STScI | SPACE TELESCOPE SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

JWST Cycle 1 Exoplanet and Disk Observations

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2021 Sagan Exoplanet Summer Virtual Workshop

JWST Status

Observatory

- All observatory post-environmental testing deployments complete
- Final stow and preparations underway prior to shipping

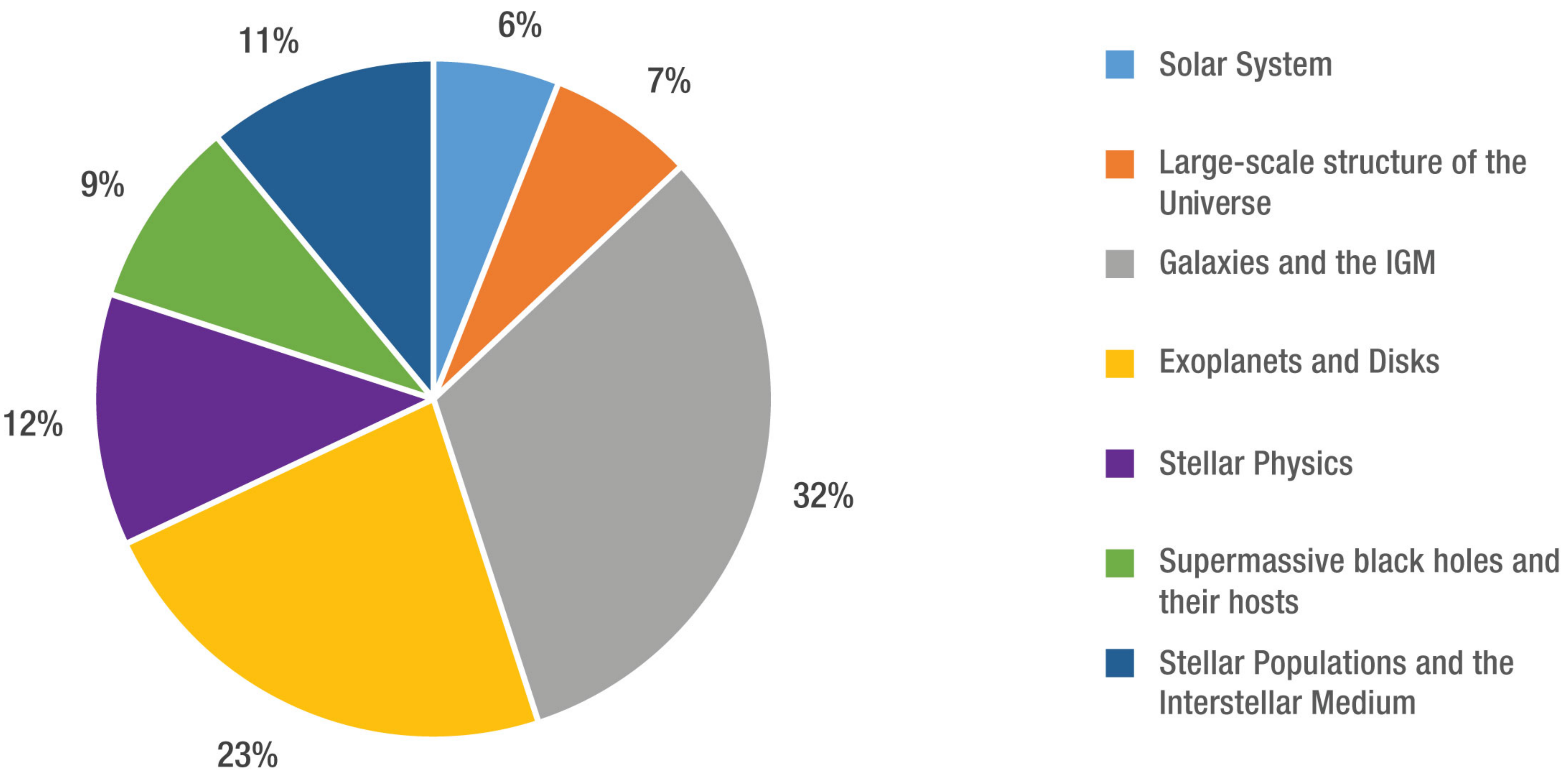
Science and Operations

- Ground segment testing and operations rehearsals restarted
  - Completed Launch Readiness Exercises #3 and #4 and commissioning rehearsals
  - LRE #4 saw more mission operations center (MOC) room staffing
- Cycle 1 program defined

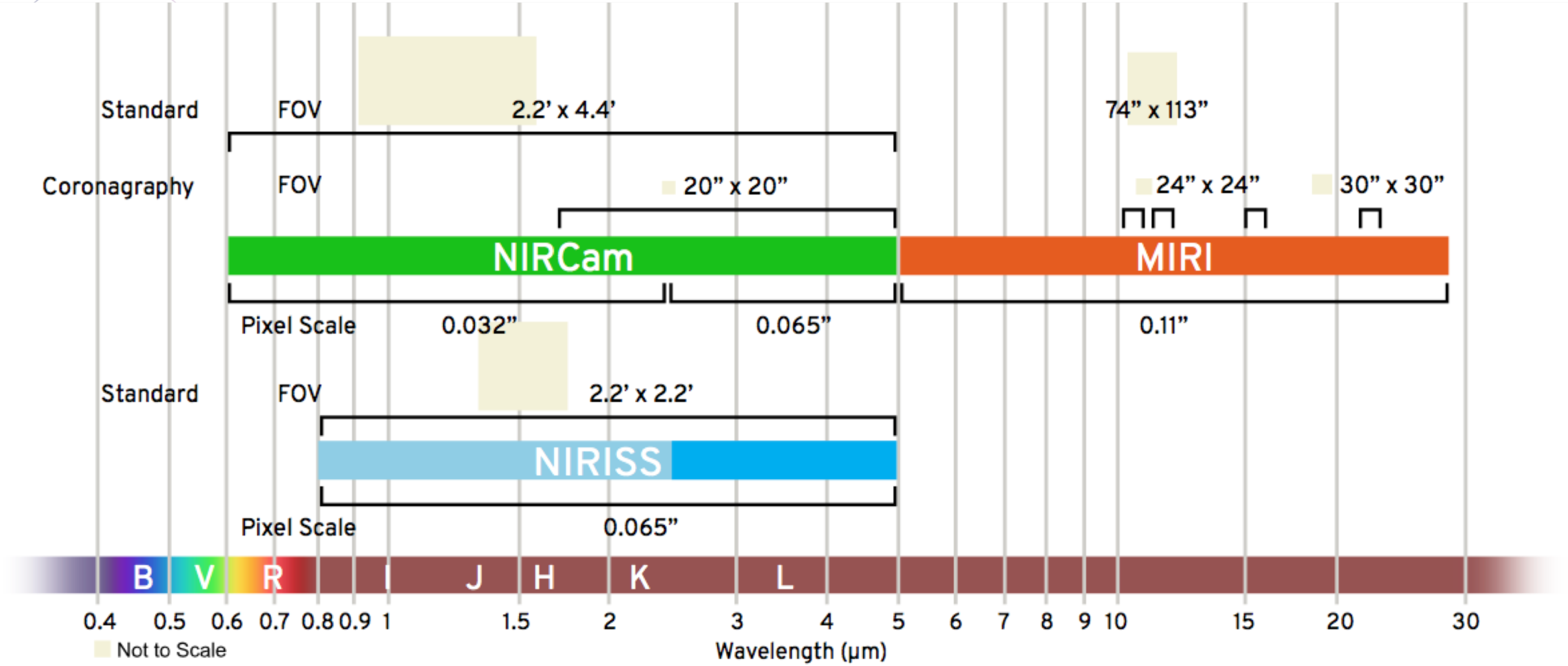
Programmatic

- On track to complete observatory for August ship date and a 10/31/21 LRD
- Working with ESA & Arianespace to be the 3rd Ariane 5 launch this year after they return to flight in late July.

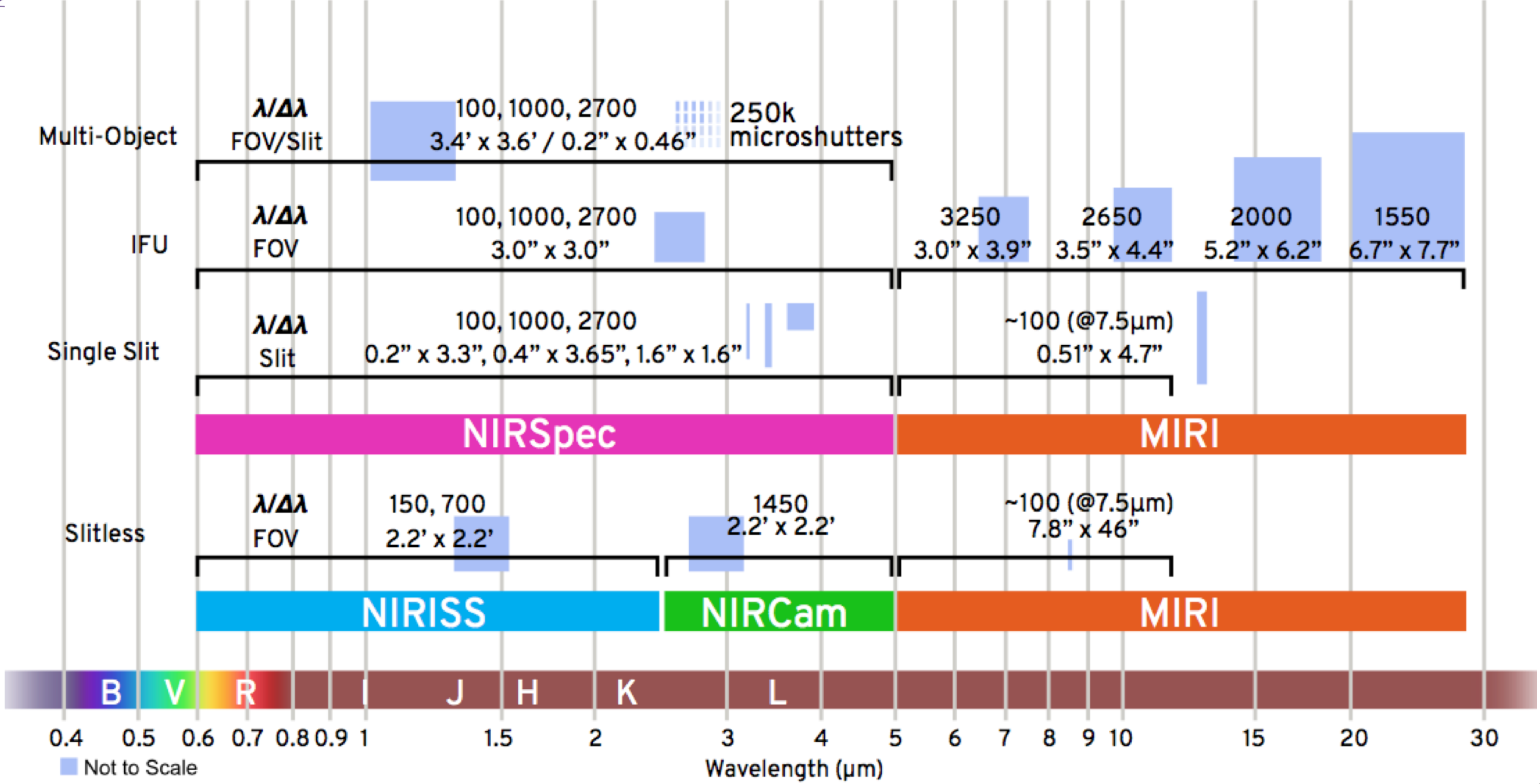
Science Categories



Imaging Modes



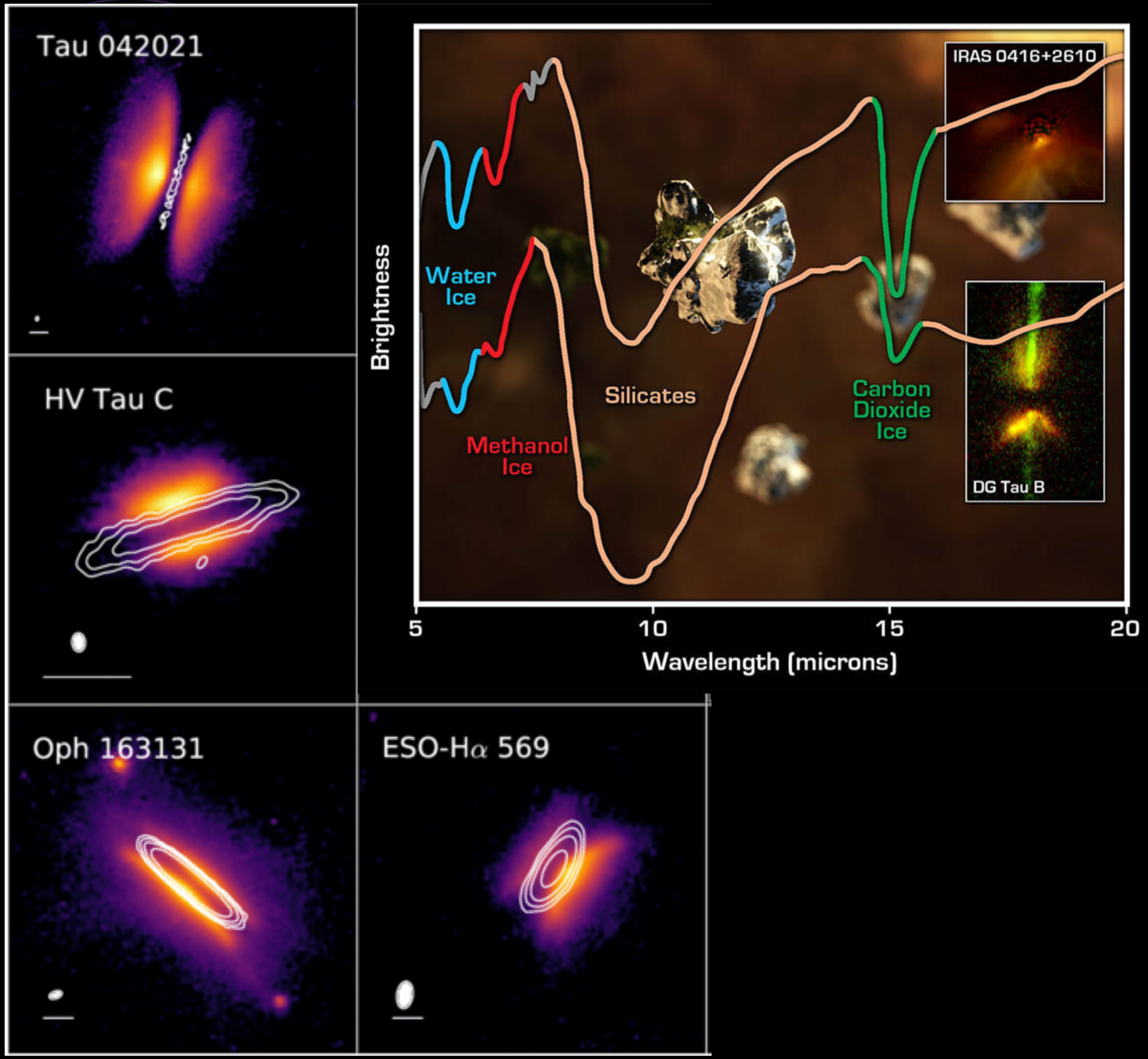
Spectroscopic Modes



Overview

- Introduction
- JWST Cycle 1 Observing Programs
    - Characterizing Dust and Gas in Protoplanetary and Debris Disks
    - Searching for Exoplanets in Disks
    - Characterizing the Surfaces and Atmospheres of Exoplanets
    - Characterizing the Surfaces and Atmospheres of Solar System Bodies
- JWST Cycle 1 Timelines
- Resources

