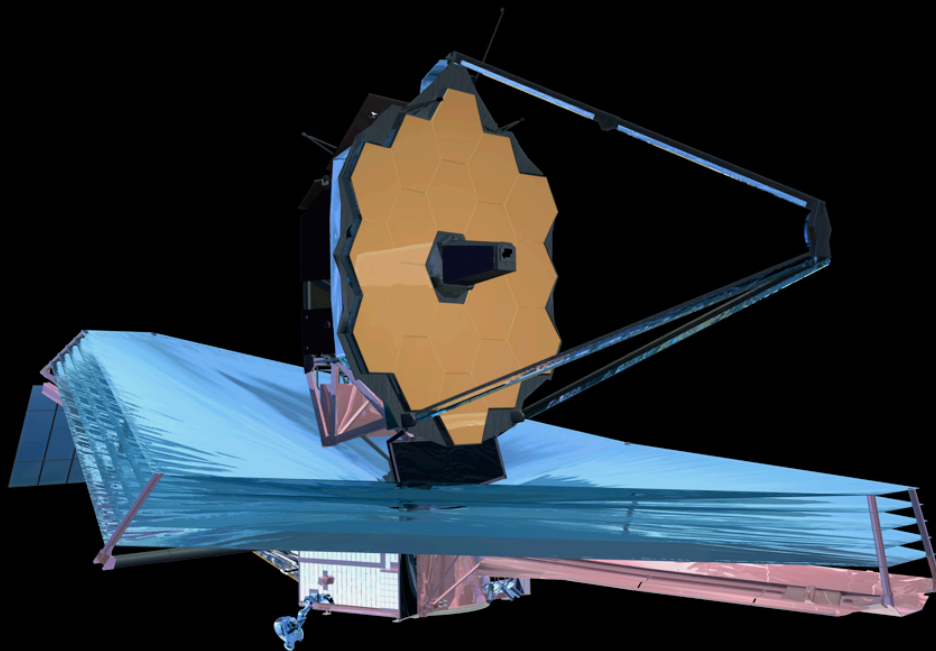


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# *The science timeline for JWST*

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*Neill Reid, Janice Lee, Jennifer Lotz – Science Mission Office  
Jason Kalirai – JWST Mission Office  
ESTEC, October 12 2015*

# Context

- Our charge at STScI is to maximise the scientific return of the missions we operate
- JWST is a mission with highly complex instrumentation and a 5-year lifetime requirement, 10-year goal
- JWST will offer a range of observing programs
- Maximising JWST's scientific potential requires that the community rapidly understand and uses its capabilities
- Data access is key to understanding JWST's capabilities
  - An Early Release Science program, generated by the community, can play a crucial role in providing broad access to representative datasets early in Cycle 1
  - Early data access increases the intellectual cycles by highlighting JWST's capabilities and enabling more ambitious Cycle 2 GO programs

# JWST Advisory Committee

*Roberto Abraham (Toronto)*  
*Neta Bahcall (Princeton)*  
*Stefi Baum (Rochester)*  
*Roger Brissenden (Chandra/SAO)*  
*Hashima Hasan (NASA, ex-officio)*  
*Tim Heckman (Johns Hopkins)*  
***Garth Illingworth (Santa Cruz, Chair)***  
***Malcolm Longair (Cavendish)***  
*John Mather (NASA, ex-officio)*  
***Mark McCaughrean (ESA, ex-officio)***  
*Chris McKee (Berkeley)*  
*Brad Peterson (Ohio State)*  
*Alain Ouellet (CSA, ex-officio)*  
*Joseph Rothenberg (JHR Consulting)*  
*Eric Smith (NASA, ex-officio)*  
*Lisa Storrie-Lombardi (Spitzer/Caltech)*  
***Monica Tosi (Bologna)***

*JSTAC: advisory to STScI Director*

*Represents the Scientific Community*



<http://www.stsci.edu/jwst/advisory-committee>

# Talk Outline

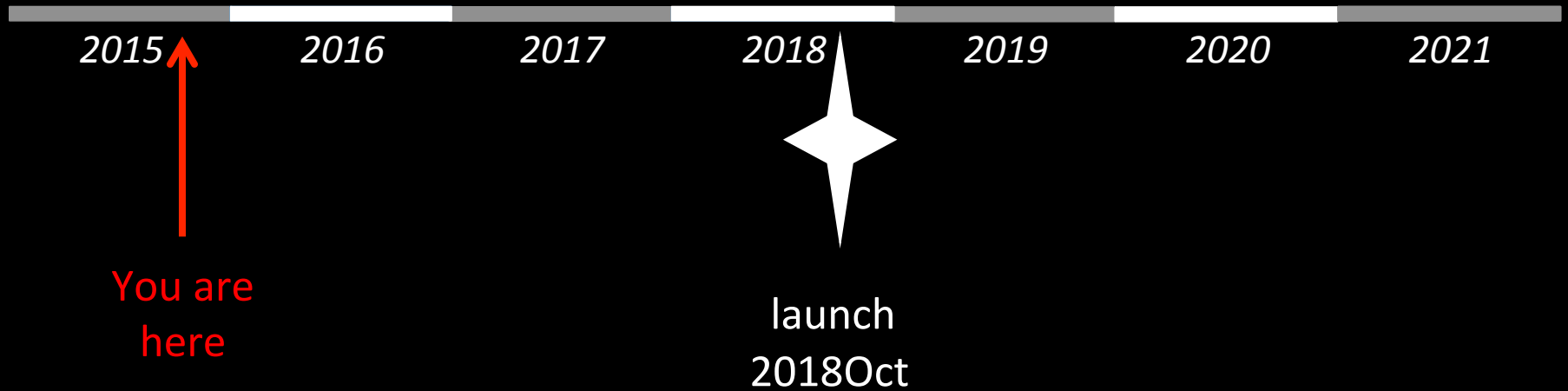
- JWST Science Planning Timeline
  - What happens when?
- Observing Programs
  - Proposal types
- An Early Release Science Program



