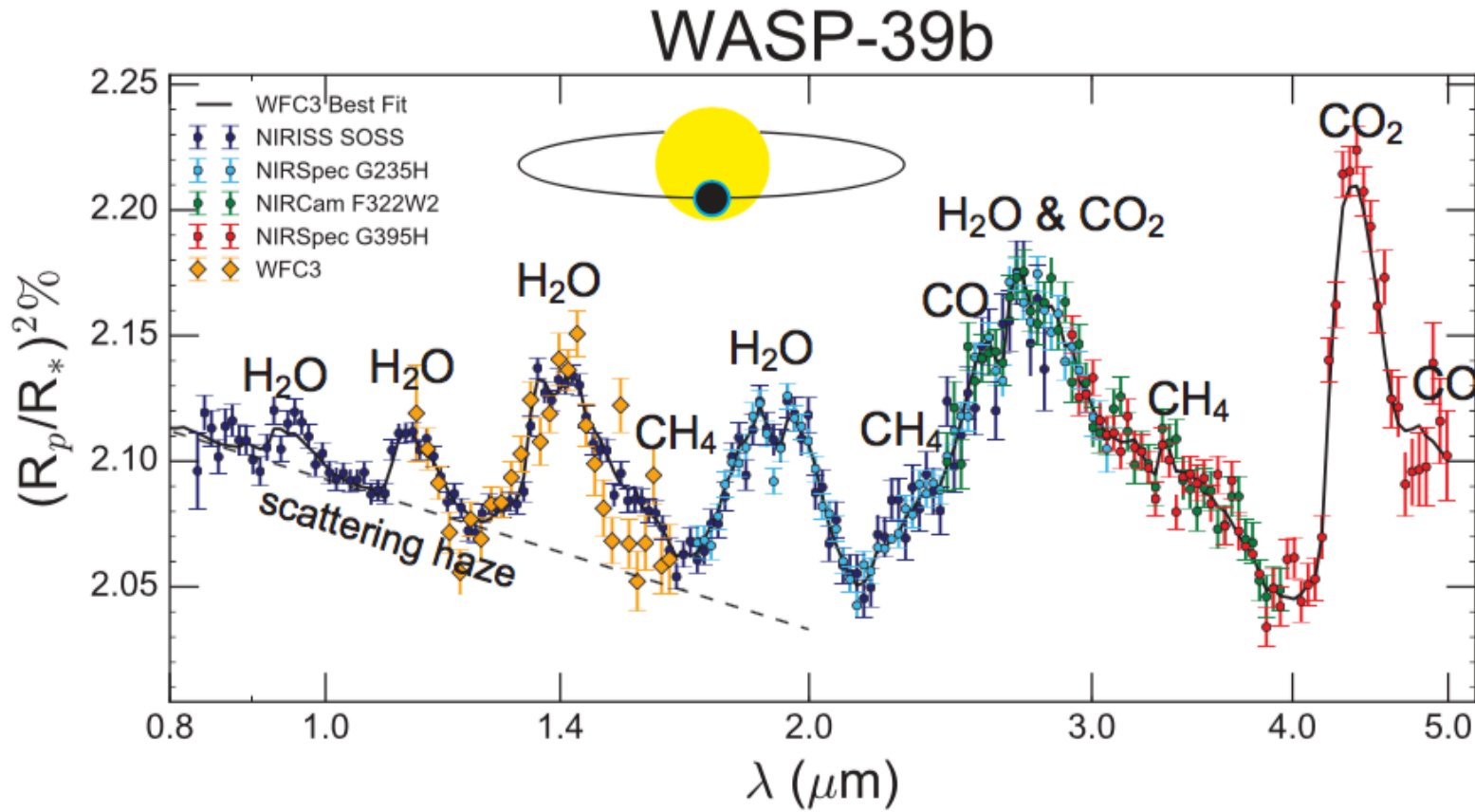
History of Systematics

- Confirm the accuracy of our systematics corrections
- Validate the strength of common atmospheric features using multiple instruments
- Determine the span of reliable wavelengths when stitching together transmission spectra from multiple modes.