Protoplanetary Disks: Ice Coated Grains



- Infrared spectroscopy of protostars has revealed ices and complex organic molecules. Ices such as H_2O, CO_2, CH_4, CH_3OH, and SO_2 are believed to exist in the outer regions of protoplanetary disks.
- Edge-on, protoplanetary disks with optically thick midplanes provide an excellent opportunity to search for and characterize icy grains
- *"IceAge: Chemical Evolution of Ices during Star Formation" (PI McClure, PID 1309, 32.7 hours) Early Release Science Program*
- *"Mapping Inclined Disk Astrochemical Signatures (MIDAS)" (PI McClure, PID 1751, 25 hours) ESO-Hα 569 and Tau 042021 with NIRSpec IFU and MIRI MRS*

Protoplanetary Disks: Volatile Gas

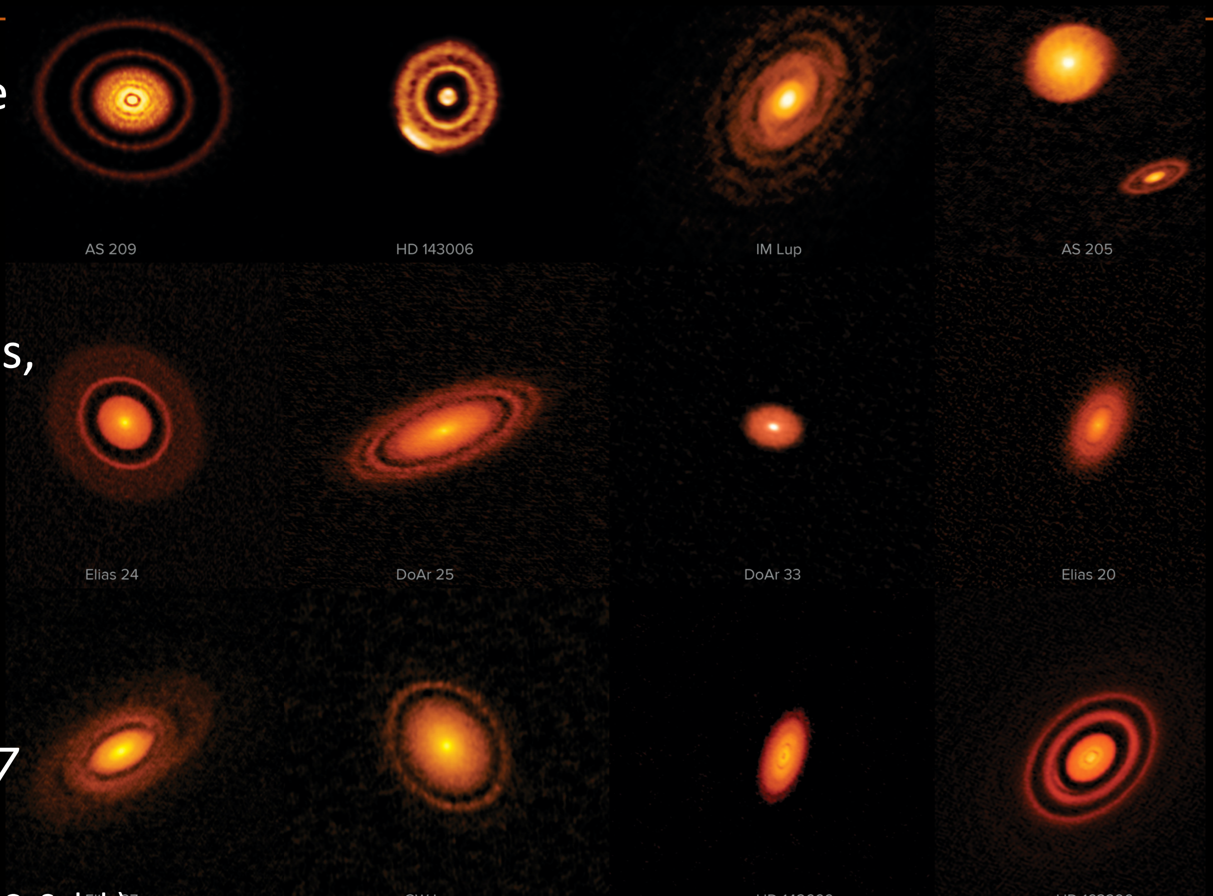
Study the chemistry of water and organics in the terrestrial planet forming regions (<5 AU). Two programs with no exclusive access period.

- Understand disk dispersal processes
- Create inventories of major molecular species, H_2O, CO, CO_2, CH_4, NH_3, etc.

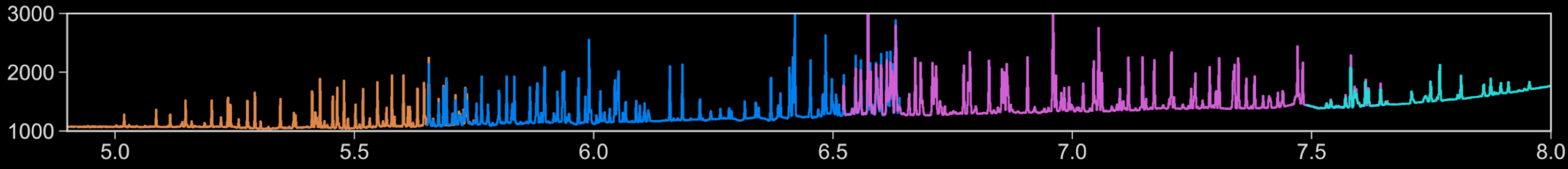
"The Deepest Search for Rare Molecules and Isotopologues in Planet-forming Disks" (PI Pontoppidan, PID 1549, 13.4 hours) MIRI MRS, search for $H_2^{18}O$, NH_3 & CH_4

"A DSHARP-MIRI Treasury Survey of Chemistry in Planet-forming Regions" (PI Salyk, PID 1584, 27.7 hours) MIRI MRS, radial abundances

ALMA-DSHARP, S. Andrews



Simulated MIRI MRS spectrum of water emission in a protoplanetary disk (C. Salyk)



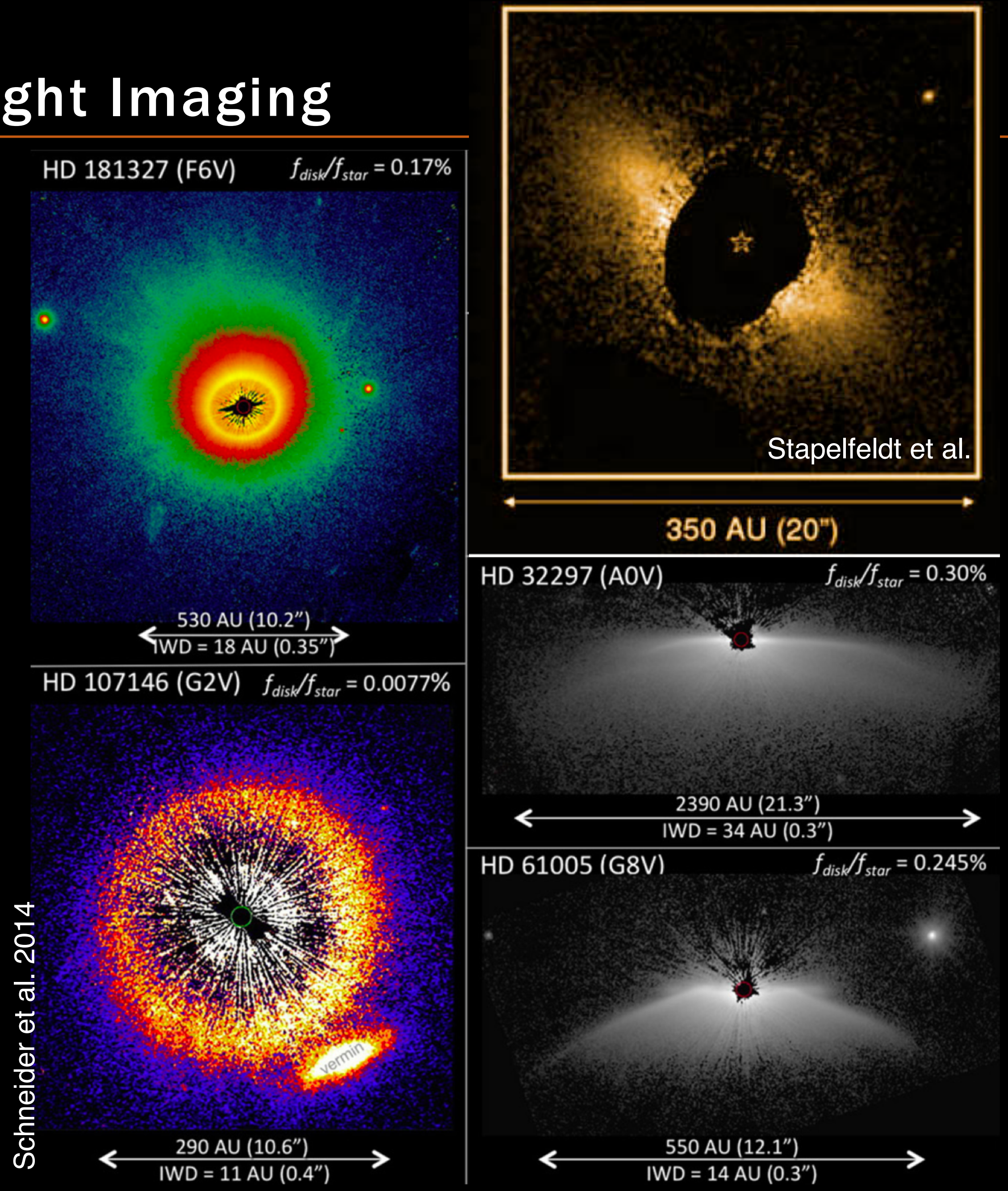
Debris Disks: Dust Scattered Light Imaging

High resolution images of debris disks have discovered

- asymmetries indicative of the presence of planets
- extended halos of small dust grains blown out of the system by radiation pressure
- scattering phase functions that may constrain the minimum grain size.

In addition, NIRCam has medium band filters that will enable imaging in and out of the water ice and CO_2 frost solid-state features to search for and map volatile ices.

"Coronagraphic Imaging of Scattered Light Debris Disks" (PI Gaspar, PID 1183, 2.5 hours) HD 181327, HD 107146, HD 10647, HD 32297, and HD 61005 with NIRCam Coronagraph



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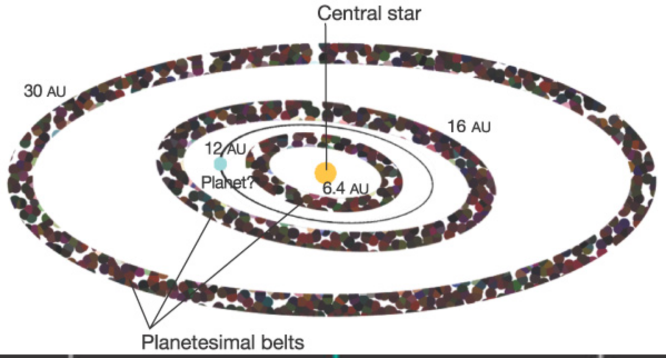
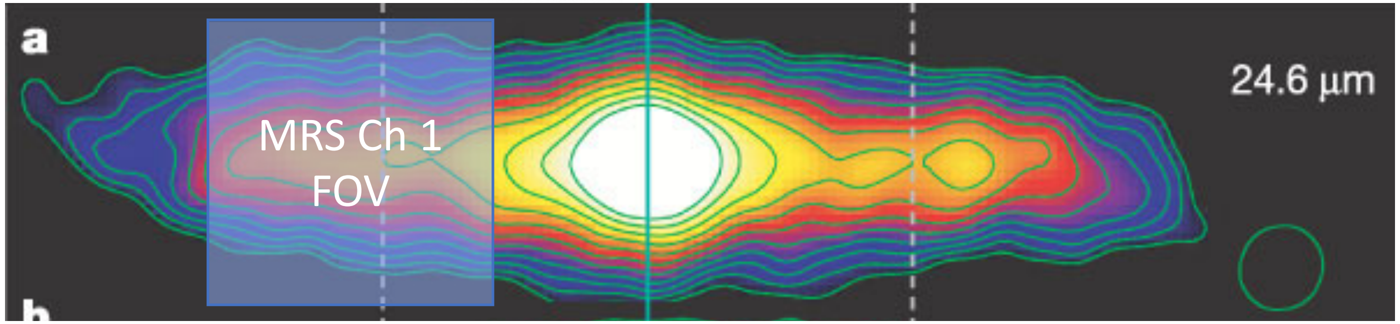
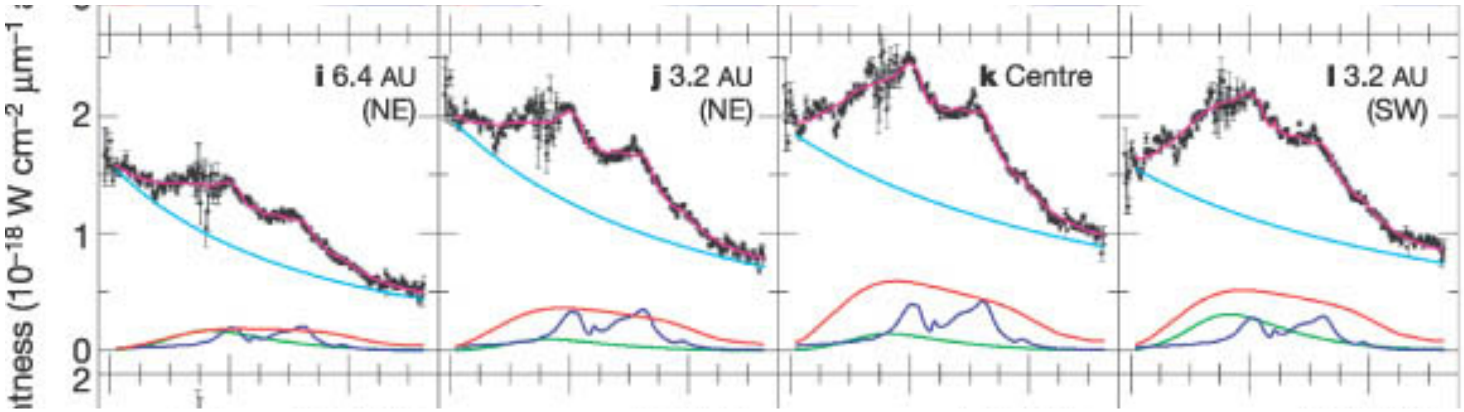
Debris Disks: Silicate Dust Emission Mapping