# JWST Science Planning Timeline

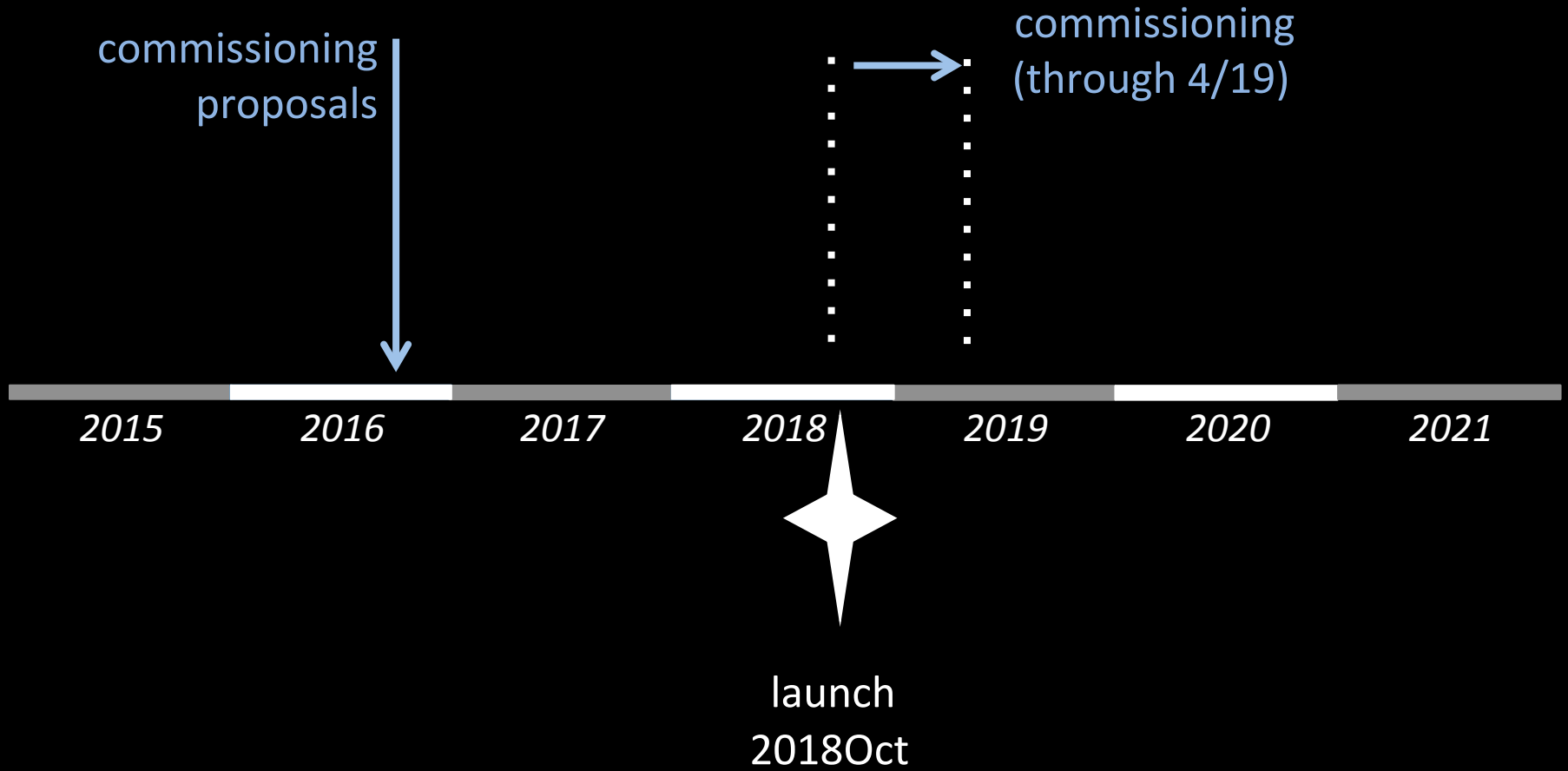
# *JWST Science Planning Timeline*

*(draft schedule as of October 2015)*



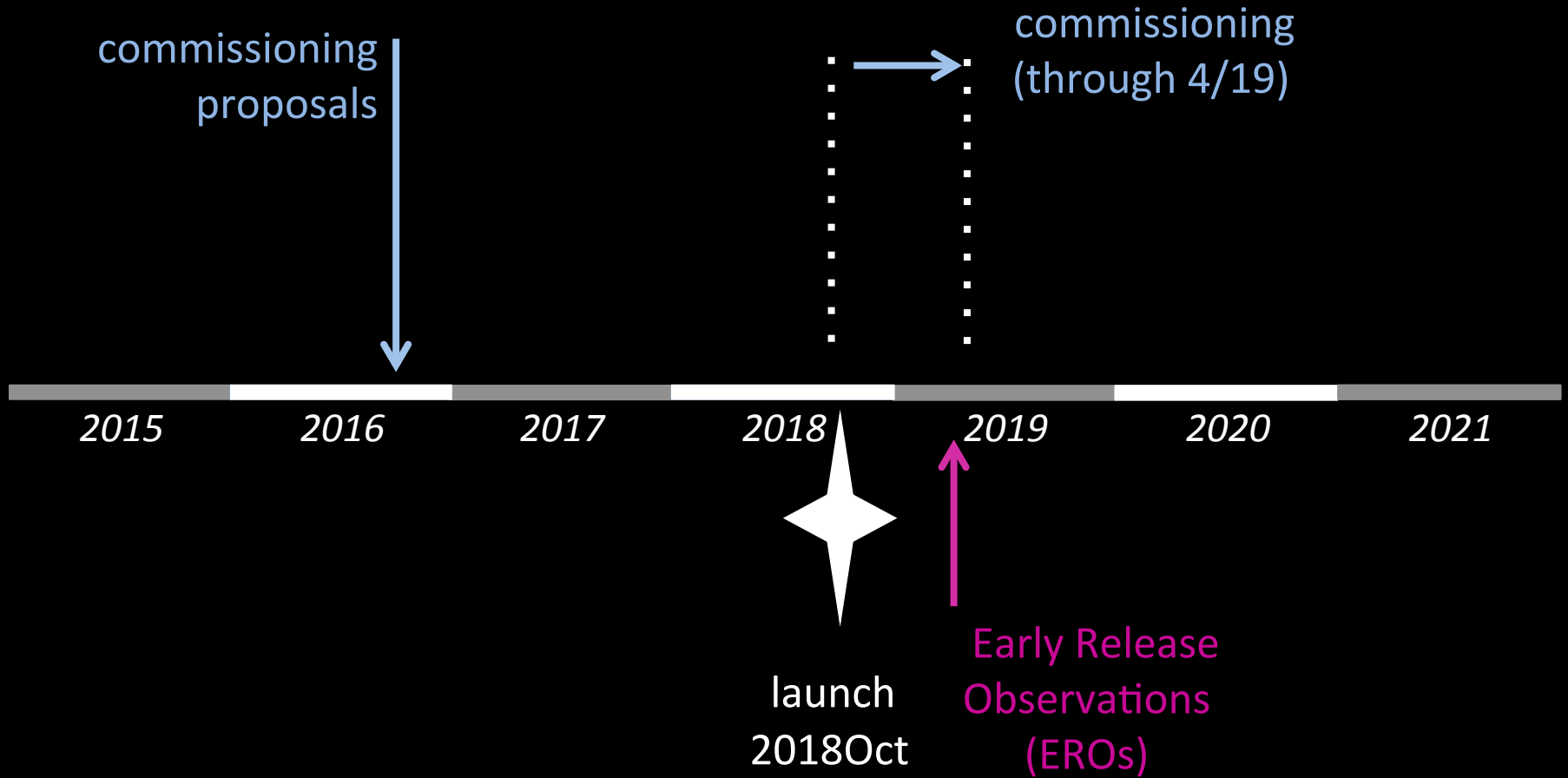
# *JWST Science Planning Timeline*

*(draft schedule as of October 2015)*