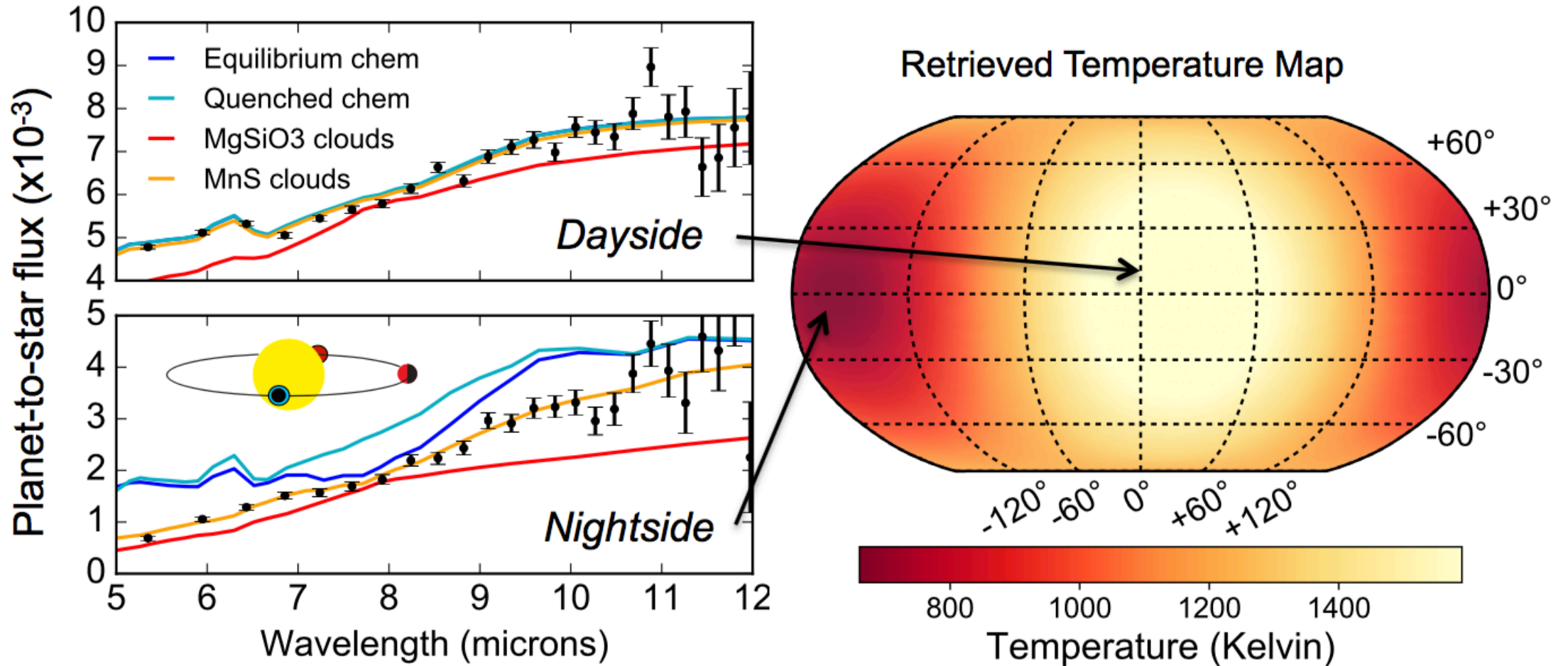


Simulated Transmission Spectrum of WASP-39b



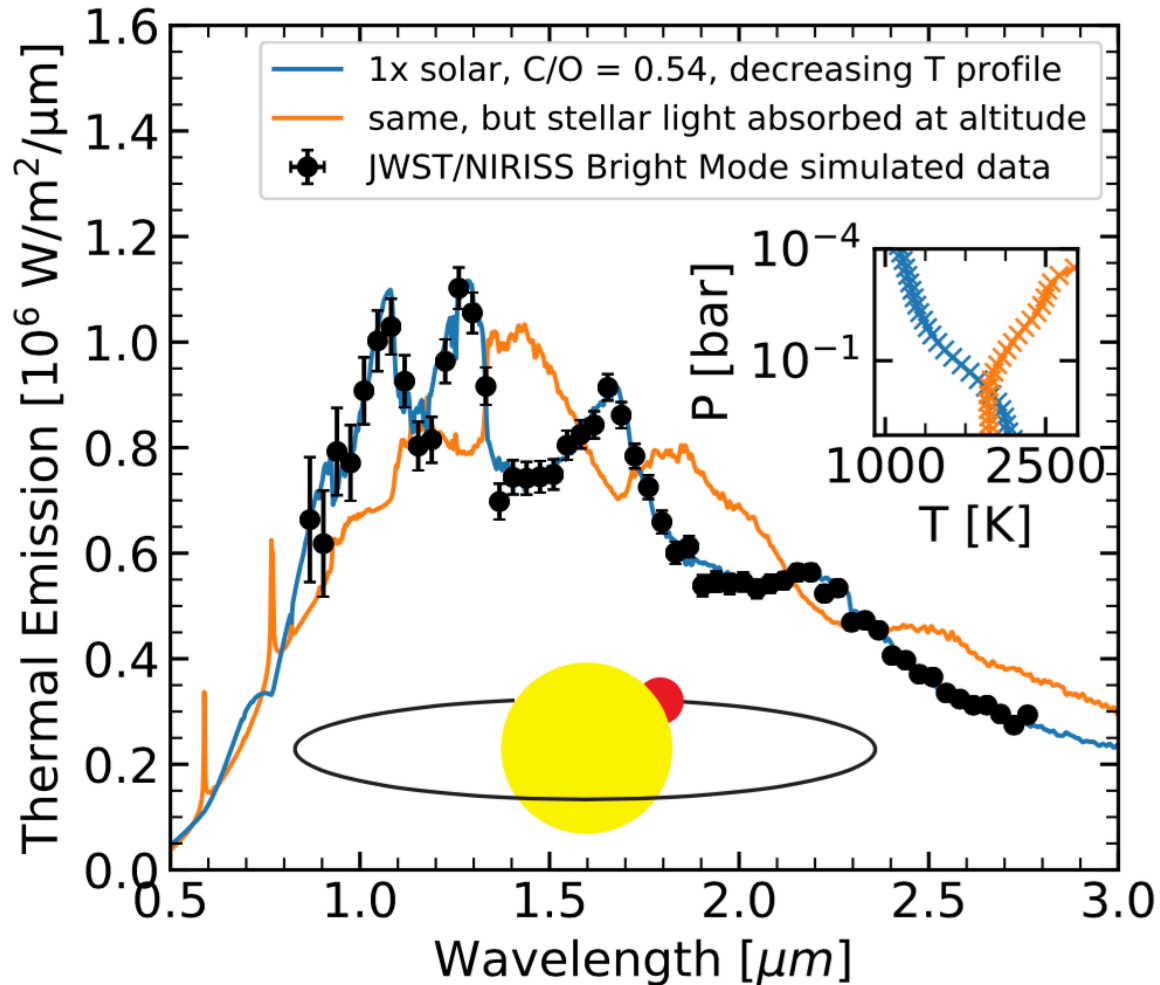