Gemini South/TReCS - Telesco et al. 2005

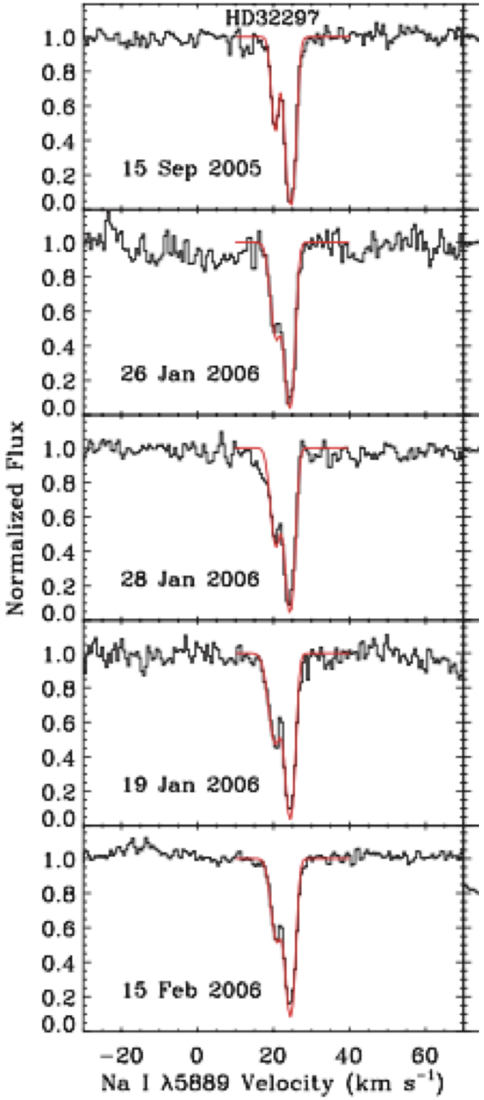


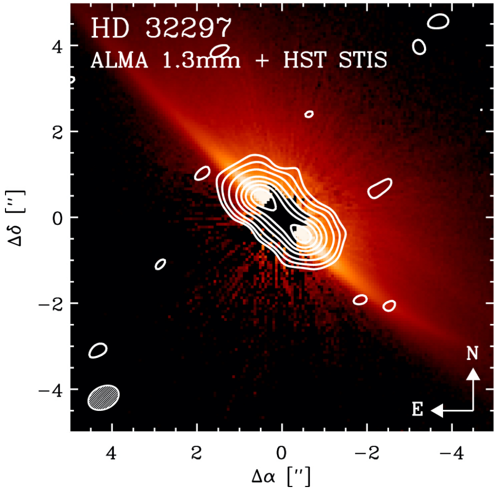
Subaru/COMICS - Okamoto et al. 2004

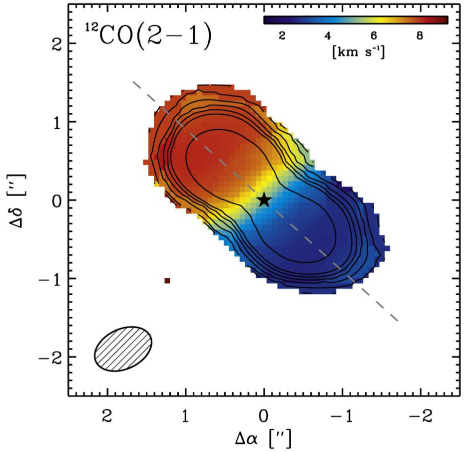
- Silicate emission features can constrain the detailed grain properties such as composition, crystalline fraction, and grain size.
- Changes in the silicate properties can provide evidence for how silicates are processed in disks.
- Ground-based (8-12 µm) and Spitzer IRS (5-35 µm) spectroscopy indicate gradients in the Fe/Mg ratio, crystallinity, and size in the β disk.
- *"Thermal Emission Spectroscopy of β Pictoris' Archetypal Debris Disk" (PI Chen, PID 1294, 8.9 hours), β Pictoris, η Crv, and η Tel with MIRI/MRS*

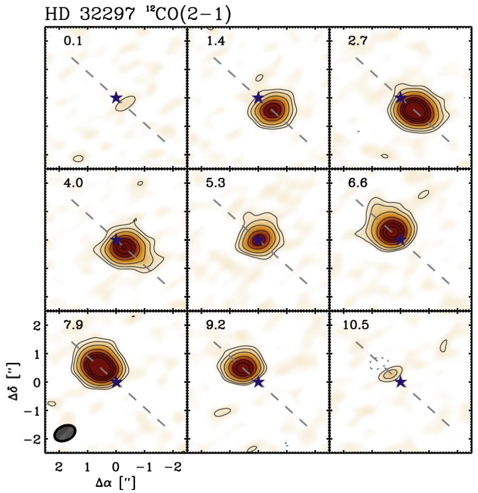
Debris Disks: Exocomets

Redfield et al. (2007)





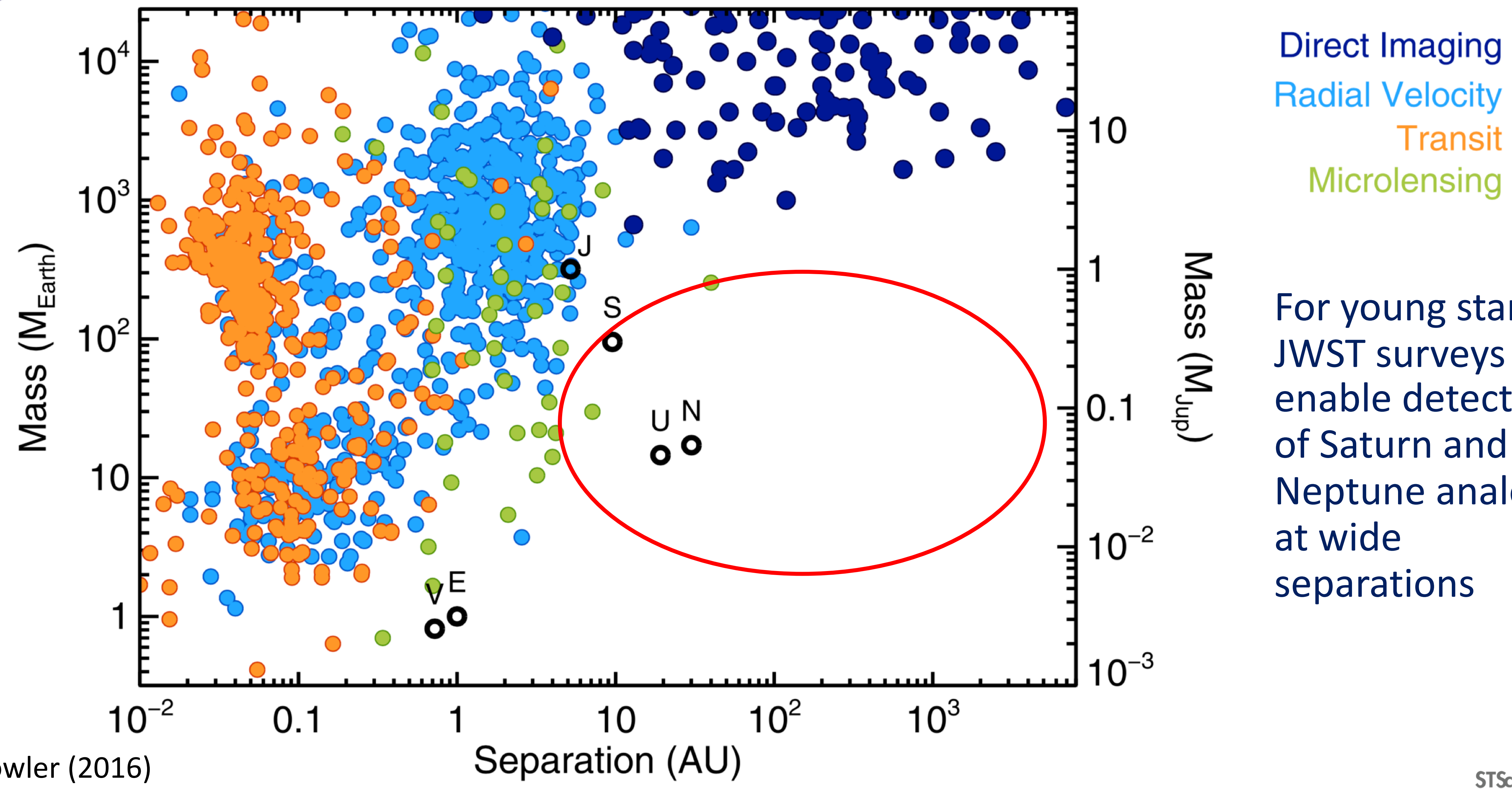




Macgregor et al. 2018

- Some edge-on debris disks have time variable, redshifted, absorption features, attributed to infalling exocomets
- Some of these systems have massive Kuiper Belt analogs that could be the source of the exocomets.
- "Coronagraphic Imaging of Scattered Light Debris Disks" (PI Gaspar, PID 1183, 2.5 hours) HD 32297 with NIRSpec Fixed Slit, H_2O and CO absorption
- "Search for NIR gas in debris disks. Is there a water delivery mechanism?" (PI Rebollido, PID 2053, 5.9 hours) HD 36546, HD 110058, HD 131488, HD 131835, HD 156623 with NIRSpec Fixed Slit, H_2O and CO absorption

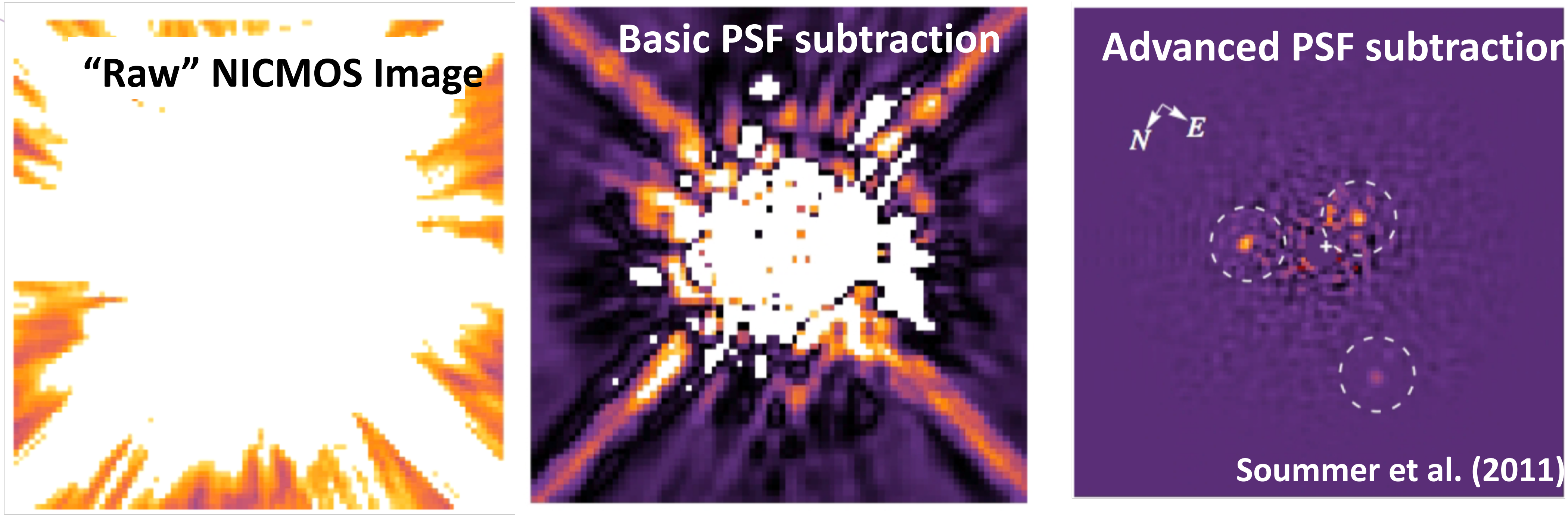
Current Exoplanet Demographics



For young stars, JWST surveys will enable detection of Saturn and Neptune analogs at wide separations

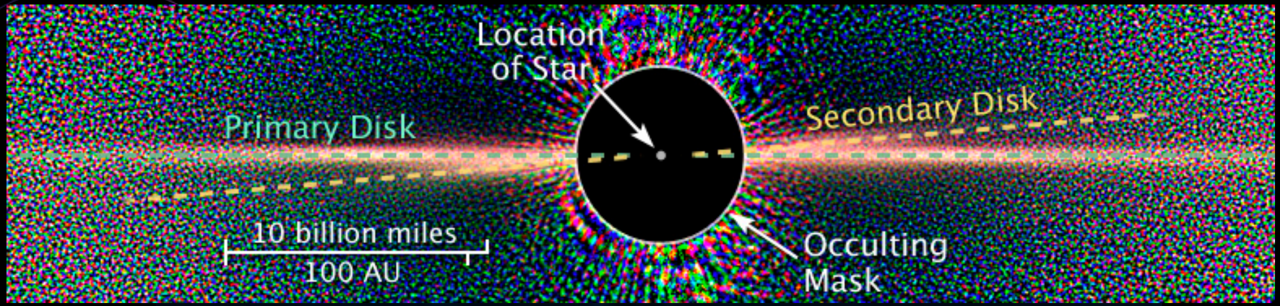
Bowler (2016)

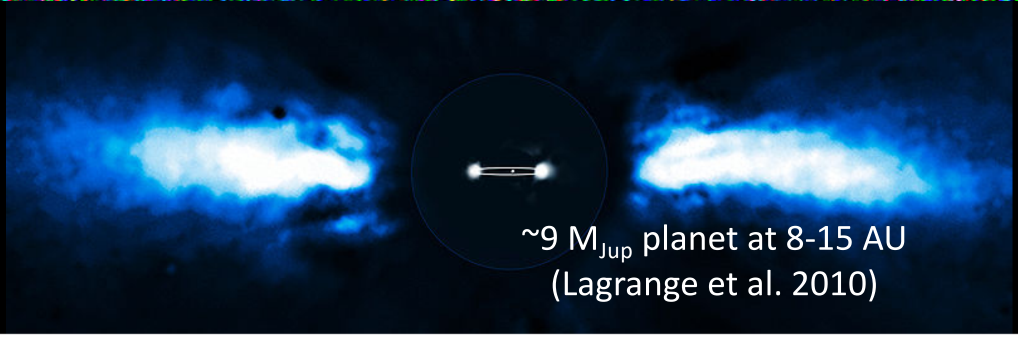
High Contrast Imaging Programs

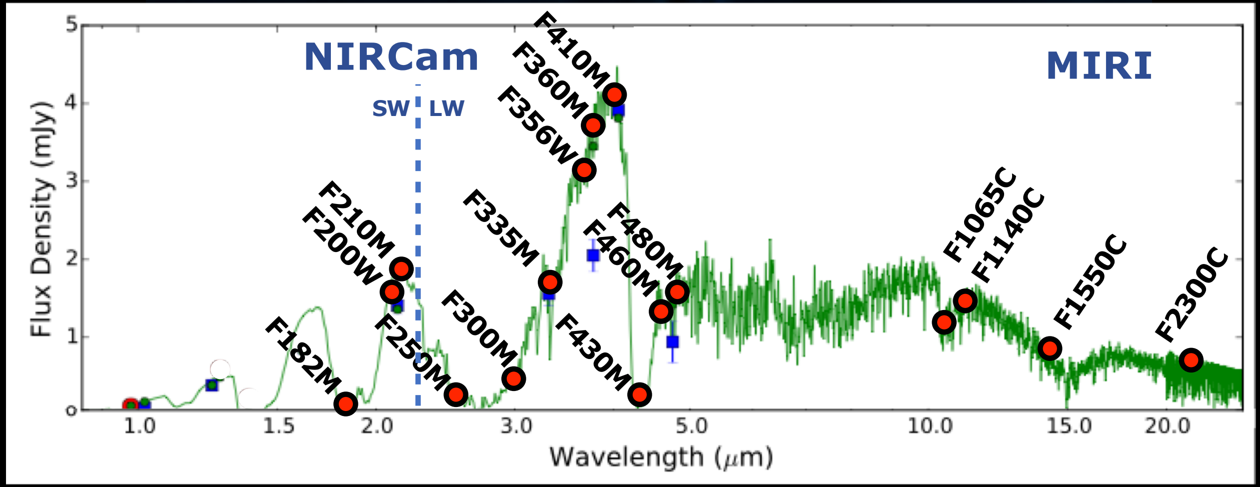


- JWST will spatially resolve exoplanets and disks around nearby stars.
- Application of PSF subtraction techniques can increase the SNR at which exoplanets and disks are detected.
- Over time, the community will develop many PSF subtraction techniques such as Reference Differential Imaging (RDI), Angular Differential Imaging (ADI), and Spectral Differential Imaging (SDI) leveraging libraries of PSF observations.
- In cycle 1, most programs will probably rely on classical PSF subtraction using a reference star with a similar spectral type.