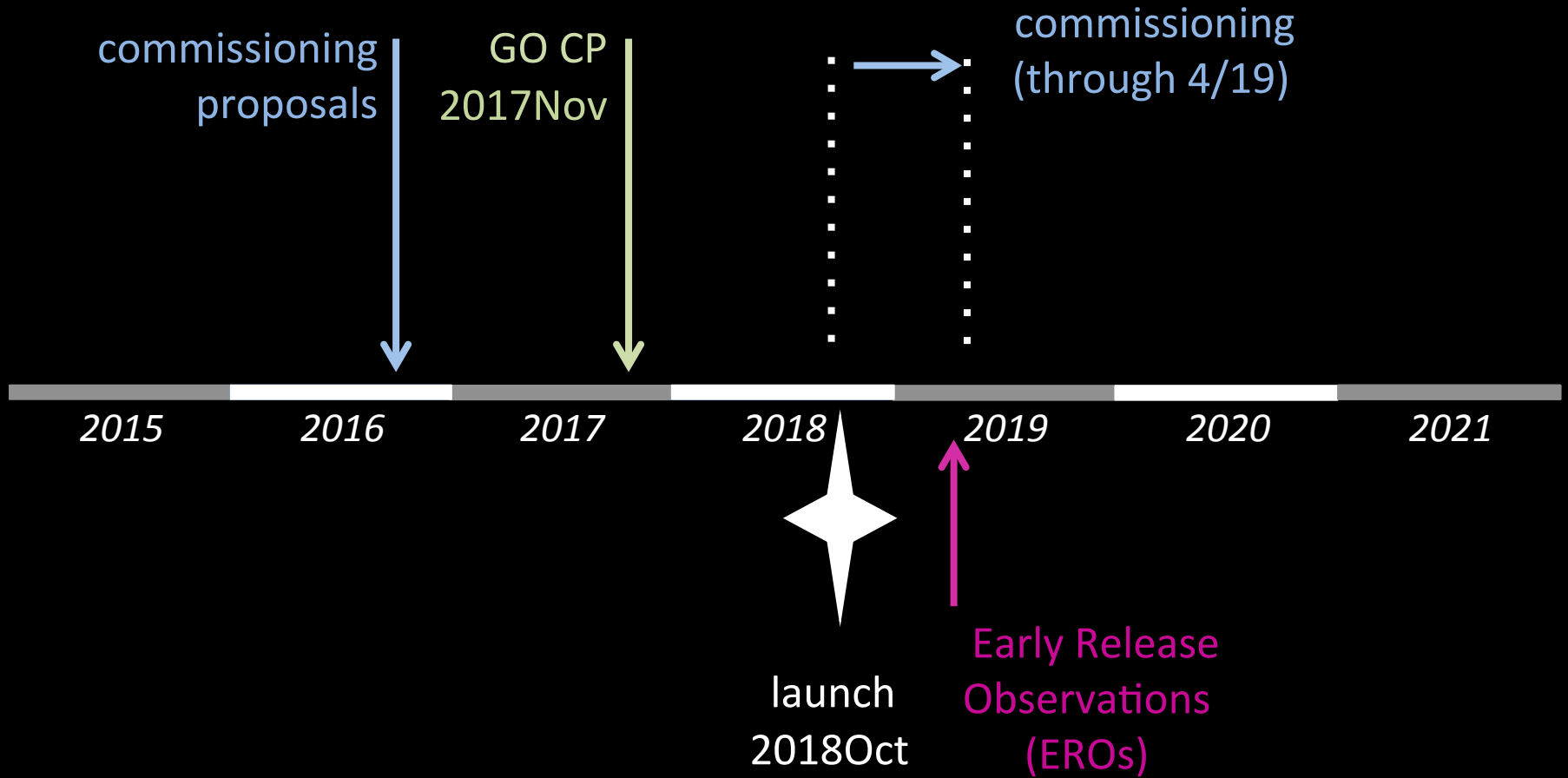
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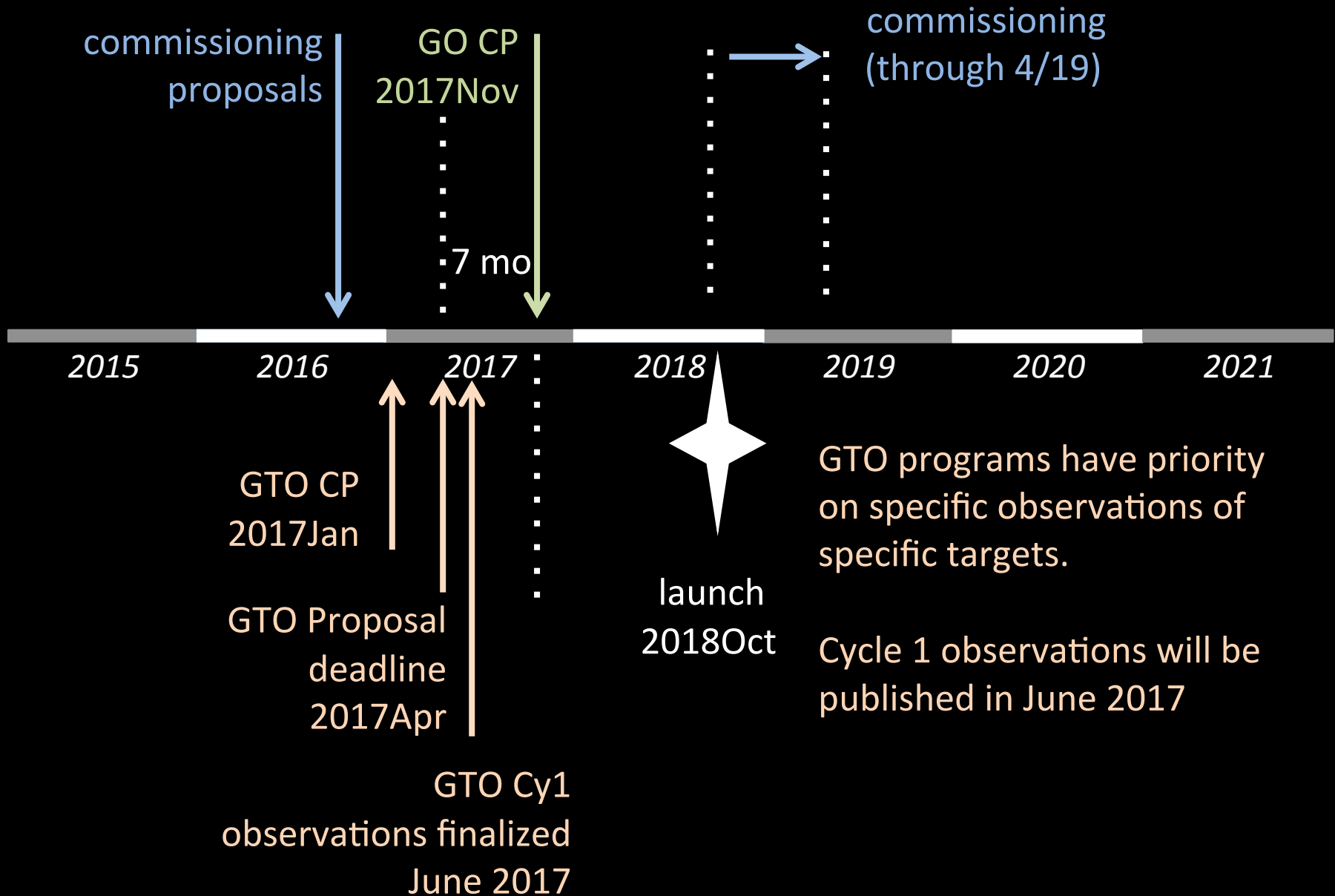
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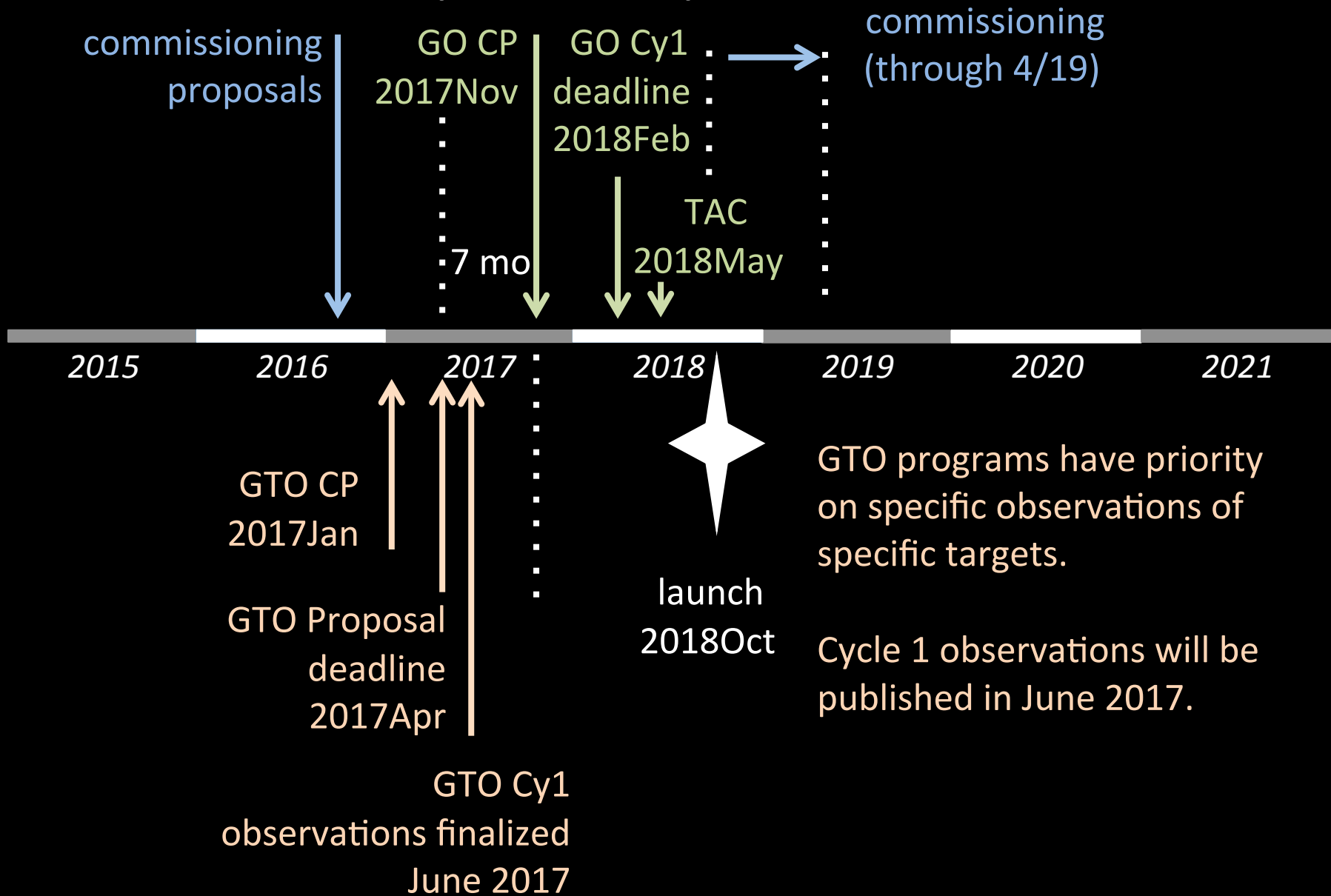
# JWST Science Planning Timeline