Simulated MIRI/LRS Phase Curve of WASP-43b





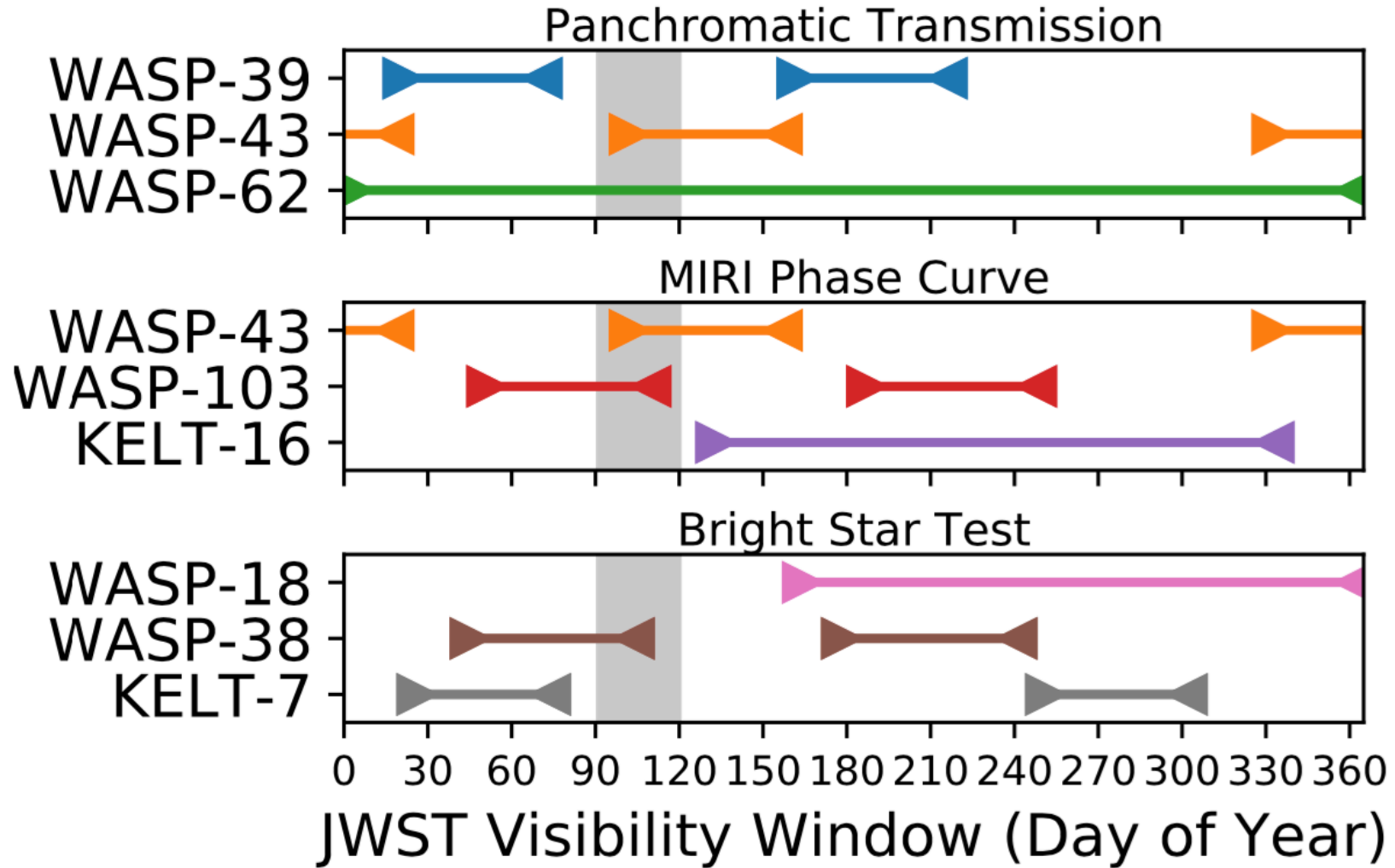
Simulated NIRISS/SOSS Emission Spectrum of WASP-18b