Debris Disks: Evidence for Sculpting by Planets





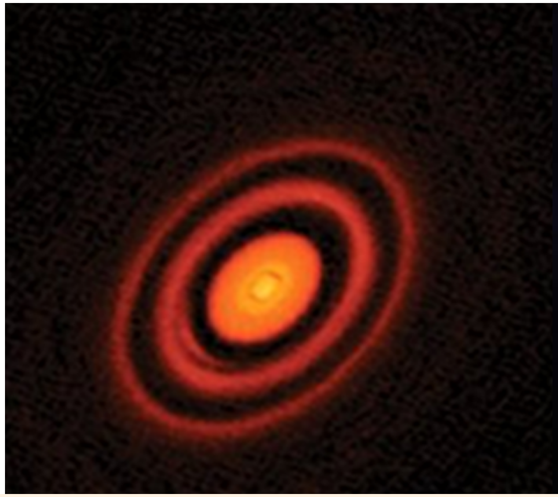


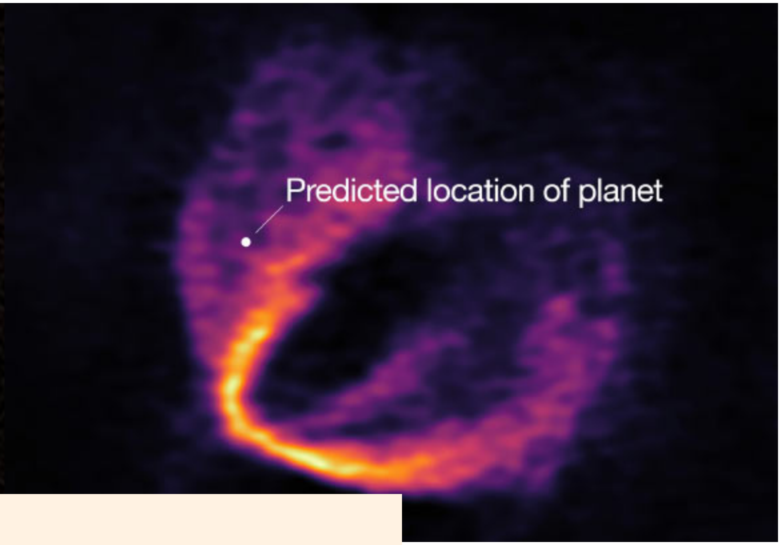
Teff = 1000 K, log(g) = 3.5 model from Barman et al.

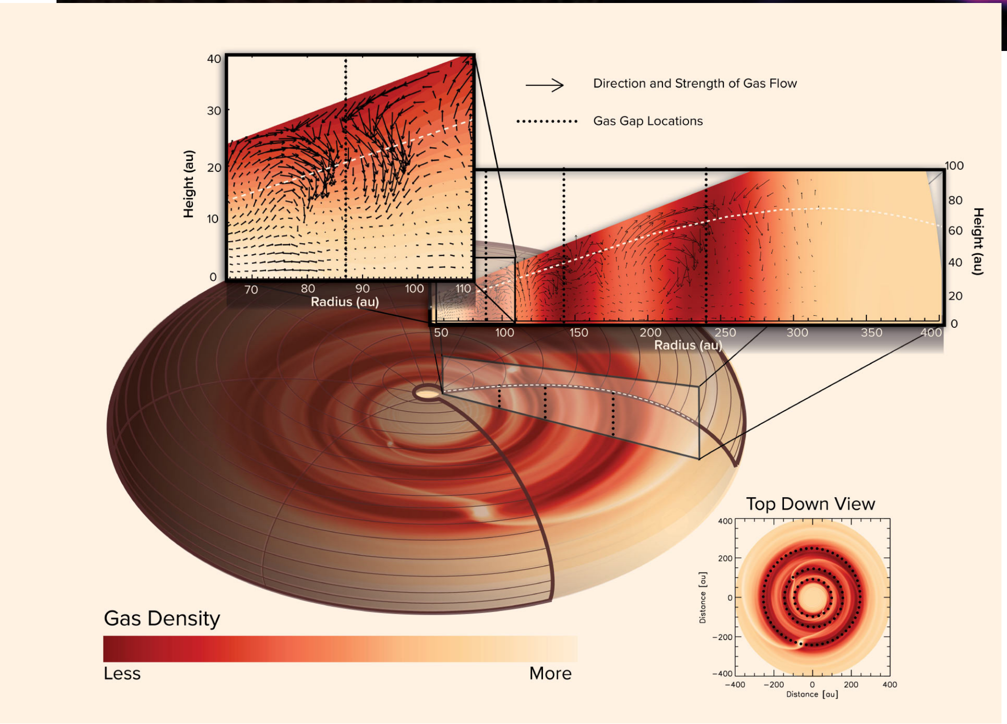
- High resolution images of debris disks have revealed the presence of structures that suggest dynamical sculpting by undetected planetary mass companions
- In Cycle 1, JWST will observe 38 young stars (including ε Eri, AU Mic, β Pic, HR 8799, κ And, and Vega) and white dwarfs using high contrast imaging techniques to search for and characterize exoplanets
- *"Coronagraphic Imaging of Young Planets and Debris Disks with NIRCam and MIRI" (PI Beichman, PID 1193, 52.1 hours) ε Eri, Fomalhaut and Vega with NIRCam and MIRI Coronagraphs*
- *"Searching for Low Mass Planets in Debris Disk Gaps" (PI Marino, PID 1668, 10.9 hours) HD 92945, HD 106146, and HD 206893 with MIRI Coronagraph*

Protoplanetary Disks: Evidence for Sculpting by Planets

- ALMA continuum and ^{12}CO observations revealed concentric annular gaps in Herbig Ae disk HD 163296 at 0.1, 0.5, 0.9, and 1.5". The two outer gaps are also depleted in CO suggesting the presence of giant planets.
- A detailed analysis of the ^{12}CO channel maps suggests that there is a 2 M_{Jup} planet offset ~2" (~260 au) from the central star.
- *"Investigating the Disk-Planet Interaction in the HD 163296 System with JWST" (PI Ricci, PID 2540, 16.8 hours), NIRCam Coronagraph*
- *"Detecting a Young 2 M_{Jup} Mass Planet Embedded in the Disk of HD 163296" (PI Cugno, PID 2153, 7.8 hours) MIRI Coronagraph*



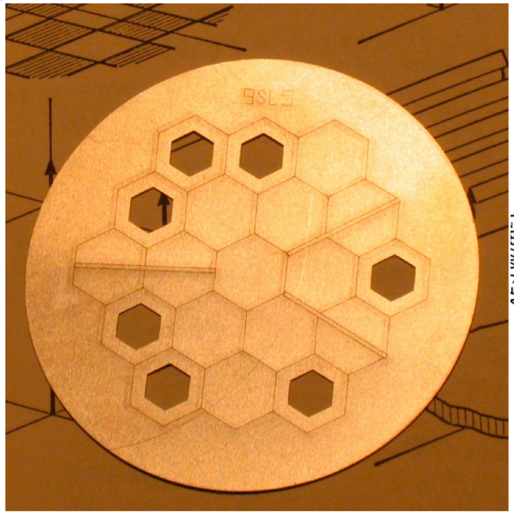


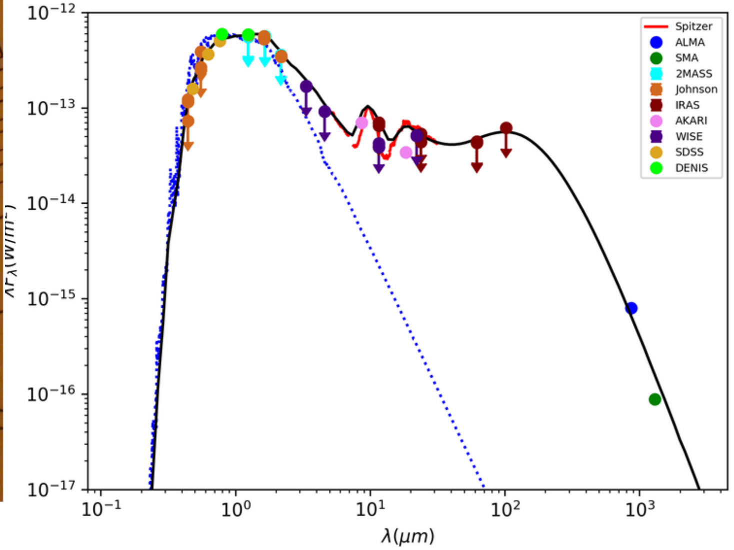


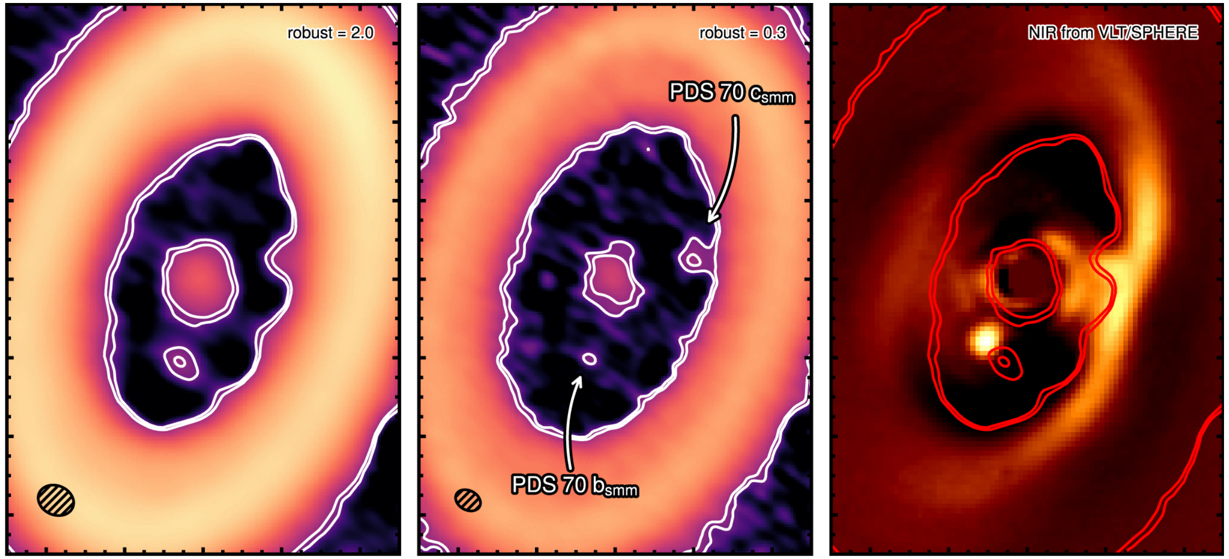
Top Left: ALMA continuum map of HD 163296, Top Right: ALMA ^{12}CO channel map with planet location overlaid (Pinte et al. 2018), Bottom: Simulation from Bae et al. 2017

Transition Disks: High Resolution Imaging

Long et al. 2018



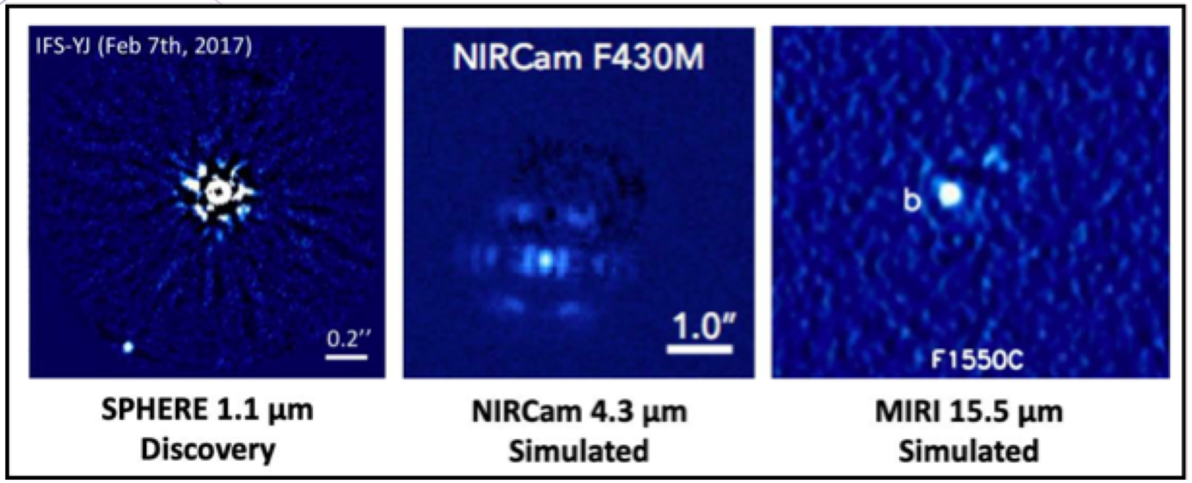




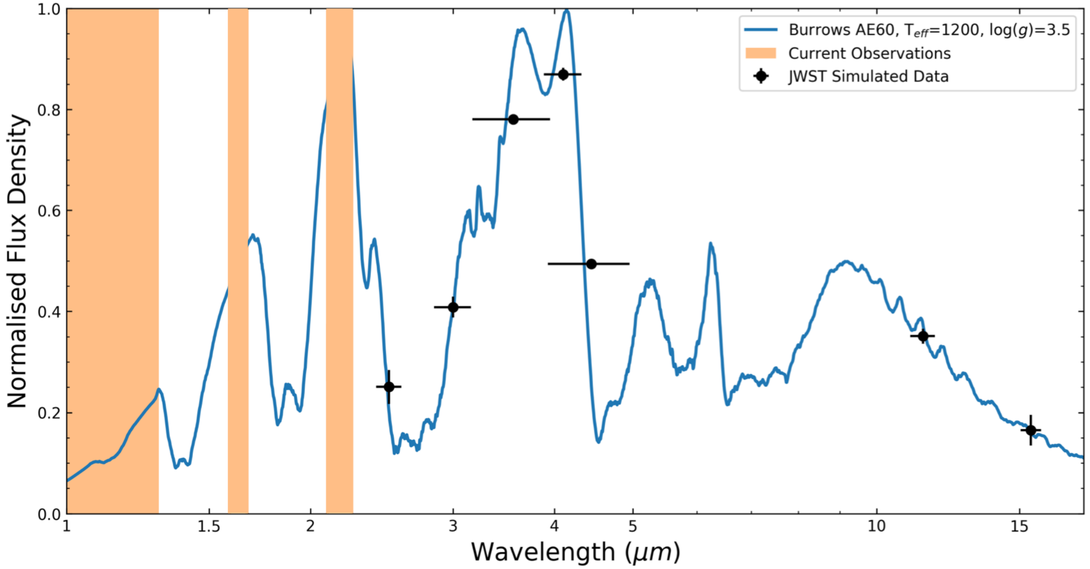
- Transition disks are protoplanetary disks with large central clearings typically first identified through SED modeling and subsequently imaged using ALMA
- Planets may be creating these central clearings
- NIRISS Aperture Masking Interferometry has the highest angular resolution (0.5 λ/D) available to JWST. It provides 10^{-4} contrast at smaller angular separations ~70 – 400 mas at 2.8 – 4.8 µm
- *"Planets in Formation and Exozodiacal Disks" (PI Johnstone, PID 1242,) PDS 70, HD100546, and HD 135344 with NIRISS AMI*