(draft schedule as of October 2015)



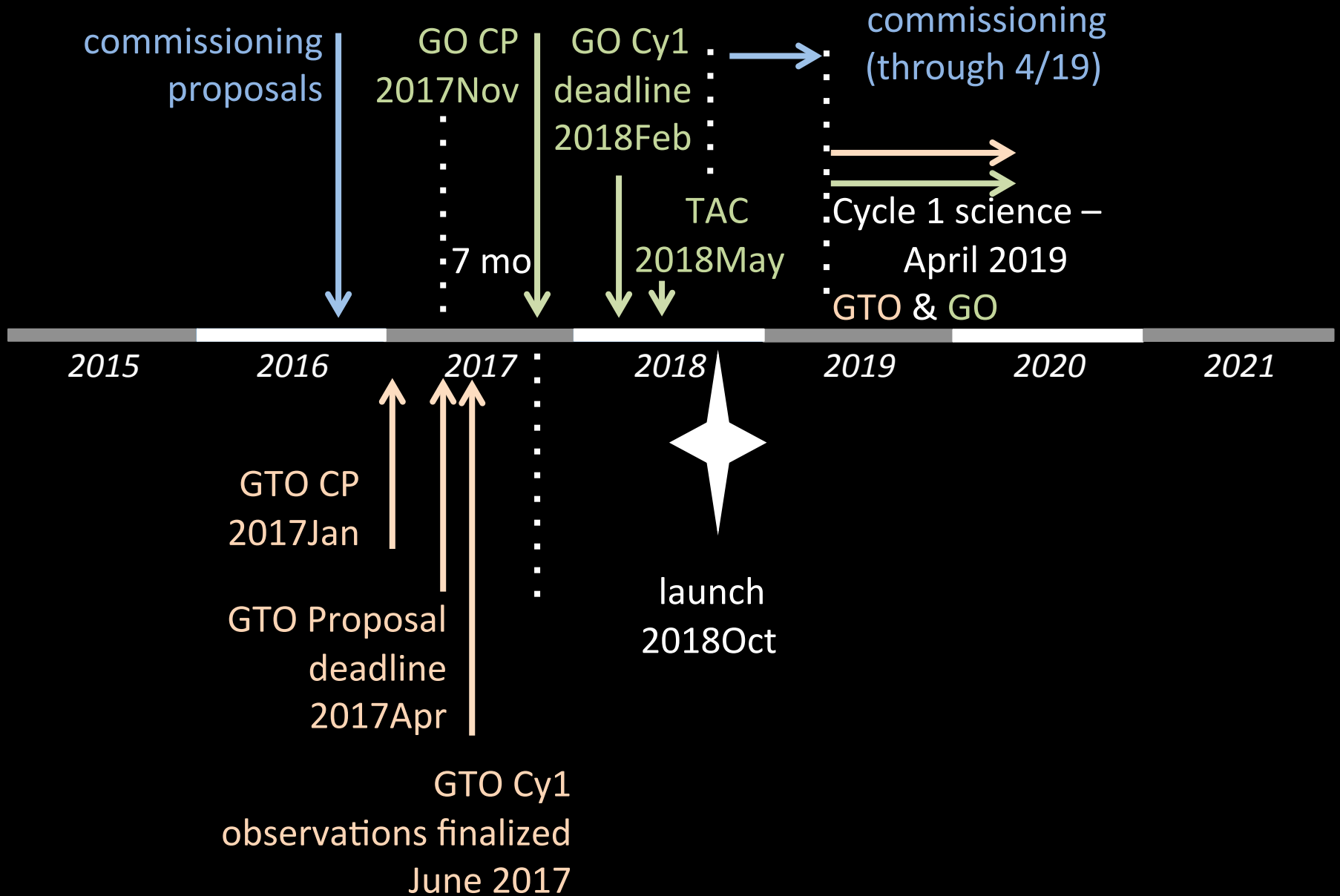
# JWST Science Planning Timeline

(draft schedule as of October 2015)



# JWST Science Planning Timeline

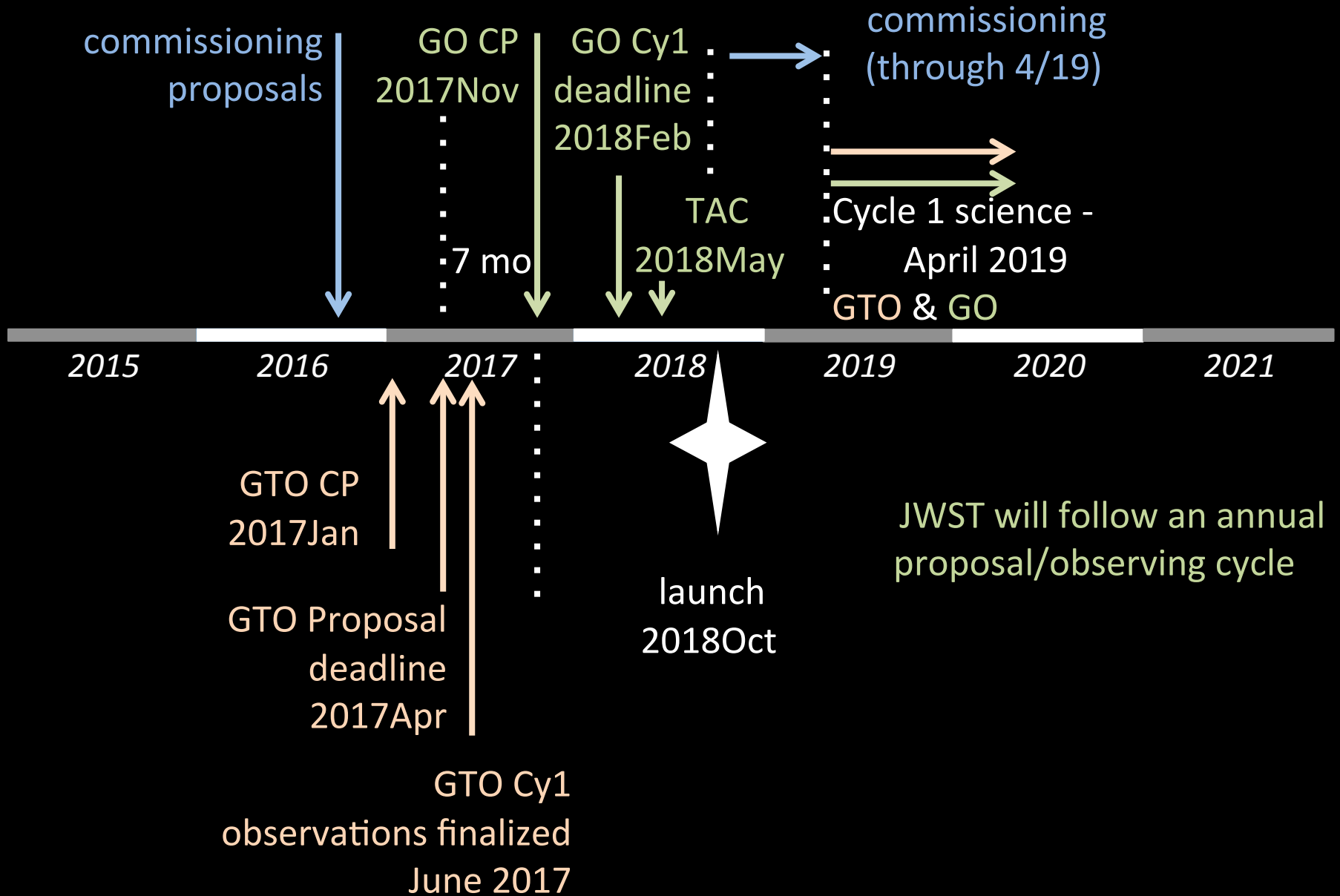
(draft schedule as of October 2015)