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

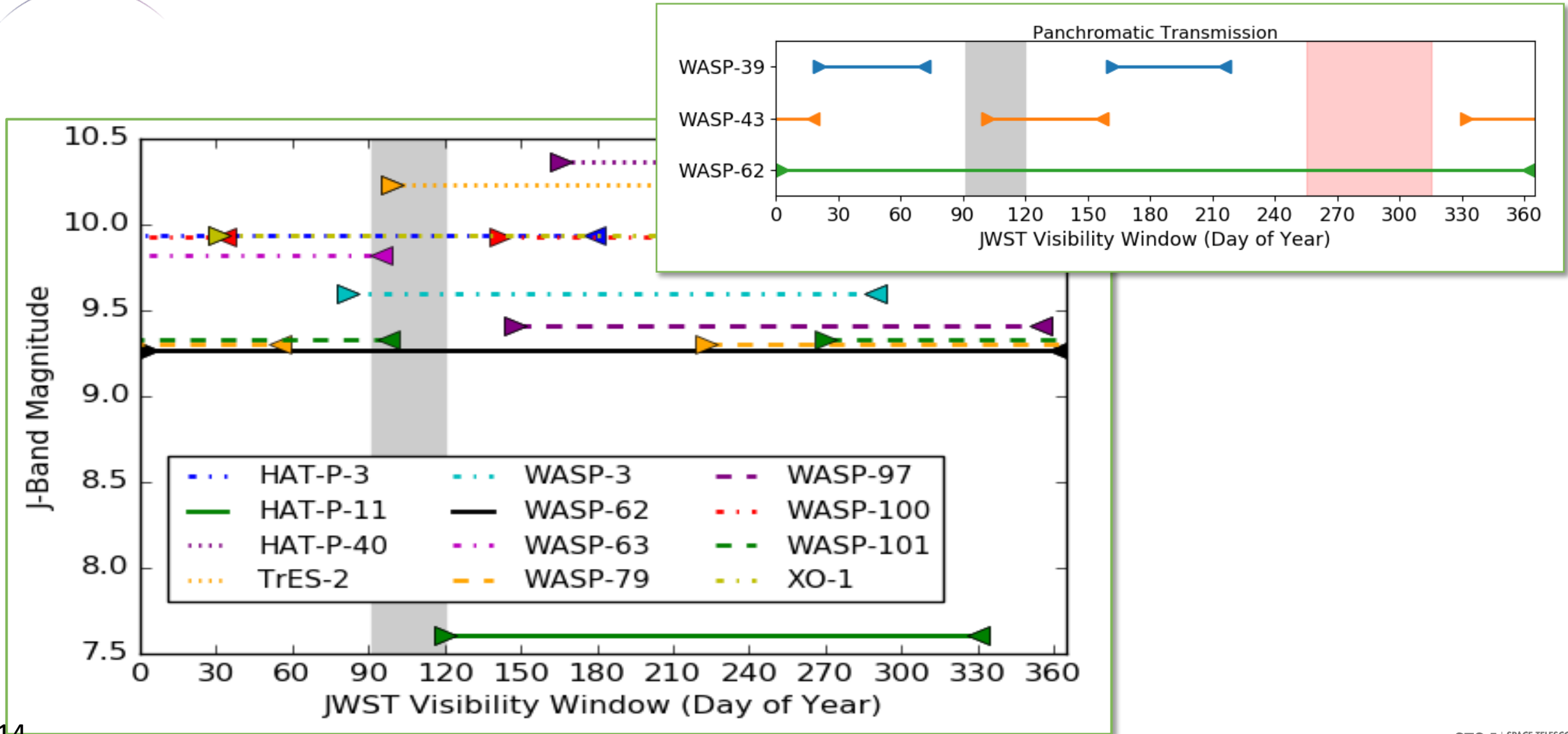


Plan for Alternative Targets





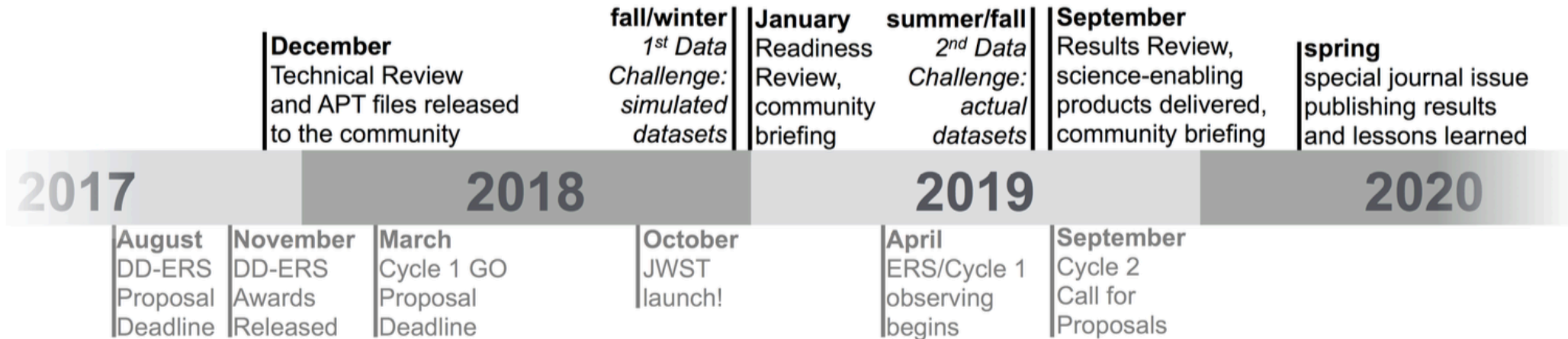
Plan for Alternative Targets





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





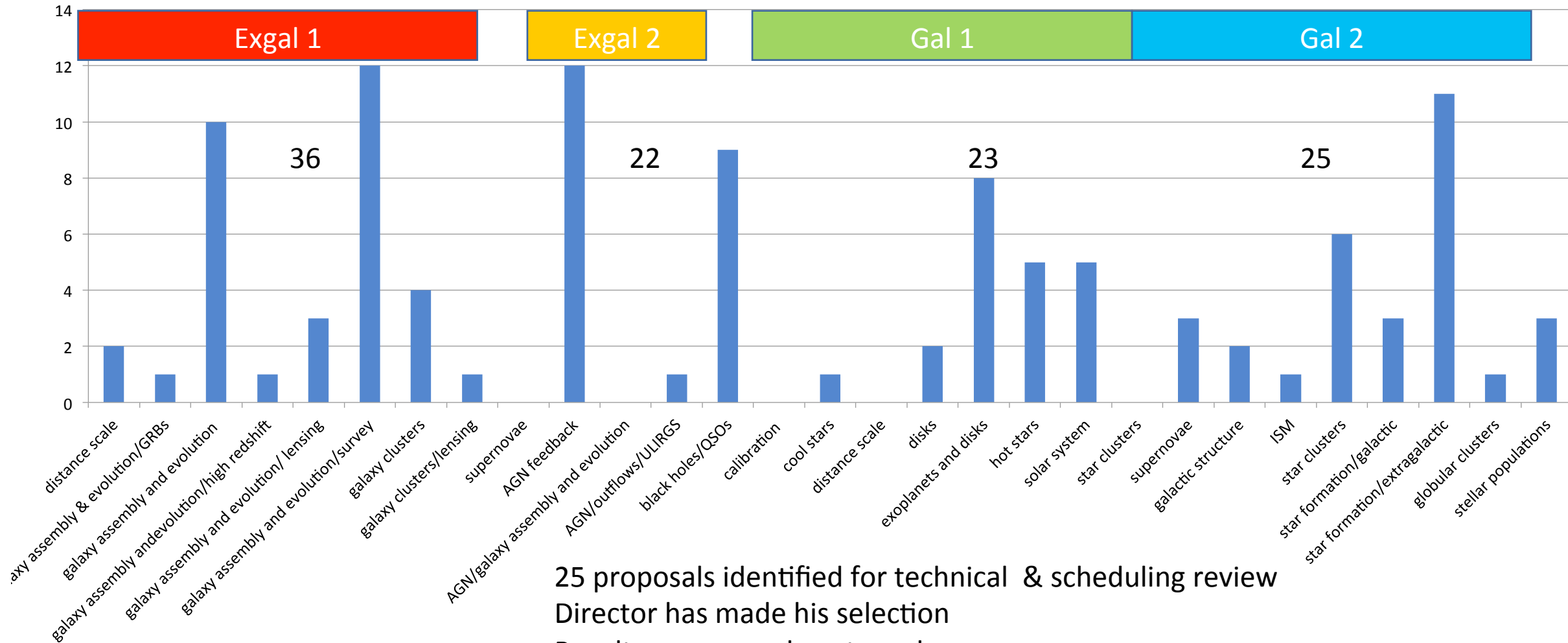
DD ERS Timeline

- January 6 2017 – Release of Call for Notices of Intent for DD ERS proposals
- March 3 2017 – Deadline for receipt of NOIs
 - 200 received involving 395 PIs & co-PIs, 3665 named investigators/collaborators
 - 104 US-based PIs from 24 states & 1 territory; 82 ESA PIs from 18 countries
- May 19 2017 – Release of Call for DD ERS proposals
- August 18 2017 – DD ERS proposal deadline
 - 106 proposals involving 2957 investigators/collaborators from 38 countries & 45 US states and territories
 - 3683.1 hours requested → 7:1 oversubscription
- October 9 & 10 2017 – DD ERS TAC, @ STScI
- Mid-October – Technical & scheduling reviews of top-ranked DD ERS proposals
- Early November – Results announced to the community