Isella et al. 2019

High Contrast Imaging Early Release Science Program



ERS target HIP 65246b (Chauvin et al. 2017/ Sasha Hinkley)



"High Contrast Imaging of Exoplanets and Exoplanetary Systems with JWST" (PI Hinkley, PID 1386, 54.8 hours) no exclusive access period

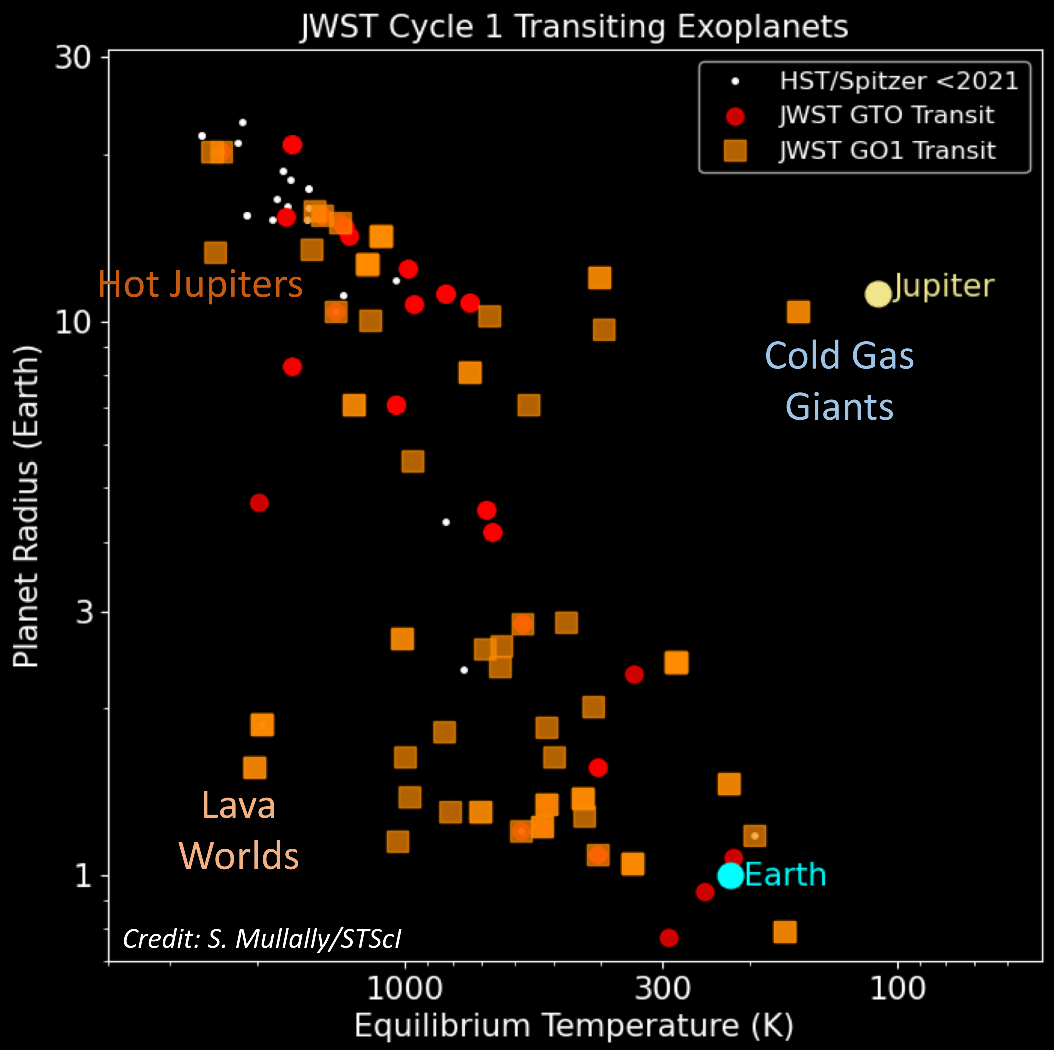
Objectives

- HST coronagraphy required numerous cycles to perfect, still being refined
- Need best understanding of instrument response, PSF stability, and PSF subtraction models
- Given JWST's relatively short 5-10 year lifetime, the correct observing strategy and data processing methods must be identified as early as possible

Observations

- HIP 65426b companion using NIRCam and MIRI Coronagraphic imaging and NIRISS AMI
- HD 141569A debris disk using NIRCam and MIRI Coronagraphic imaging
- VHS 1256b wide separation companion using NIRCam Imaging and NIRSpec IFU and MIRI MRS spectroscopy

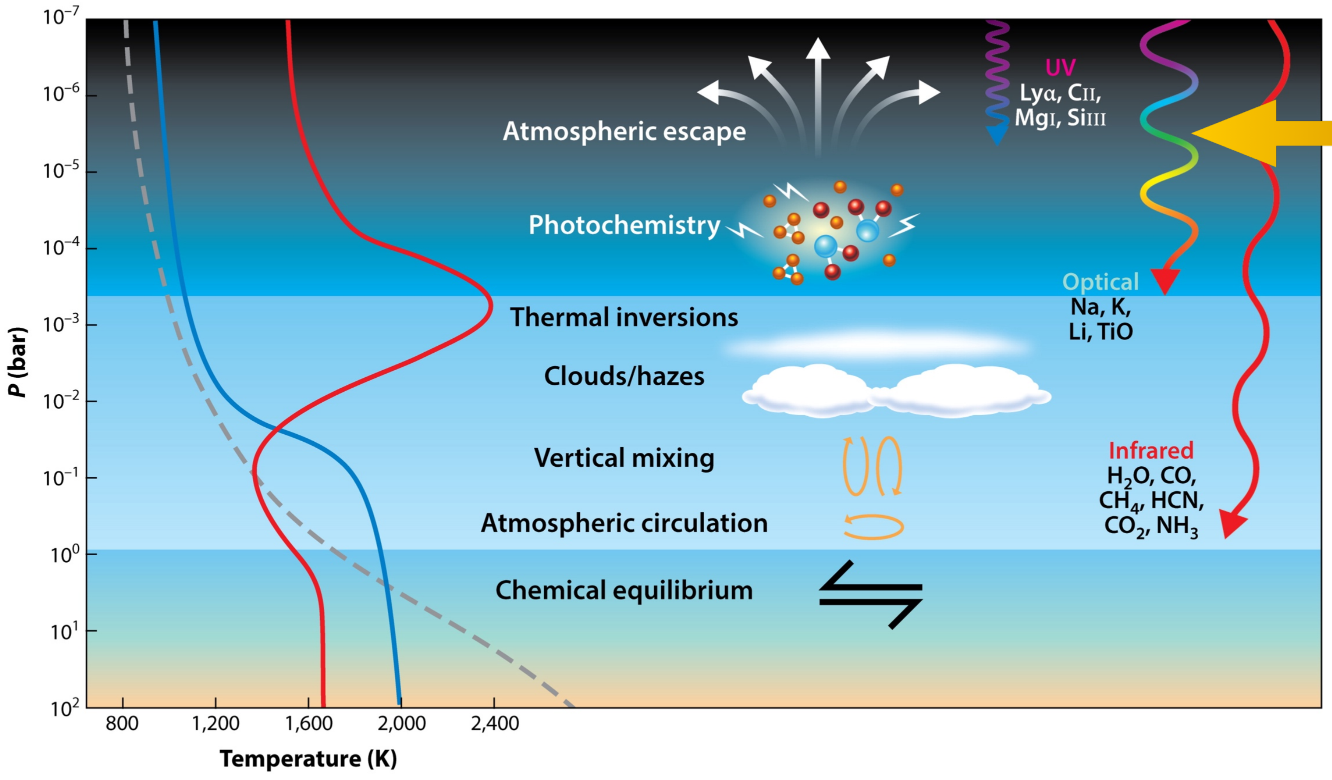
Exoplanet Science Goals



Explore the diversity of exoplanet atmospheres across a range of size, temperature, age and stellar environment.

- Several transiting hot Jupiters and a planet in the Neptune desert
- Direct imaging and spectra of cold gas giants
- Study sub-Neptunes and super-Earths with time series spectroscopy for a deep look at this populations of planets not found in our Solar System
- Several young giant planets including those newly formed in debris disks.
- 2 terrestrial planets so hot they are balls of lava
- Planets transiting active M dwarf stars, offering the best opportunity to explore the atmospheres of terrestrial worlds.

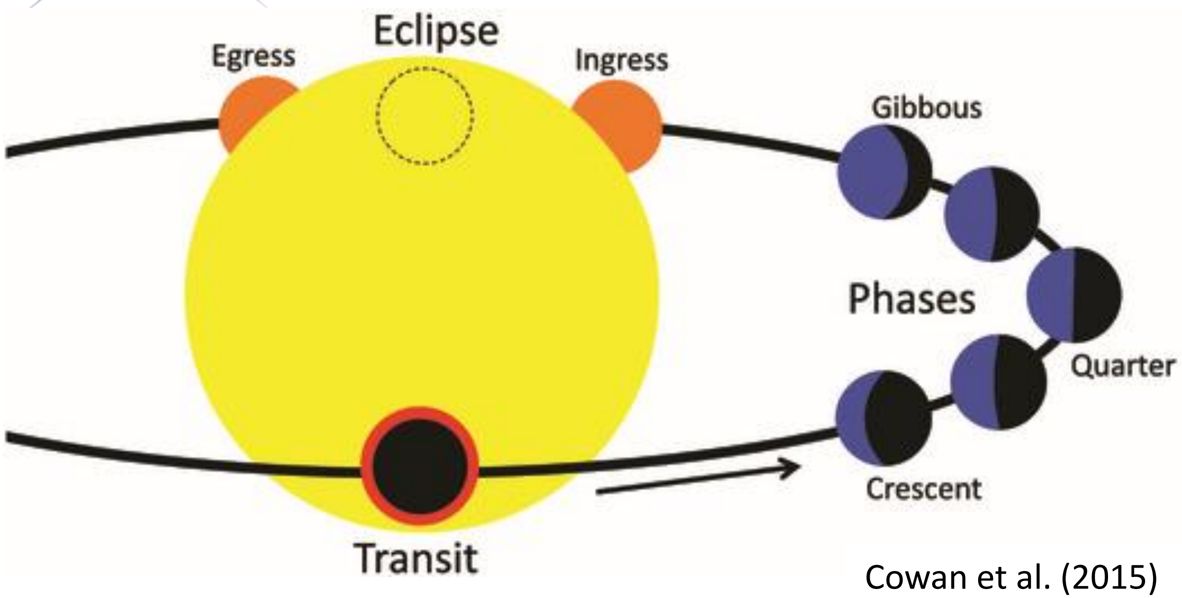
Giant Planet Atmospheres



Madhusudhan N. 2019. *Annu. Rev. Astron. Astrophys.* 57:617–63

- Measure the chemistry and thermal structure of giant planet atmospheres.
  - Measure the presence of important molecular species such as H_2O, CO, CH_4, CO_2, C_2H_2, HCN, and NH_3
  - Measurements of the C/O ratio will constrain whether the planets formed beyond the ice line and migrated inward.
- Detailed atmospheric studies will explore:
  - Height and composition of clouds/hazes
  - How does the atmosphere vary with longitude?
  - How does the atmosphere respond to varying amounts of radiation from its host star.

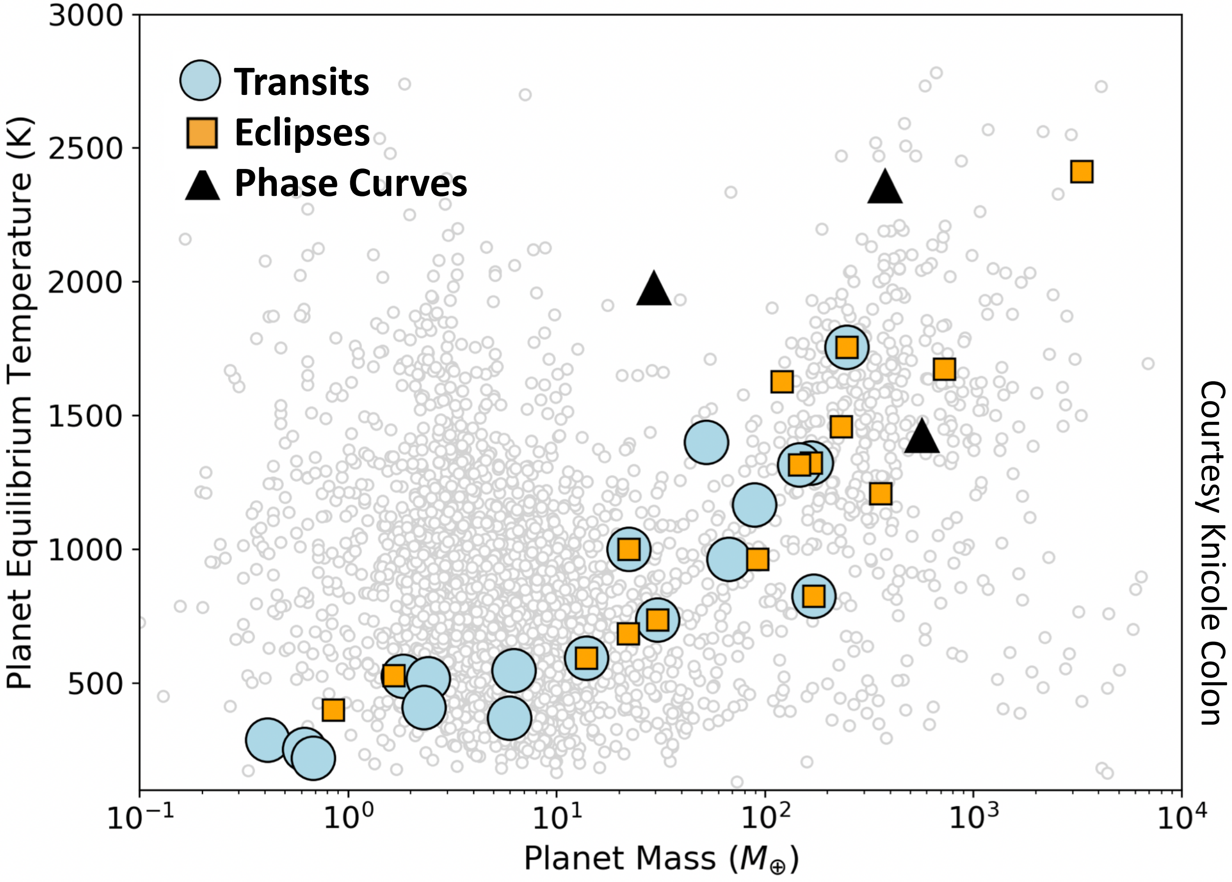
Transiting Exoplanet Programs



Cowan et al. (2015)

In Cycle 1, JWST will observe 68 transiting exoplanets using a variety of instruments and modes, 25 discovered with TESS.