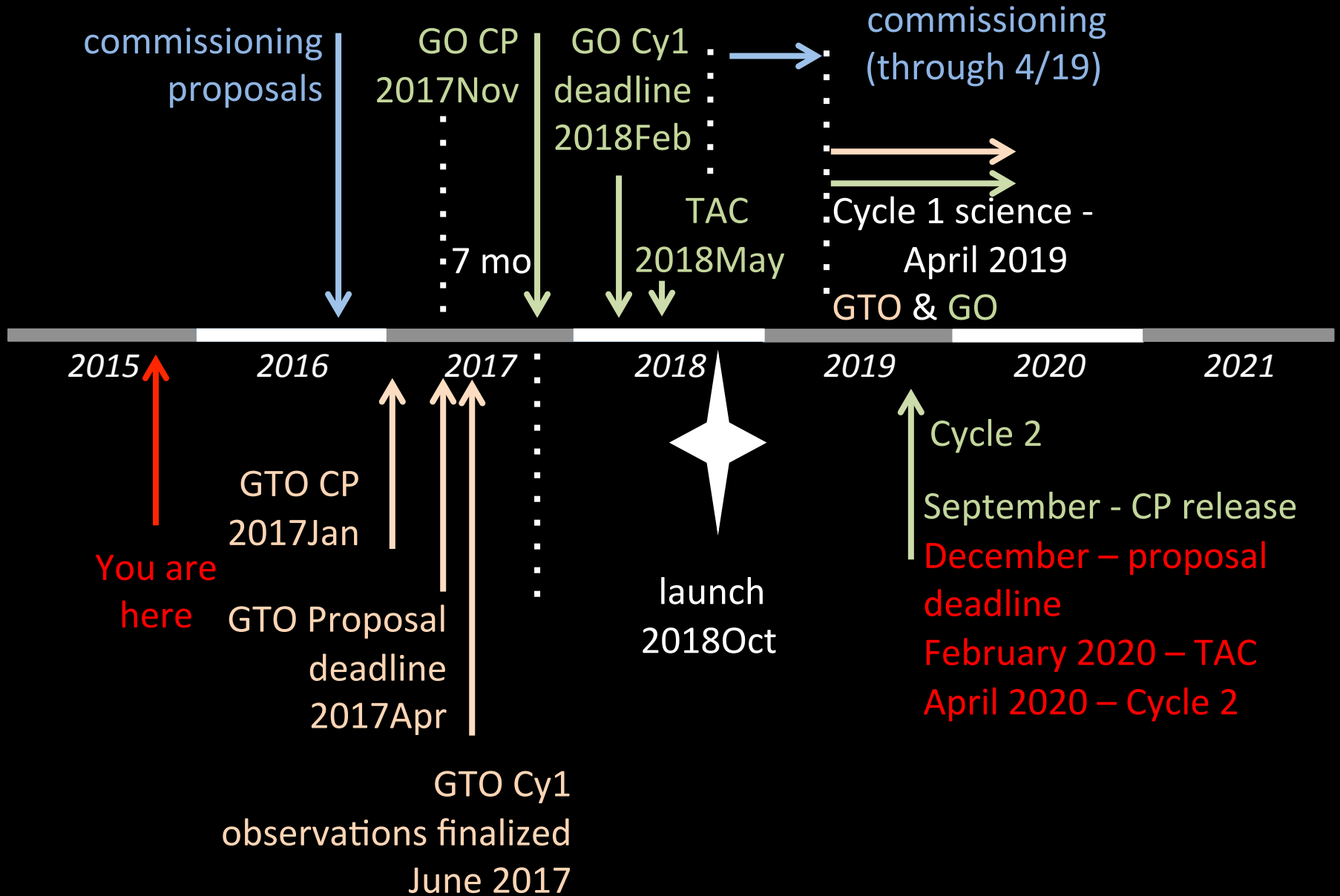
# JWST Science Planning Timeline

(draft schedule as of October 2015)



# JWST Science Planning Timeline

(draft schedule as of January 2015)



# Observing Programs

# Observations

- JWST will be at L2
  - Continuous observations (in principle) analogous to Spitzer rather than Hubble
- Observing programs will be allocated wall-clock time
  - Overheads incorporated in the allocation
  - 8,766 hours available per year
    - 5,000 to 6,000 hours on-target integration time

# Classes of Program

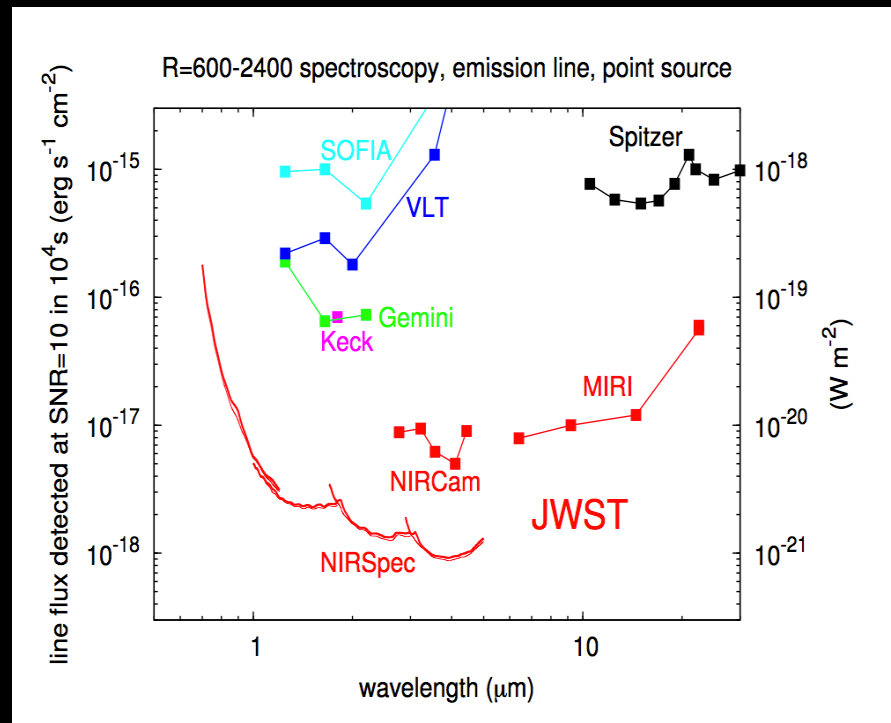
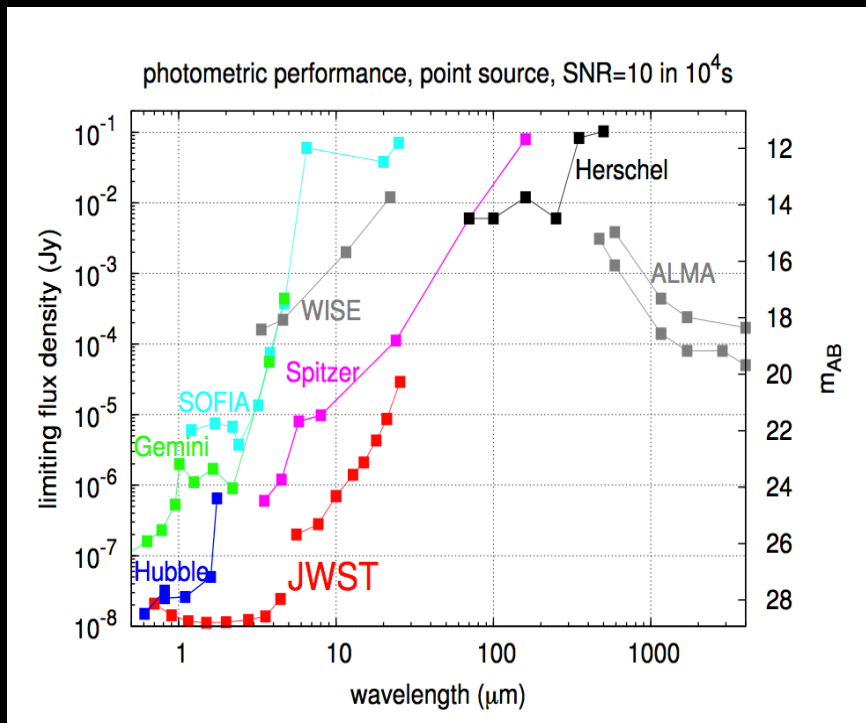
- Guest Observer (GO programs)
  - Open access for the community
  - ~80% of time in Cycles 1 through 5
- Guaranteed Time Observer (GTO) programs
  - 4020 hours allocated over first 30 months (i.e. Cycles 1 through 3)
  - NASA policy constraints on time/cycle
- Director's Discretionary Time (DD) programs
  - Up to 10%/cycle i.e.  $\leq 877$  hours
  - Rapid response observations & targeted science programs