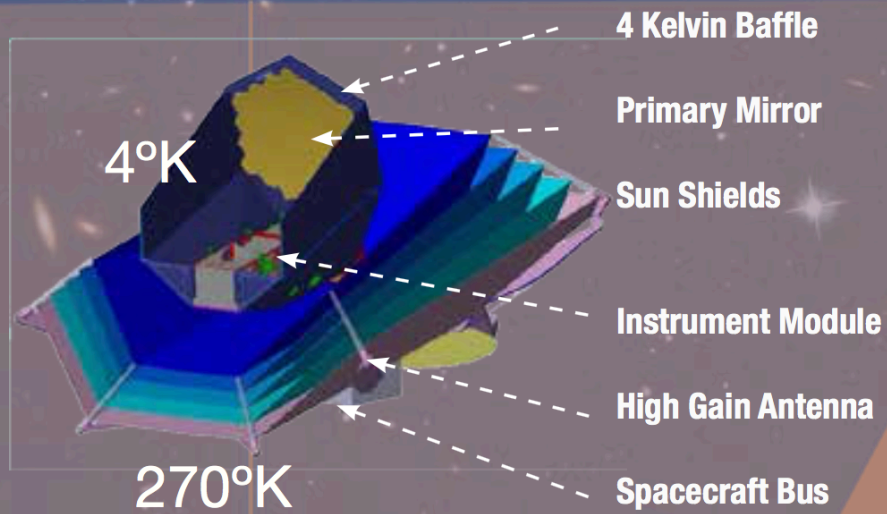
DD ERS proposal submissions

Broad range of science topics in 4 groupings

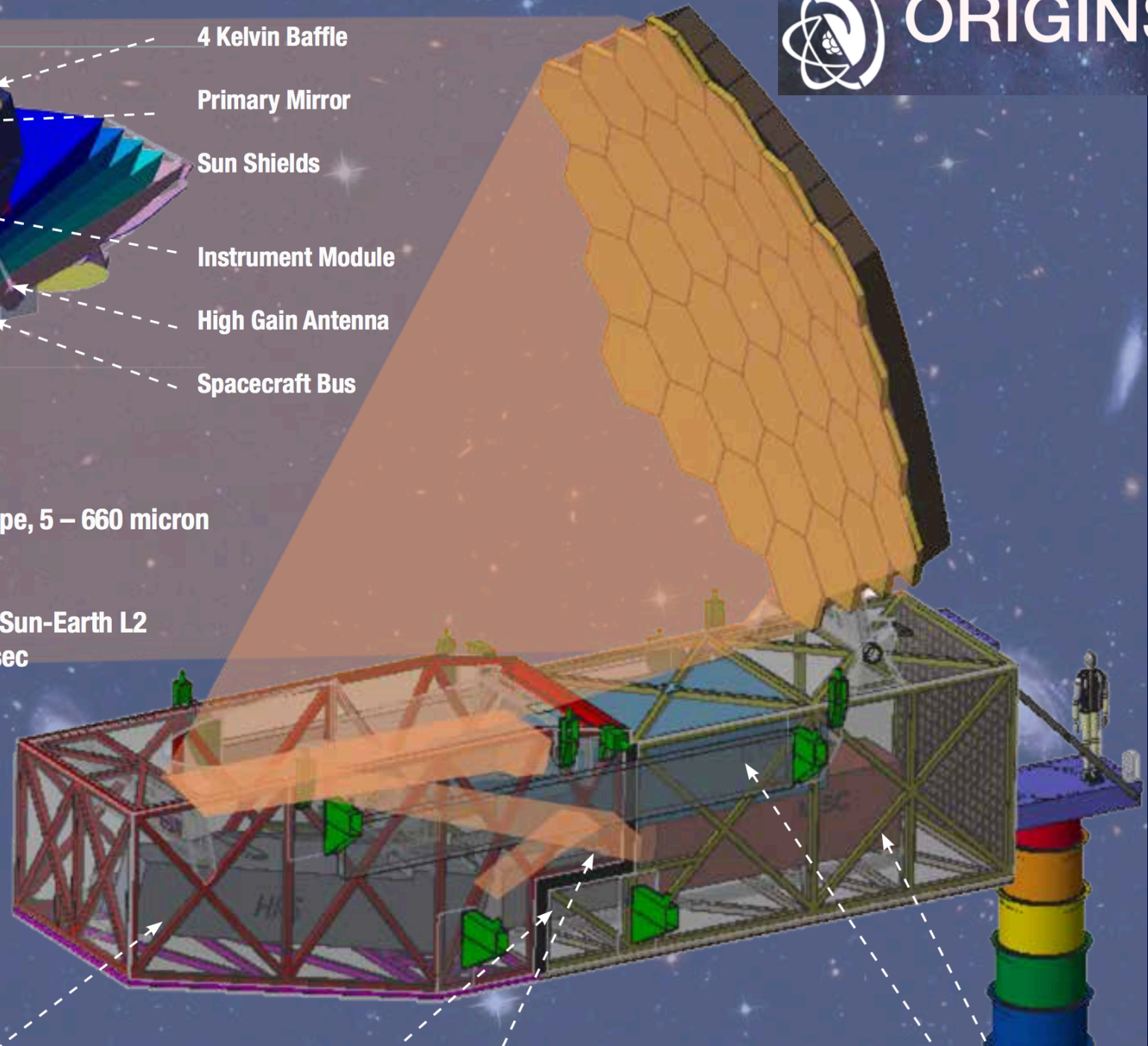


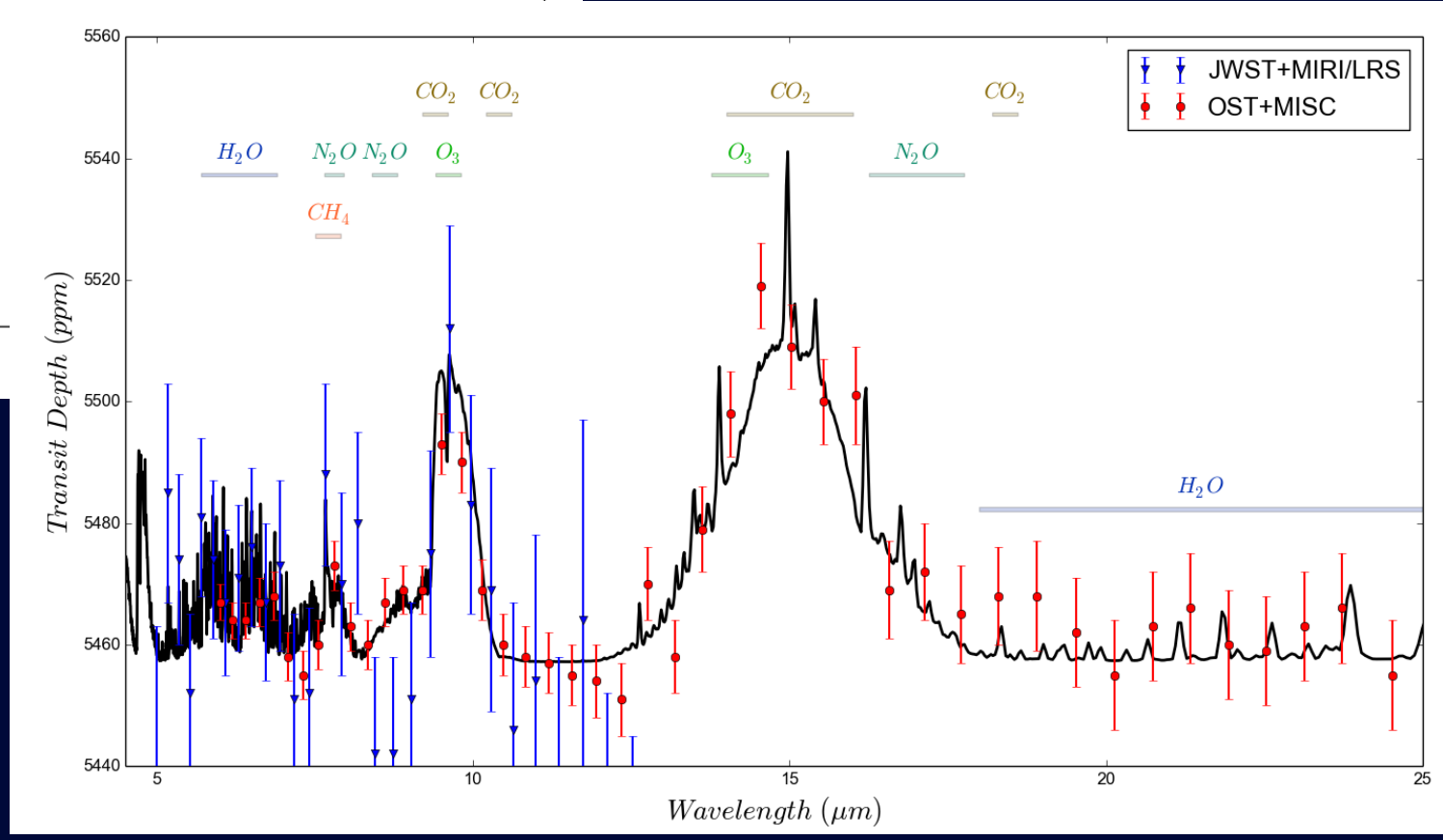
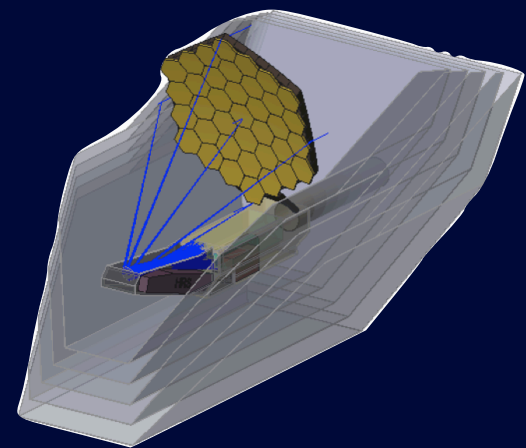