- 13 NIRCam Grism
- 23 NIRISS Single Object Slitless Spectroscopy (SOSS)
- 50 NIRSpec Bright Object Time Series (BOTS)
- 22 MIRI Low Resolution Spectrograph (LRS) Slitless



Courtesy Knicole Colon

Transiting Exoplanet Early Release Science Program

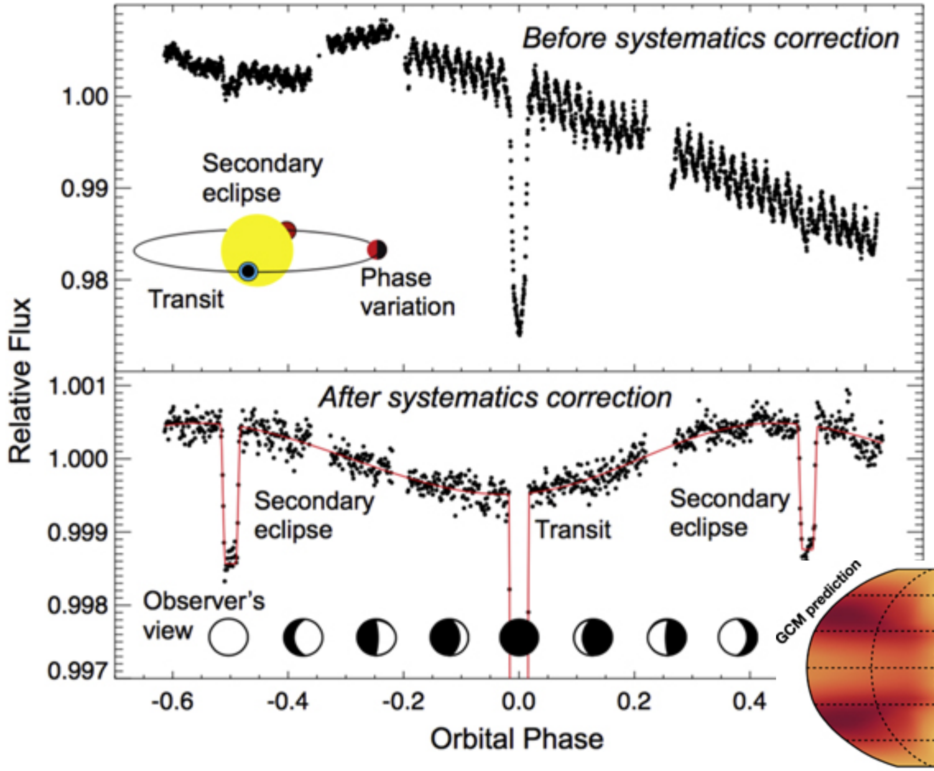
"The Transiting Exoplanet Community Early Release Science Program" (PI Natalie Batalha, PID 1366, 80.5 hours) no exclusive access period

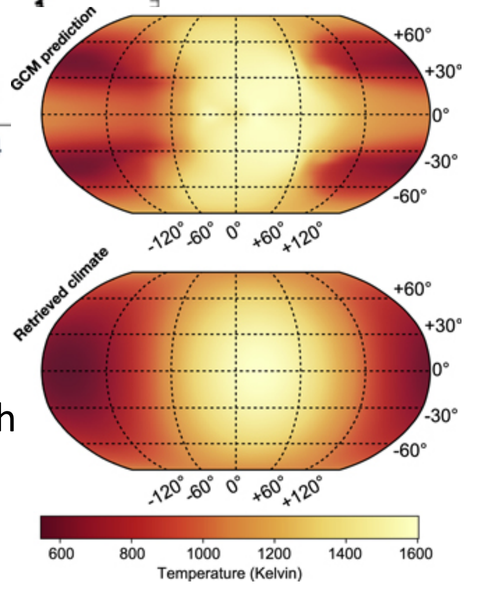
Objectives

- Determine the spectrophotometric timeseries performance of key instrument modes
- Establish best practices for removing systematic noise
- Provide the community with a comprehensive suite of data to demonstrate scientific capabilities

Observations

- WASP-39b transmission spectrum using NIRISS SOSS, NIRCam Grism, NIRSpec BOTS
- WASP-43b phase curve using MIRI LRS
- WASP-18b bright object using NIRISS SOSS

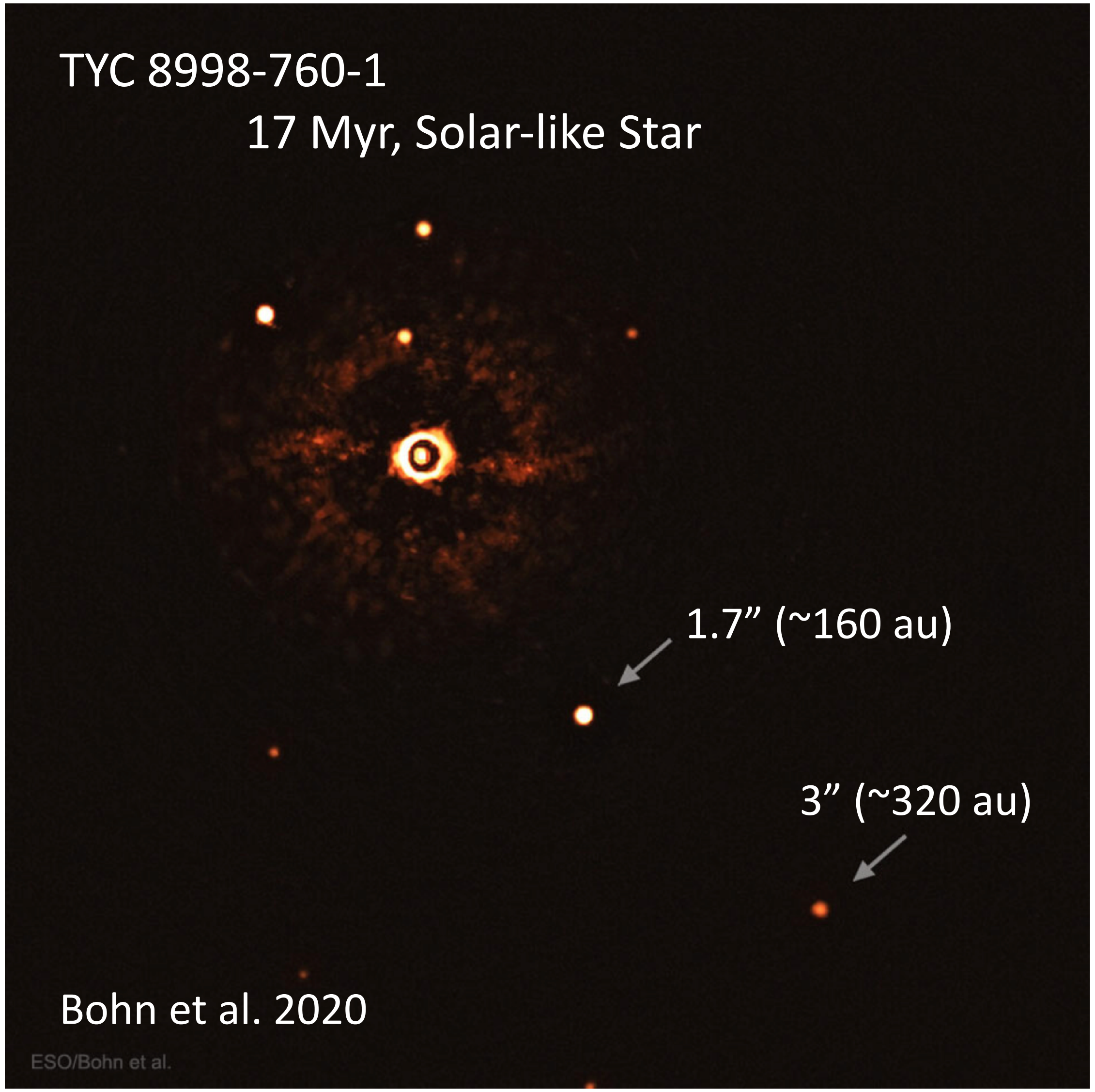




Top: Example Spitzer/IRAC 4.5 µm phase curve for HD 189733b. The periodic variations and long-term drift are due to intrapixel sensitivity variations coupled with undersampled PSF and telescope pointing variations. Right: Predicted temperature map for WASP-43b (Bean et al. 2018)

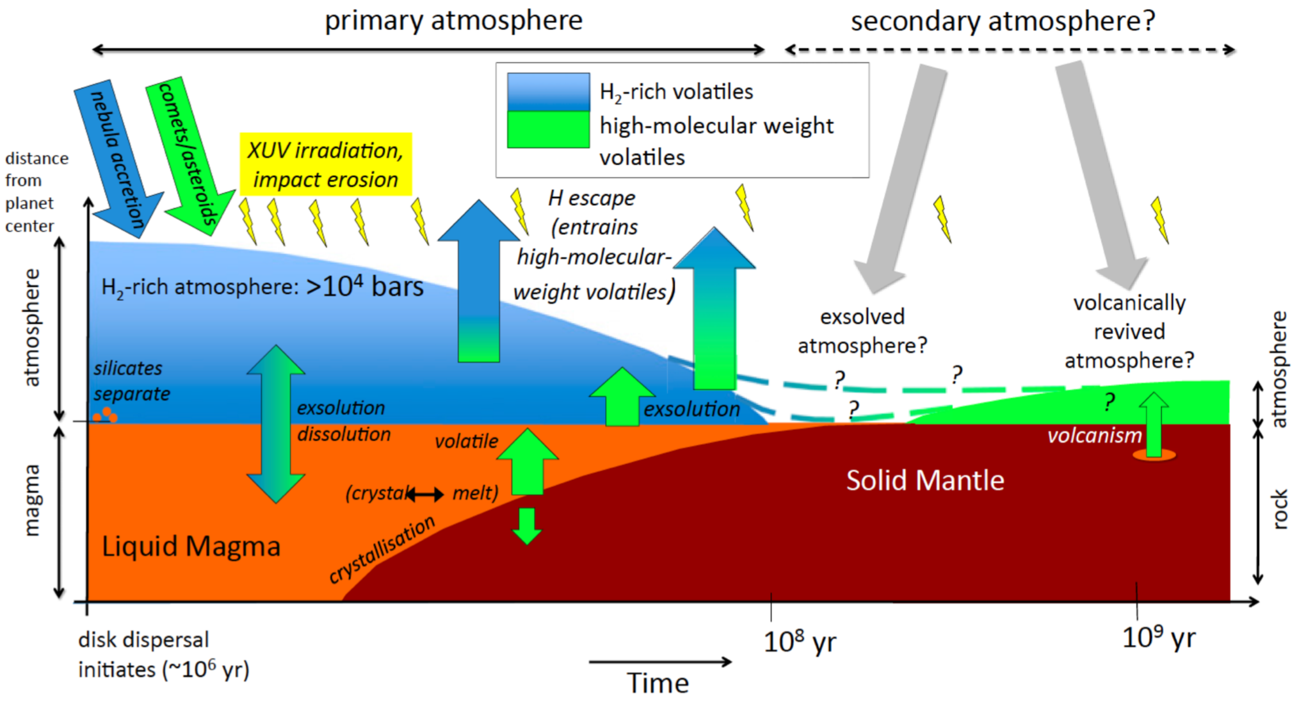
High Contrast Spectroscopy

- High contrast imaging techniques can also be applied to Integral Field Unit (IFU) data to reveal infrared spectra
- Companions must be Neptune mass and above and young to be sufficient bright to be detected
- *"Integral Field Spectroscopy of the Benchmark Substellar Companion HD 19467B" (PI Perrin, PID 1414, 9.2 hours) NIRSpec IFU*
- *"Direct Imaging Spectroscopy of Two Jovian Exoplanets: Characterization of the TYC 8998-760-1 Multiplanet System" (PI Wilcomb, PID 2044, 5.3 hours) NIRSpec IFU and MIRI LRS*



Super-Earth and Sub-Neptune Atmospheres

Provide the first comprehensive look at the composition and formation of planets 1-4 times the radius of the Earth.



Kite & Barnett 2020

- Use NIRSpec, MIRI and NIRISS to obtain transit spectroscopy of atmospheres of at least 12 planets smaller than Neptune.
- Determine the basic composition of terrestrial and sub-Neptune planets, looking for CO_2 and CH_4.
- *”Seeing the Forrest and the Trees” (PI Natasha Batalha, PID 2512, 141.6 hours)* sub-Neptunes and super-Earths
- It is unknown if terrestrial worlds orbiting active M dwarf stars can hold on to their primary atmospheres. Webb will determine which planets harbor an atmosphere.
- Study whether stellar activity from active M stars are contaminating exoplanet atmosphere measurements.
- *“Tell Me How I’m Supposed to Breathe with No Air” (PI Stevenson, PID 1981, 75.6 hours)* Earth-like planets transiting active M-dwarf stars

Hot Rocky Planets

Constrain past and present geology

- *"A Search for Signatures of Volcanism and Geodynamics of the Hot Rocky Exoplanet LHS 3844b" (PI Kriedberg, PID 1846, 11.9 hours) thermal emission spectrum using MIRI/LRS, silicate emission and SO_2 spectra*

Do Lava Worlds have an atmosphere and does it rain lava on the night side of these worlds?