# How much GO time in Cycle 1?

- 8766 hours available to schedule
- Up to 10% of total time as DD time
  - ~870 hours → ~7900 hours for GO+GTO
- NASA policy requires that GTO programs account for between 25% and 49% of the time available to GO and GTO programs in Cycle 1
  - Assume ~2200 hours for GTO time
- GO programs would constitute ~5700 hours in Cycle 1
- Hubble has ~3500 science orbits/year
  - ~5200 hours (with overheads)
- JWST Cycle 1 will offer more GO time than a typical Hubble Cycle
- GO allocation increases in Cycle 2 & 3 as GTO time decreases

# JWST Discovery Space

- JWST is an incredibly powerful machine
  - 10-100x sensitivity advantage over HST/Spitzer at higher resolution
  - Extensive discovery space for exploratory science in relatively small time allocations



# JWST GO Program Types

- We anticipate that JWST GO size categories will include
  - Small, Medium, Large, Very Large
- We anticipate a balanced distribution in program sizes
  - Small/Medium/Large in early cycles
  - Initially, the majority of time will be allocated to Small programs
- We also anticipate specialised categories
  - Long-term programs → Small/Medium programs whose science **requires** observations in future cycles (astrometry, variability)
  - ToO programs
  - Treasury/Legacy programs
  - Joint programs with other facilities (eg Hubble, Chandra, ALMA/NRAO, ground-based OIR facilities)
- JWST will also accept proposals for archival & theory research programs

We continue to refine these concepts in consultation with the JSTAC.



# An Early Release Science program

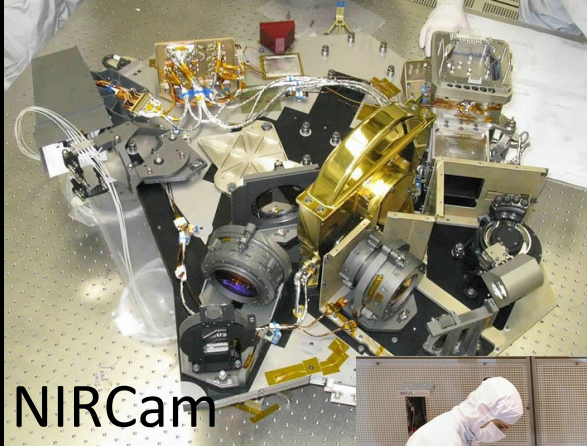
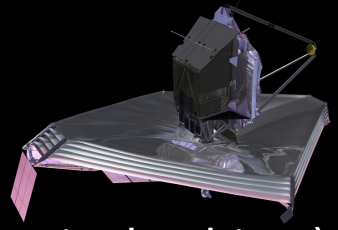
A science program of the community chosen  
by the community for the community

# JWST & the future of astrophysics

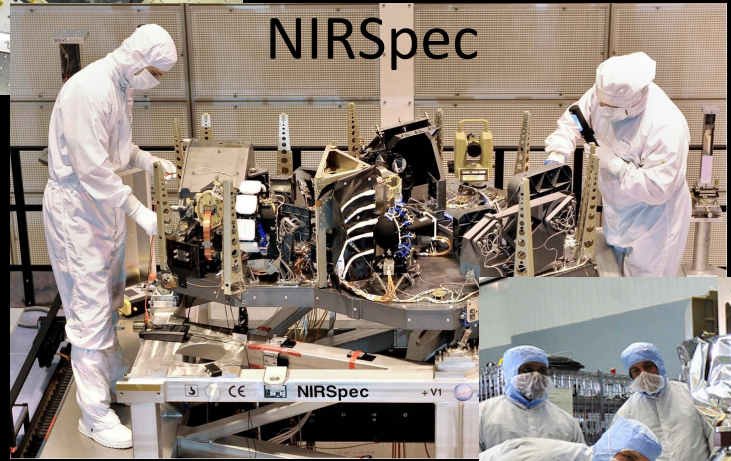
- JWST epitomises international co-operation as one of the largest science programs ever undertaken, worldwide.
  - We need to make JWST correspondingly productive
- JWST is an incredibly powerful machine with broad scientific reach and complex instrumentation

# Complex Instruments

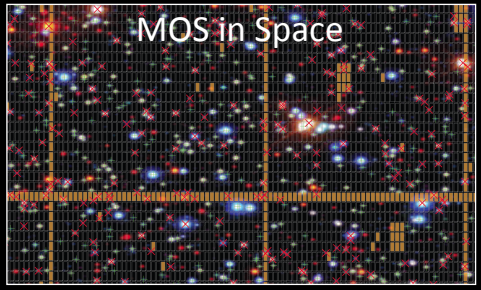
- >40 imaging filters
- 8 spectroscopic modes  
(multi-object, IFU, wide field grism, single object)
- multiple coronagraphs