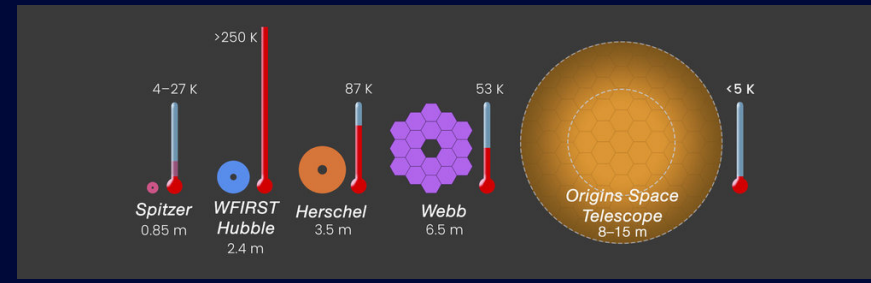
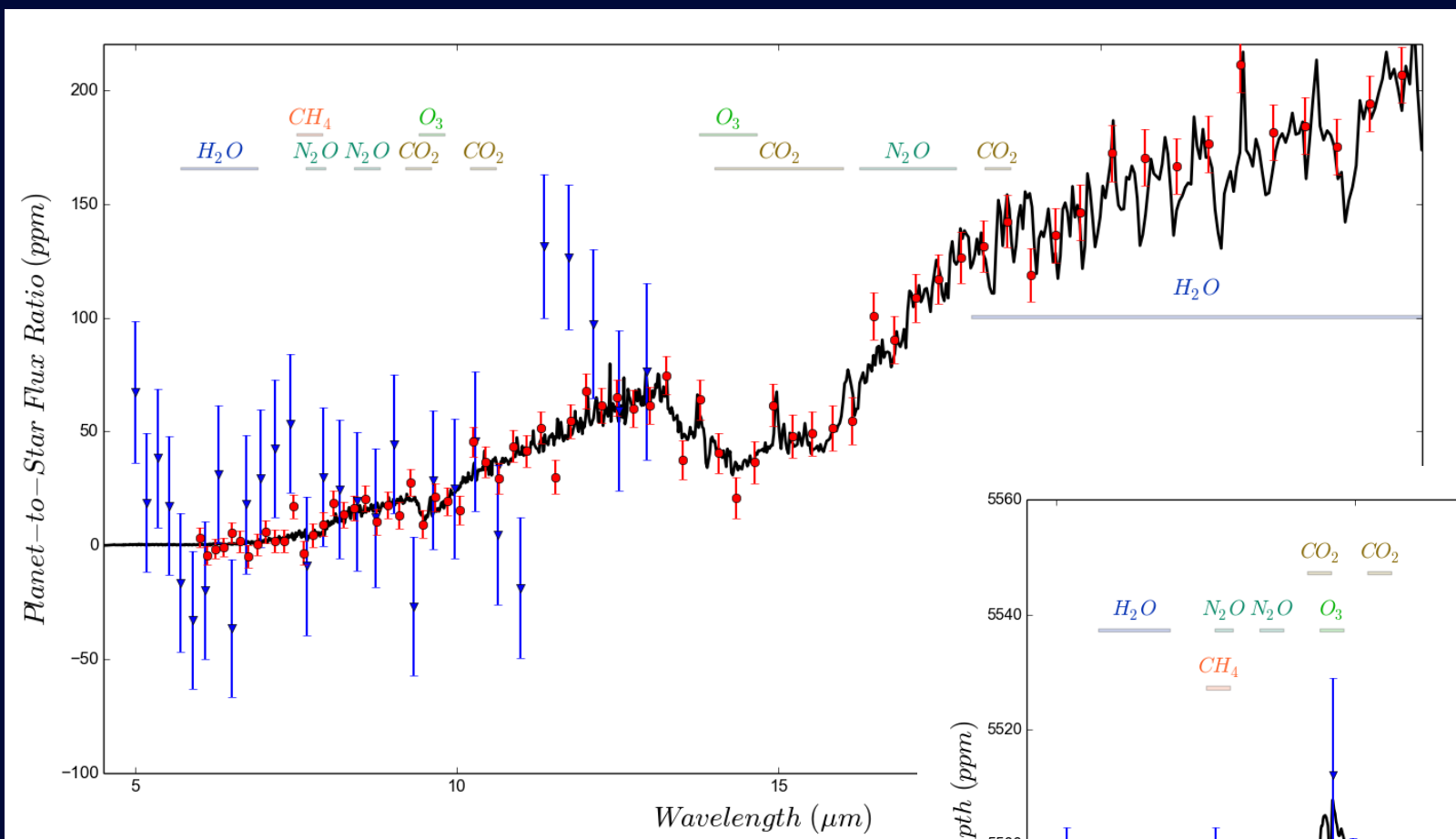
25 proposals identified for technical & scheduling review
Director has made his selection
Results announced next week

ERS results will be announced next week!