- *"Determining the Atmospheric Composition of the Super-Earth 55 Cancri e" (PI Hu, PID 1952, 16.8 hours) 2 secondary eclipses one with NIRCam Imaging and the other with MIRI/LRS*
- *"Is it Raining Lava in the Evening on 55 Cancri e?" (PI Brandeker, PID 2084, 25.0 hours) 4 transits with NIRCam Grism Time Series, SiO gas*

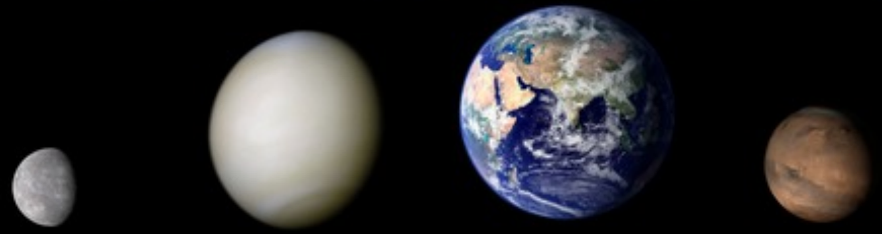
Individual Systems: TRAPPST-1

Illustrations

TRAPPIST-1 System
Feb. 2018

	b	c	d	e	f	g	h
Orbital Period	1.51 *days*	2.42 *days*	4.05 *days*	6.10 *days*	9.21 *days*	12.36 *days*	18.76 *days*
Distance to Star	0.0115 *AU*	0.0158 *AU*	0.0223 *AU*	0.0293 *AU*	0.0385 *AU*	0.0469 *AU*	0.0619 *AU*
Planet Radius	1.12 R_{earth}	1.10 R_{earth}	0.78 R_{earth}	0.91 R_{earth}	1.05 R_{earth}	1.15 R_{earth}	0.77 R_{earth}
Planet Mass	1.02 M_{earth}	1.16 M_{earth}	0.30 M_{earth}	0.77 M_{earth}	0.93 M_{earth}	1.15 M_{earth}	0.33 M_{earth}
Planet Density	0.73 ρ_{earth}	0.88 ρ_{earth}	0.62 ρ_{earth}	1.02 ρ_{earth}	0.82 ρ_{earth}	0.76 ρ_{earth}	0.72 ρ_{earth}
Surface Gravity	0.81 *g*	0.96 *g*	0.48 *g*	0.93 *g*	0.85 *g*	0.87 *g*	0.55 *g*

Solar System
Rocky Planets



	Mercury	Venus	Earth	Mars
Orbital Period	87.97 *days*	224.70 *days*	365.26 *days*	686.98 *days*
Distance to Star	0.387 *AU*	0.723 *AU*	1.000 *AU*	1.524 *AU*
Planet Radius	0.38 R_{earth}	0.95 R_{earth}	1.00 R_{earth}	0.53 R_{earth}
Planet Mass	0.06 M_{earth}	0.82 M_{earth}	1.00 M_{earth}	0.11 M_{earth}
Planet Density	0.98 ρ_{earth}	0.95 ρ_{earth}	1.00 ρ_{earth}	0.71 ρ_{earth}
Surface Gravity	0.38 *g*	0.90 *g*	1.00 *g*	0.38 *g*

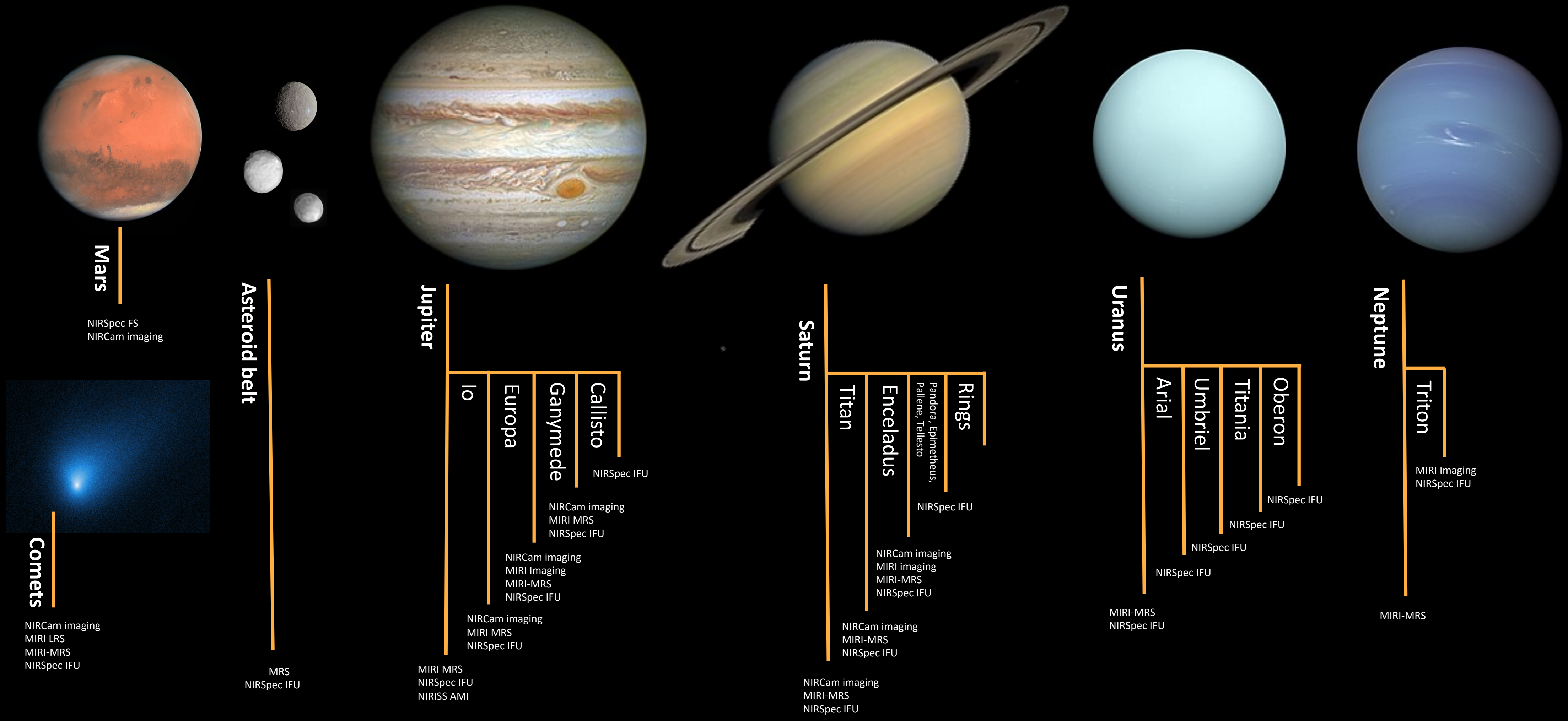
TRAPPIST-1 Observations

All seven planets in the TRAPPIST-1 system will be observed in Cycle 1.

"The TRAPPIST-1 JWST Community Initiative" Gillon et al. 2020, astro-ph/2002.04798

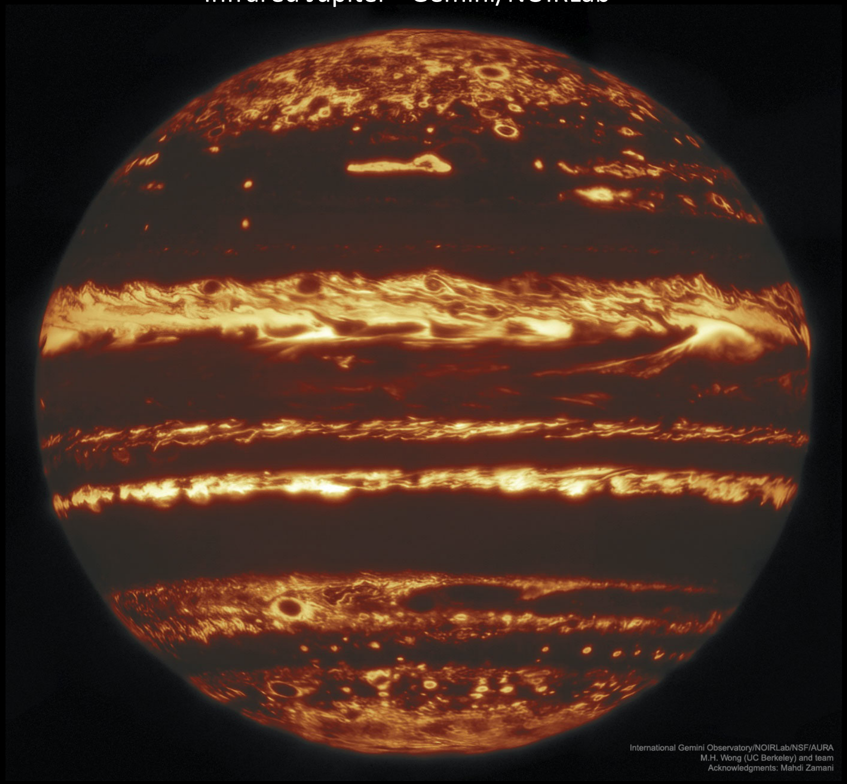
TRAPPIST-1b	"MIRI Observations of Transiting Exoplanets" (PI Greene, PID 1177) 5 eclipses with MIRI Imaging F1500W
TRAPPIST-1b	"Thermal emission from TRAPPIST-1b" (PI Lagage, PID 1279, 25.1 hours) 5 eclipses with MIRI Imaging F1280W
TRAPPIST-1c	"Hot Take on a Cool World: Does TRAPPIST-1c Have an Atmosphere?" (PI Kriedberg, PID 2304, 17.9 hours) dayside thermal emission with MIRI Imaging
TRAPPIST-1c	"Probing the Terrestrial Planet TRAPPIST-1c for the Presence of an Atmosphere" (PI Rathcke, PID 2420, 25.0 hours) 4 transits with NIRSpec BOTS
TRAPPIST-1d,f	"NIRISS Exploration of the Atmospheric Diversity of Transiting Exoplanets (NEAT)" (PI Lafreniere, PID 1201) 1 transit of d with NIRSpec BOTS, 5 transits of f with NIRISS SOSS
TRAPPIST-1e	"Transit Spectroscopy of TRAPPIST-1e" (PI Lewis, PID 1331, 22.5 hours) transit with NIRSpec BOTS
TRAPPIST-1b,c,g,h	"Atmospheric Reconnaissance of the TRAPPIST-1 Planets" (PI Lim, PID 2589, 53.7 hours) 2 transits of b and c with NIRISS SOS, 2 transits of g and h with NIRSpec BOTS

Solar System Bodies

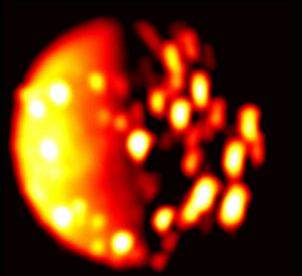


Jupiter, Saturn, and their Satellites

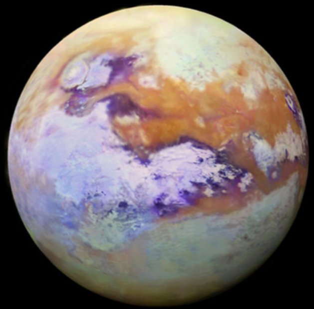
Infrared Jupiter - Gemini/NOIRLab



Infrared Io - NASA/Juno

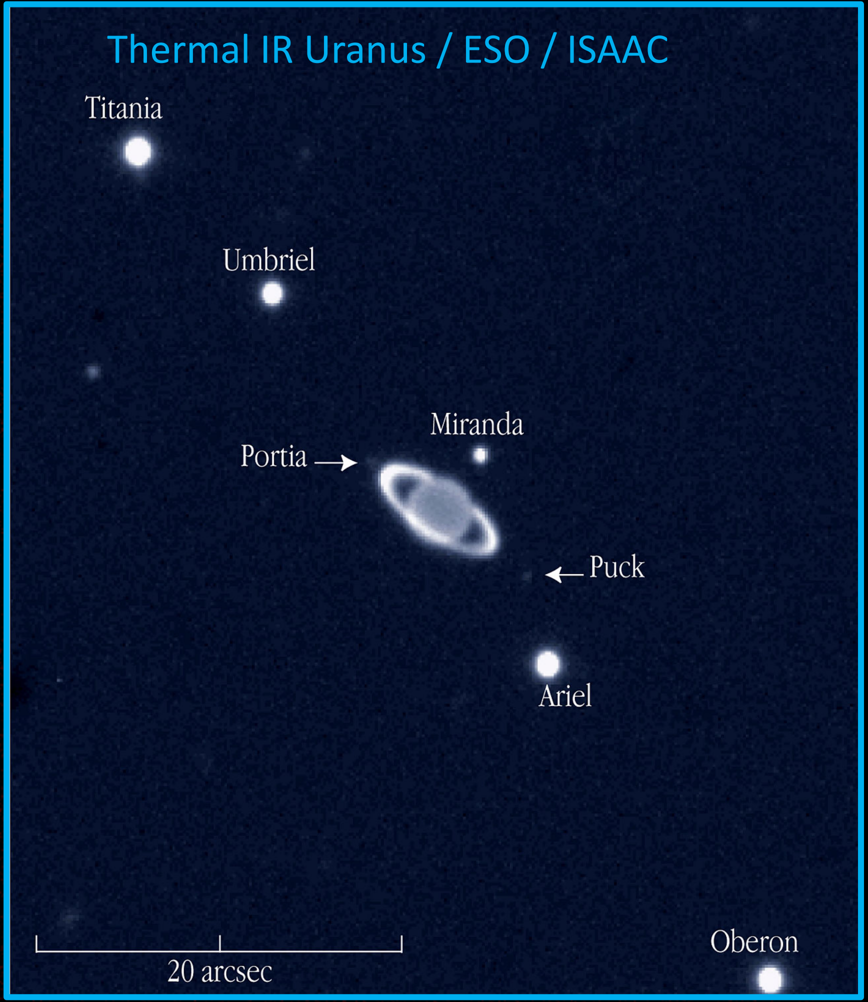


Infrared Titan - NASA/Cassini



- Explore below the visible cloud decks of the Jovian and Saturnian atmospheres to understand their weather systems and chemistry
- Search for new moons and measure the surface compositions of the known moons
- “Jupiter’s Great Red Spot” *(PI Fletcher, PID 1246, 5.1 hours) MIRI MRS*
- ”ERS Observations of the Jovian System as a Demonstration of JWST’s Capabilities for Solar System Science” *(PI de Pater, PID 1373, 40.9 hours)*
  - *Jupiter South Pole using NIRSpec IFU, MIRI MRS*
  - *Jupiter Great Red Spot using NIRCam Imaging, NIRSpec IFU*
  - *Jupiter Ring System using NIRCam Imaging*
  - *Io using NIRISS AMI, NIRSpec IFU, MIRI MRS*
  - *Ganymede using NIRSpec IFU, MIRI MRS*
- Constrain the chemistry of the hydrocarbon atmosphere of Titan
- “Titan Climate, Composition, and Clouds” *(PI Nixon, PID 1251, 13.8 hours) NIRCam Imaging, NIRSpec IFU, MIRI MRS*

Uranus and Neptune

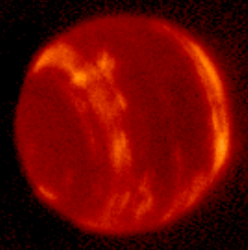


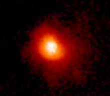
The ice giants – Uranus and Neptune – have not been visited by probes with modern instruments

- Obtain a full chemical inventory of the ice giant atmospheres
- NIRSpec IFU and MIRI MRS imaging spectroscopy at multiple longitudes of both Uranus and Neptune
- Monitoring of atmospheric conditions over multiple epochs

Their moon systems are part of the Kuiper Belt and their composition can be compared to other surveys of Trans-Neptunian Objects

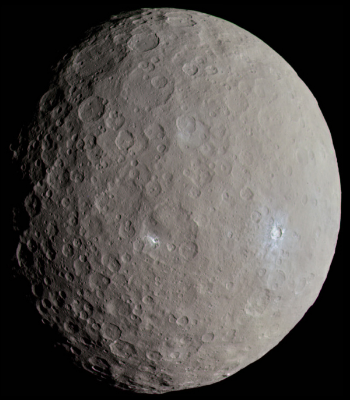
- Understand the relation of the ice giant moons to the Kuiper Belt.
- IFU and MRS spectroscopy of the major moons of Uranus to measure composition in both leading and trailing hemispheres





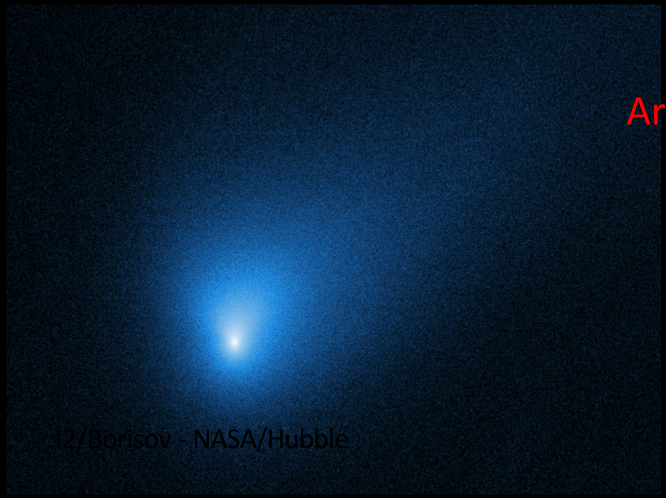
Thermal IR Neptune / Keck / M Brown

Asteroids, Comets, and Trans Neptunian Objects



Ceres - NASA/Dawn

Arrokoth - NASA/New Horizons



2I/Borisov - NASA/Hubble

What is the volatile content of asteroid populations?