NIRCam



NIRSpec



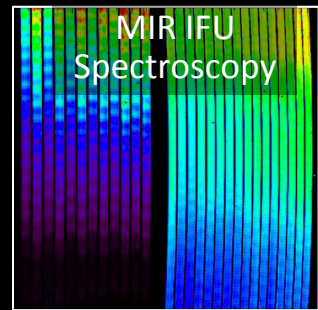
MOS in Space



Moving Target Support



MIRI



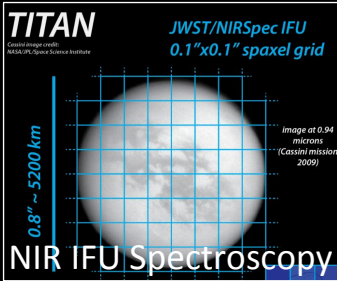
MIR IFU Spectroscopy



Ultra Deep Fields



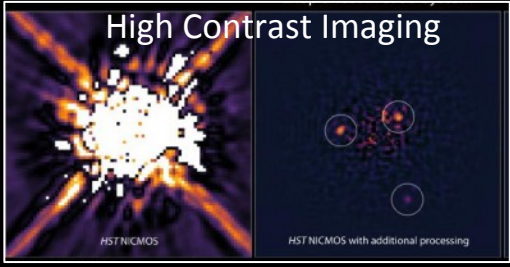
NIRISS



TITAN

JWST/NIRSpec IFU  
0.1''x0.1'' spaxel grid

NIR IFU Spectroscopy



High Contrast Imaging

HST NICMOS

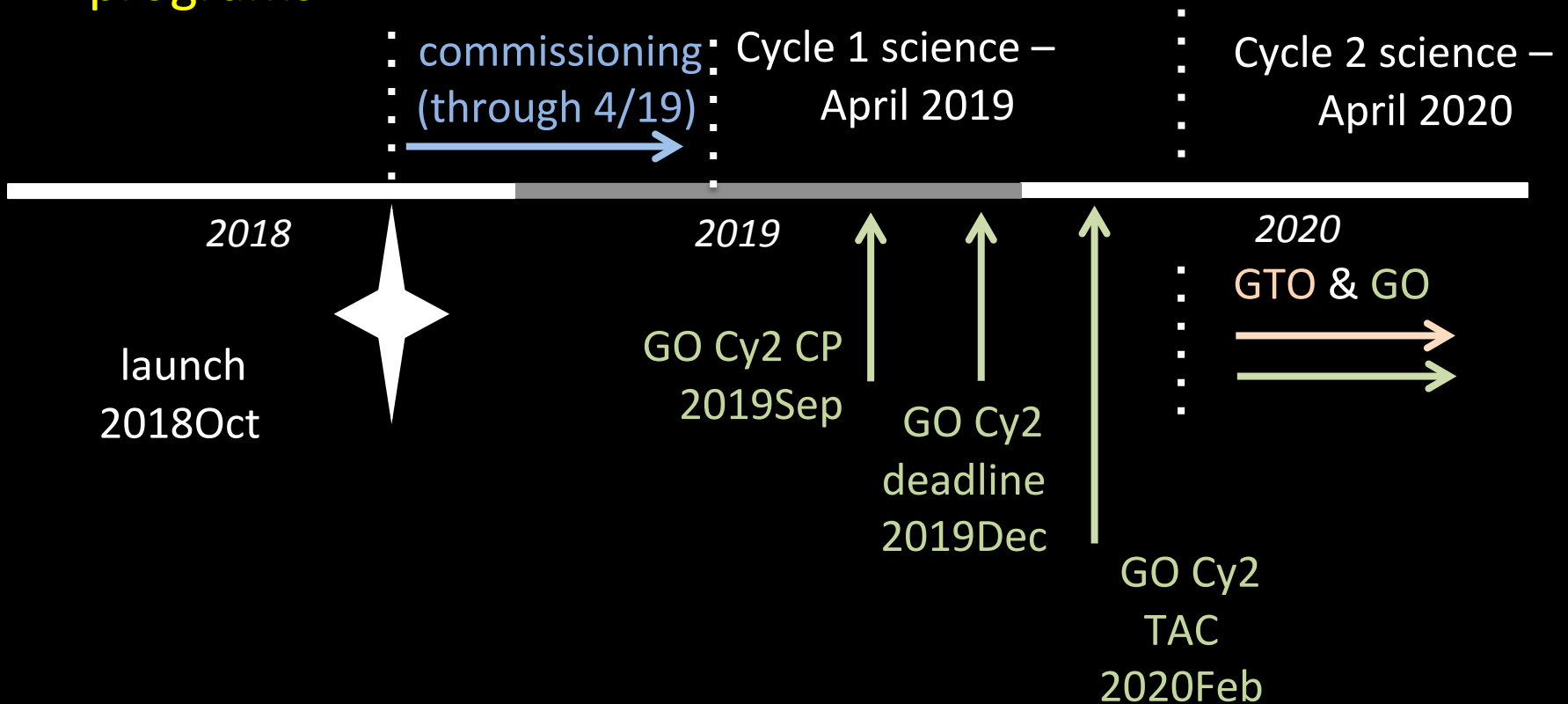
HST NICMOS with additional processing

# JWST & the future of astrophysics

- JWST epitomises international co-operation as one of the largest science programs ever undertaken, worldwide.
  - We need to make JWST correspondingly productive
- JWST is an incredibly powerful machine with broad scientific reach and complex instrumentation
  - Exploiting that power requires an informed community
  - Providing early access to data from representative science programs is crucial to understanding JWST's capabilities and enabling the community to maximise the science return.

# Cycle 2 proposal schedule

- JWST science observations start in April 2019
  - Cycle 2 proposal deadline in early December 2019, ~7.5 months into Cycle 1
- The general community will have very limited access to non-proprietary observations to aid preparations for Cycle 2 programs



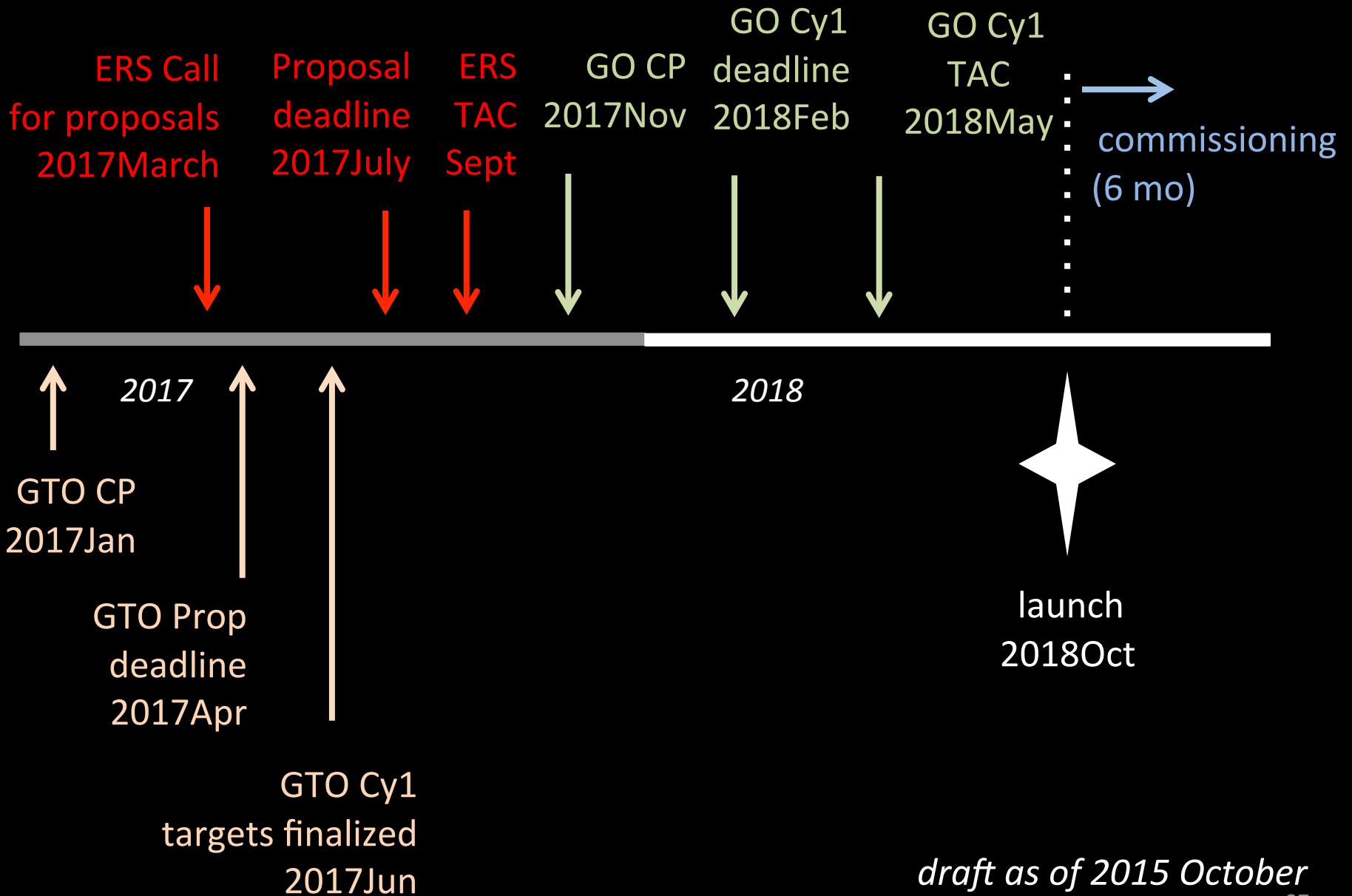


# An Early Release Science Program

- The JSTAC has recommended implementation of an Early Release Science Program
  - “*..to obtain images and spectra that would be used to demonstrate key modes of the JWST instruments. ...the First-Look data be released both in raw form and with any initial calibrations as soon as possible; the key aspect is speed.*”  
[JSTAC letter, 21/6/2010]
- The primary goal is to maximise the science impact of JWST by
  - Educating the community on JWST’s instrumental capabilities
  - Ensuring rapid data availability
  - Engaging the community now in planning the program
- To achieve those goals, the program should
  - Provide a wide range of scientifically interesting datasets
  - Exercise a wide range of the instrument modes for a range of science topics
  - Execute very early in the first cycle
  - Plan the program based on proposals from community members  
[JSTAC letter 26/3/2014]

Concept: A suite of science-driven observing programs, designed by the community and selected through proposal peer review

# *JWST Cycle 1 ERS Proposal Schedule*



# Next steps

- Refine the program concept
  - Identify appropriate range of technical challenges to be addressed by ERS programs
  - Develop more detailed definition of program specifications, e.g.
    - Size constraints, target distribution ( $\alpha$ ,  $\delta$ ), target flexibility, etc.
  - Develop a more detailed implementation timeline
- The overall program will be shaped based on community input.
  - Questionnaire circulated to meeting attendees
    - Please complete
  - <http://goo.gl/forms/IR0rHG4H4o>
  - Discussion session Thursday @ 17:00