- 9.1m diameter Telescope, 5 – 660 micron
- 5 Science Instruments
- Launch 2035
- Mission Operations at Sun-Earth L2
- Data Rate: 348Mbits/sec





Ask not what JWST can do for you;
ask what **you** can do for JWST.





Bonus Slides

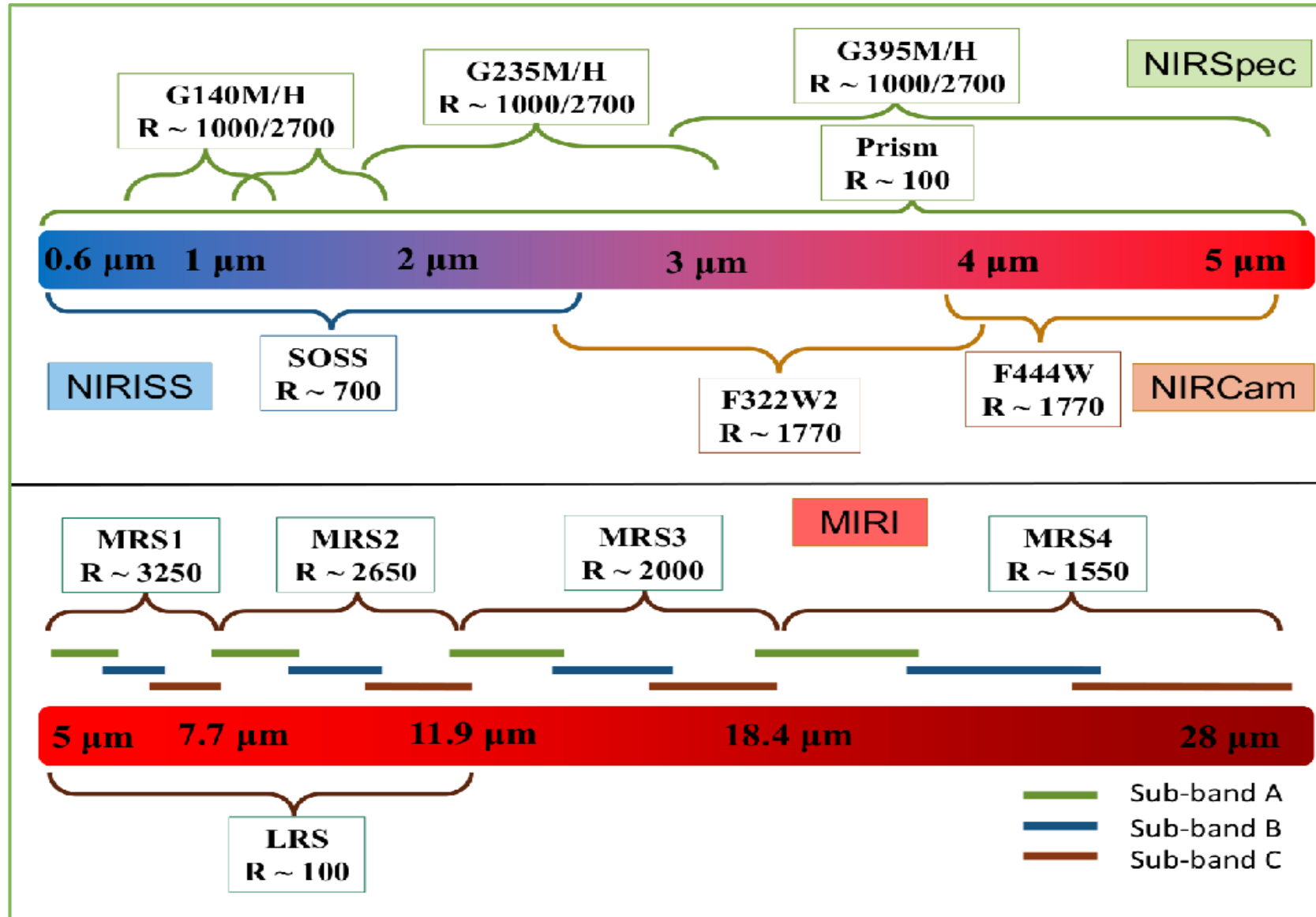


Early Release Science (ERS)

- Solution to JWST timeline problem:
 - JWST Advisory Committee recommends creation of ERS program
- Provide open access to select JWST observations asap in Cycle 1
- Goals:
 - Seed initial discovery
 - Quickly build experience
 - Inform preparation of Cycle 2 proposals
- ERS program highlights:
 - Targets selected before Cycle 1 call for proposals
 - ~500 hours of DD time
 - Peer-reviewed proposals submitted by community
 - Key observing modes and data analysis challenges
 - Science driven
 - No proprietary period
 - Among first Cycle 1 observations
 - Science-enabling products



Spectroscopic Observing Modes





ORIGINS

Space Telescope