# Summary

- The JWST science planning timeline
  - Cycle 1 GO Call issued November 2017 (~2 years!)
  - Cycle 1 proposal deadline currently set for February 2018
- JWST will offer a balanced range of GO programs
- We propose to implement a community-selected Early Release Science program that will provide representative datasets for key instrument modes through a suite of science-driven observing proposals
  - We invite your active participation in defining and implementing that program
  - Discussion session on Thursday
  - E-mail suggestions (to [jwst\\_ers @ stsci.edu](mailto:jwst_ers@stsci.edu))

Backup

# Organising principles

Concept: A suite of science-driven observing programs, designed by the community and selected through proposal peer review

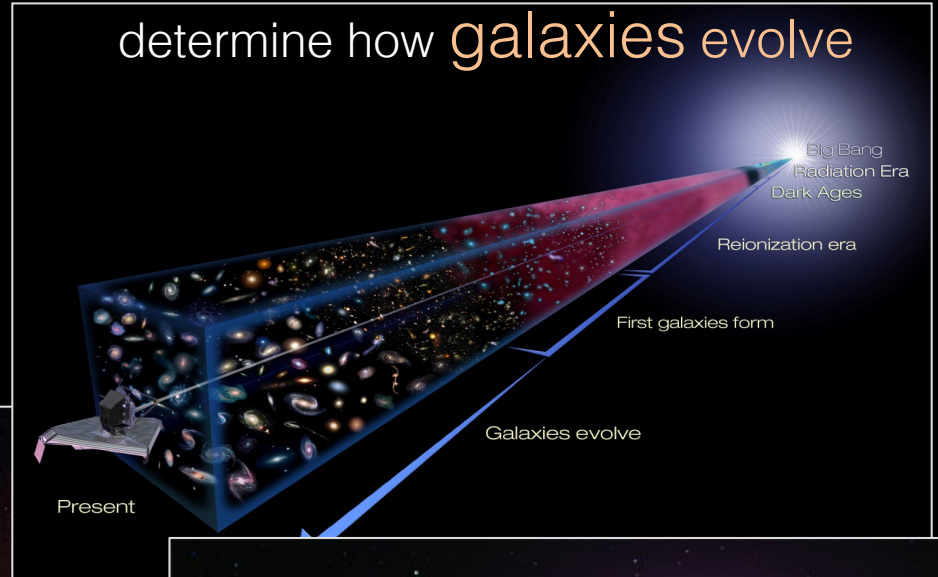
- Programs will be required to address specific technical challenges
  - E.g. crowded field photometry, high mid-IR background, spectral extraction, MOS observations (known targets)
- The program will likely be supported by Director's Discretionary Time
  - Program scale: 500-600 hours
- Data will have no exclusive access period
- Observations specified & proposals in place by Cycle 1 GO Call
  - Provides APT templates for the GO community
  - Enables AR proposals and synergistic GO proposals for supplementary and/or complementary observations
  - ERS programs cannot duplicate GTO observations
  - GO programs cannot duplicate ERS observations
- Calibrated data products will be made available on a rapid basis
  - STScI will provide assistance in their production

# The Scientific Vision

see the Universe's **first galaxies**



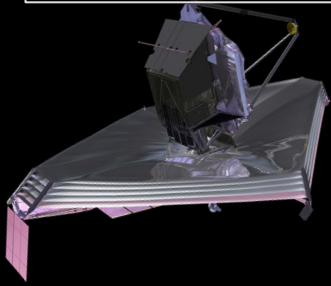
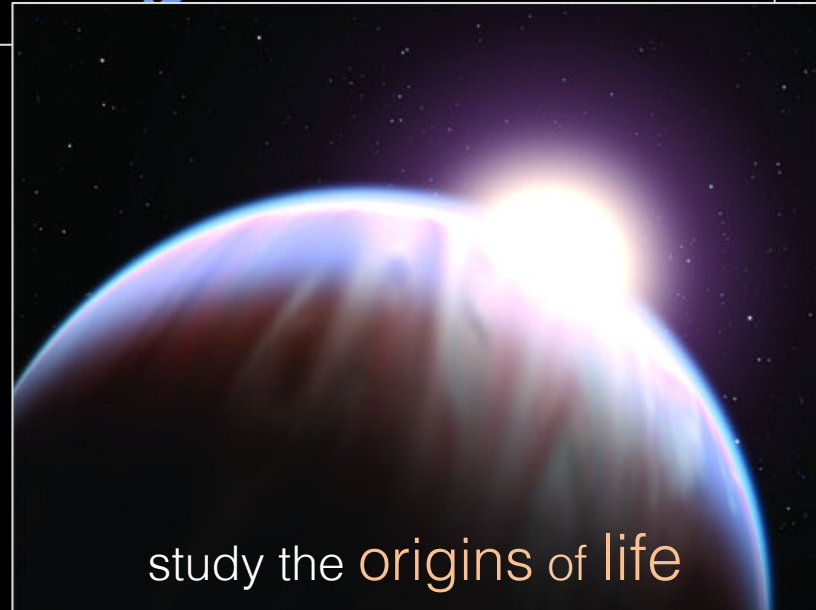
determine how **galaxies evolve**



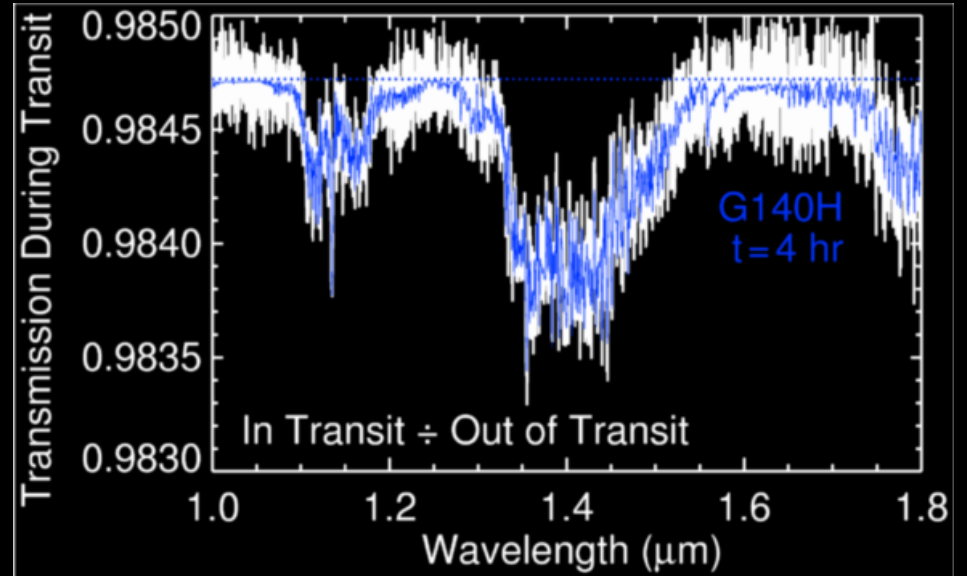
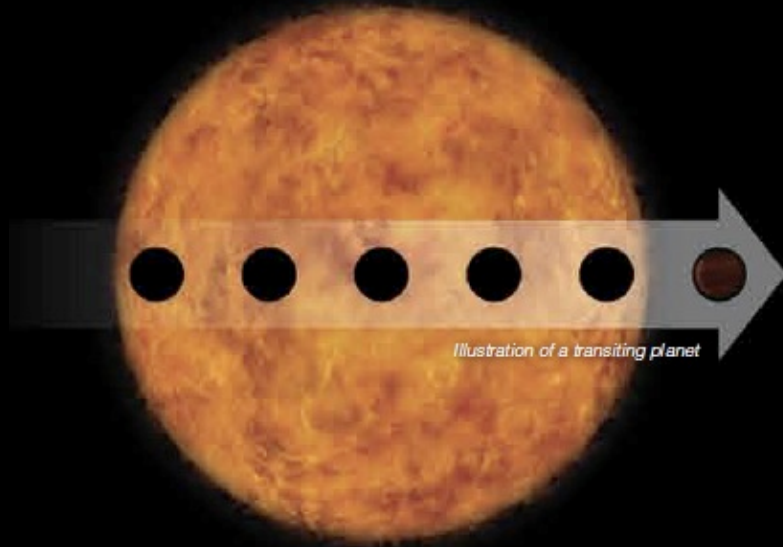
uncover newborn stars and planets



study the **origins of life**



# Exoplanet characterisation



# Solar System observations