- Webb has the capability to obtain sensitive infrared spectroscopy, revealing the surface chemical composition, of some of the smallest and and most distant minor bodies in the solar system.
- NIRSpec and MIRI spectroscopy of at least 20 asteroids, including some of the largest minor bodies, Ceres and Pallas

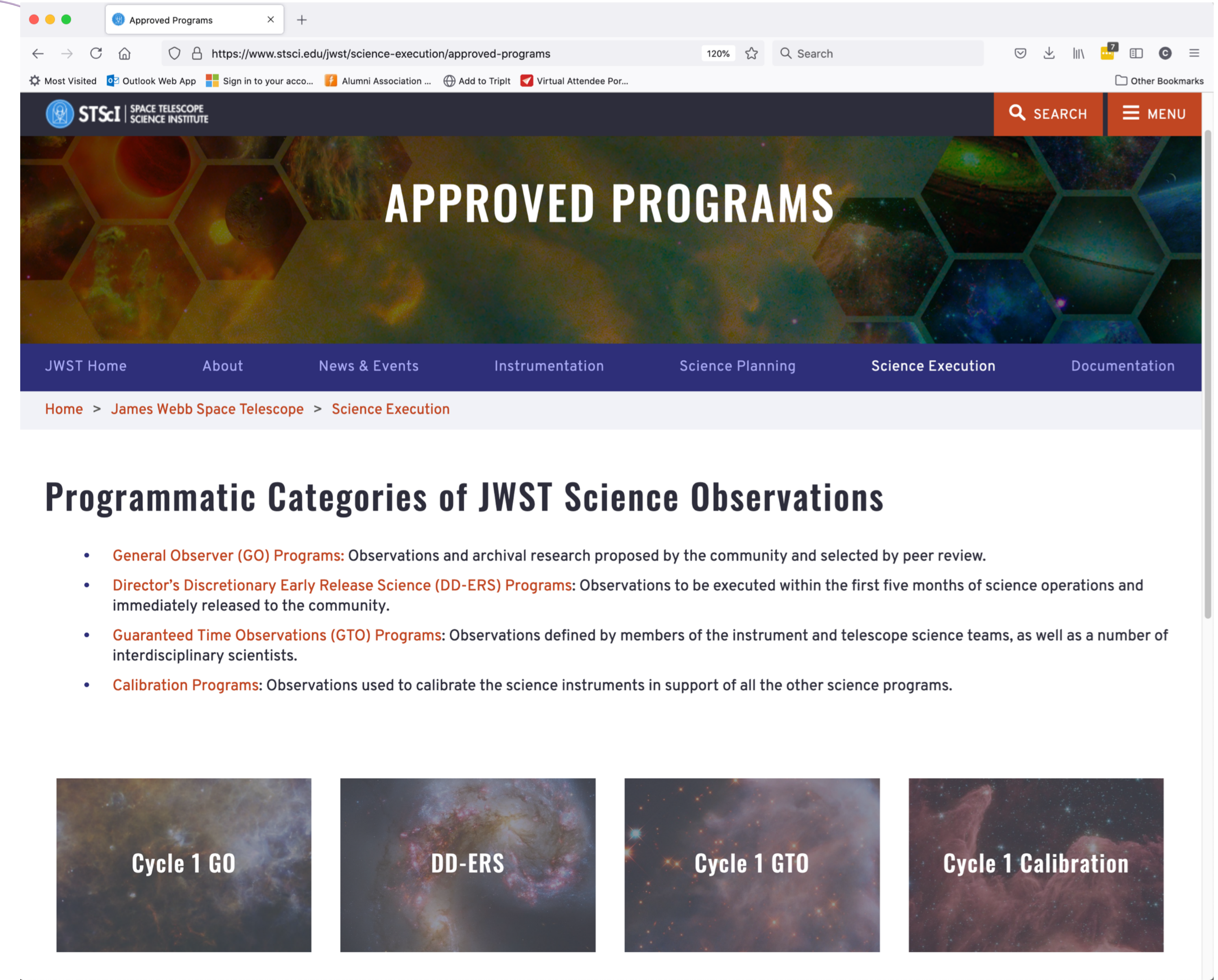
Unlock the frozen record of the early solar system by characterizing the composition of trans-neptunian objects (TNOs)

- NIRSpec and MIRI spectroscopy of at least 94 TNOs.
- Use blind surveys to detect new populations of TNOs – as many as 30 down to 10 km sizes

Obtain a more complete chemical inventory of comets as fossil records of the solar system, and other planetary systems

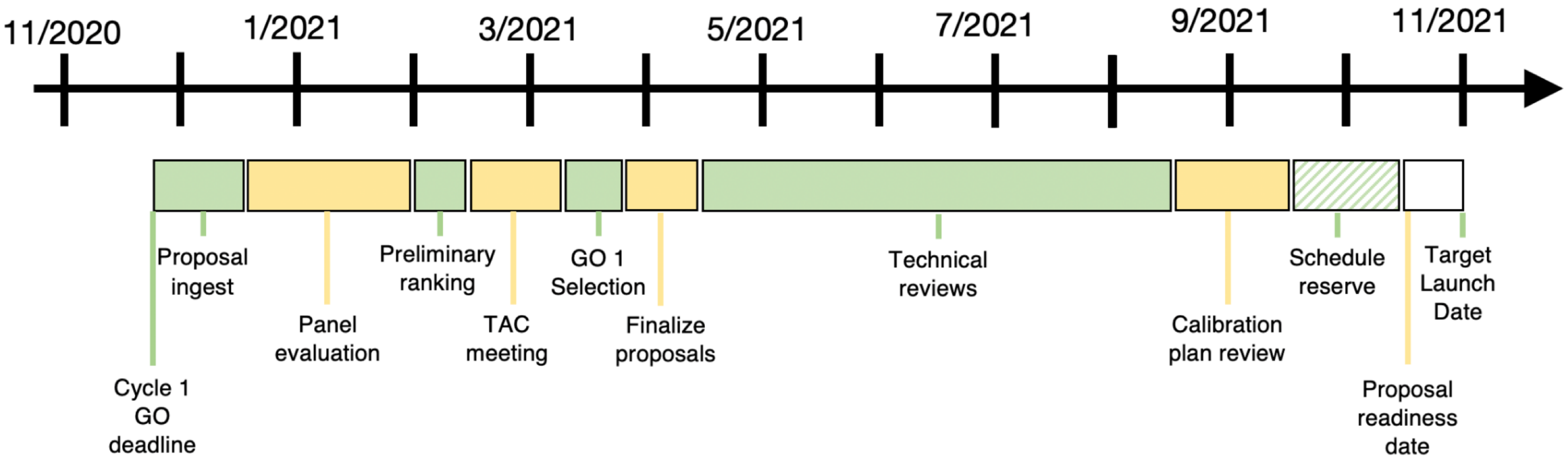
- NIRSpec and MIRI spectroscopy of at about 12 comets
- Be prepared to measure the chemical composition of the next interstellar cometary visitor. Is our solar system chemically typical?

JWST Approved Programs Available On-line



Approved programs can be viewed at https://www.stsci.edu/jwst/science-execution/approved-programs

Technical & Scheduling Reviews



All proposals will be subject to technical and scheduling reviews by STScI staff

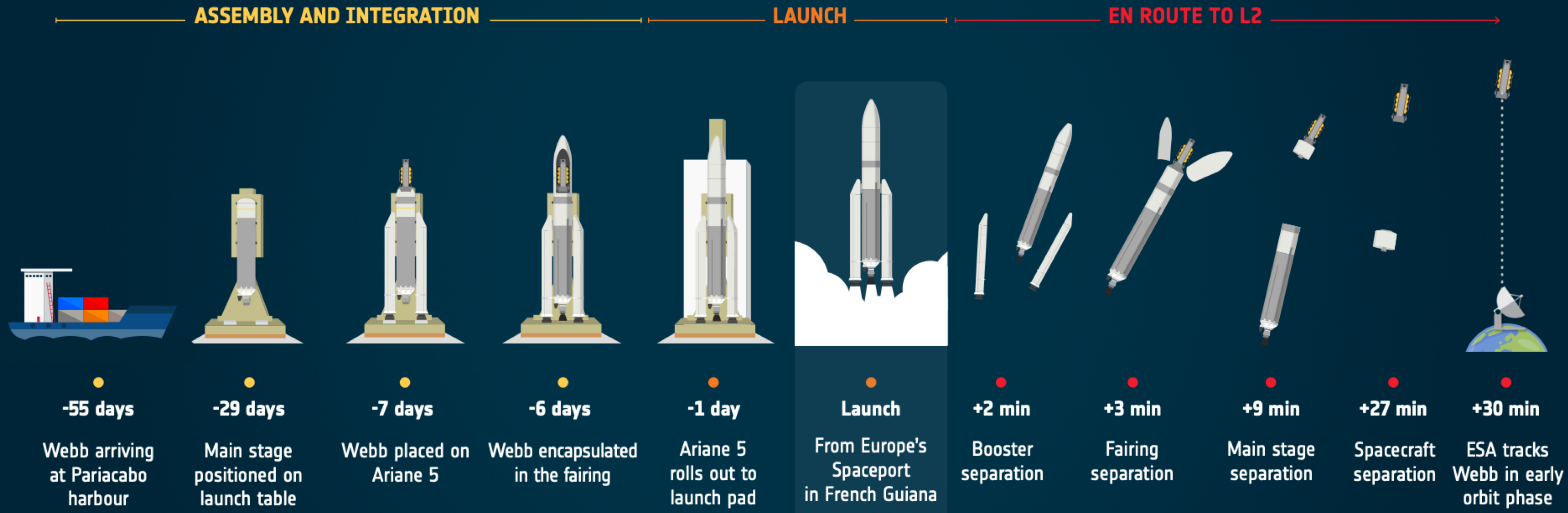
Key scheduling issues:

- High data volume – may preclude parallel observations in some instances
- Uninterrupted observations – only allowable when scientifically required

Some programs may require adjustments that lead to longer charged times

- We will be flexible in allowing some such adjustments in Cycle 1

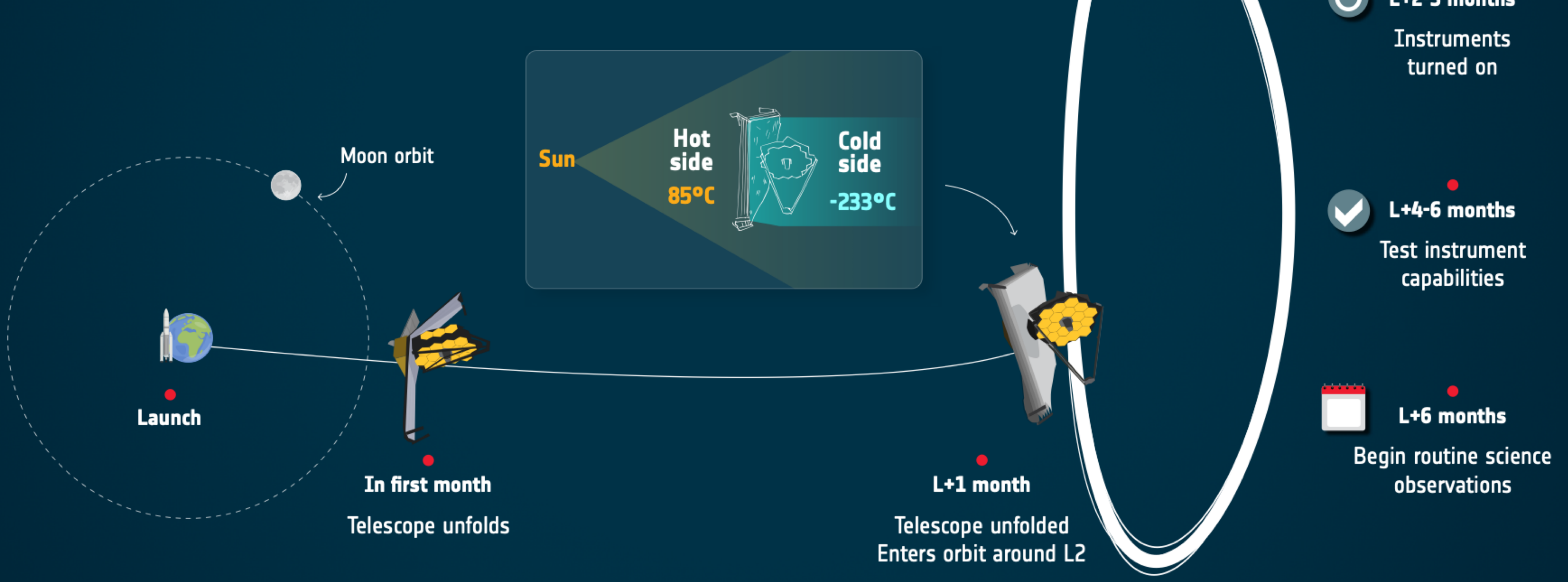
LAUNCH TIMELINE AT EUROPE'S SPACEPORT



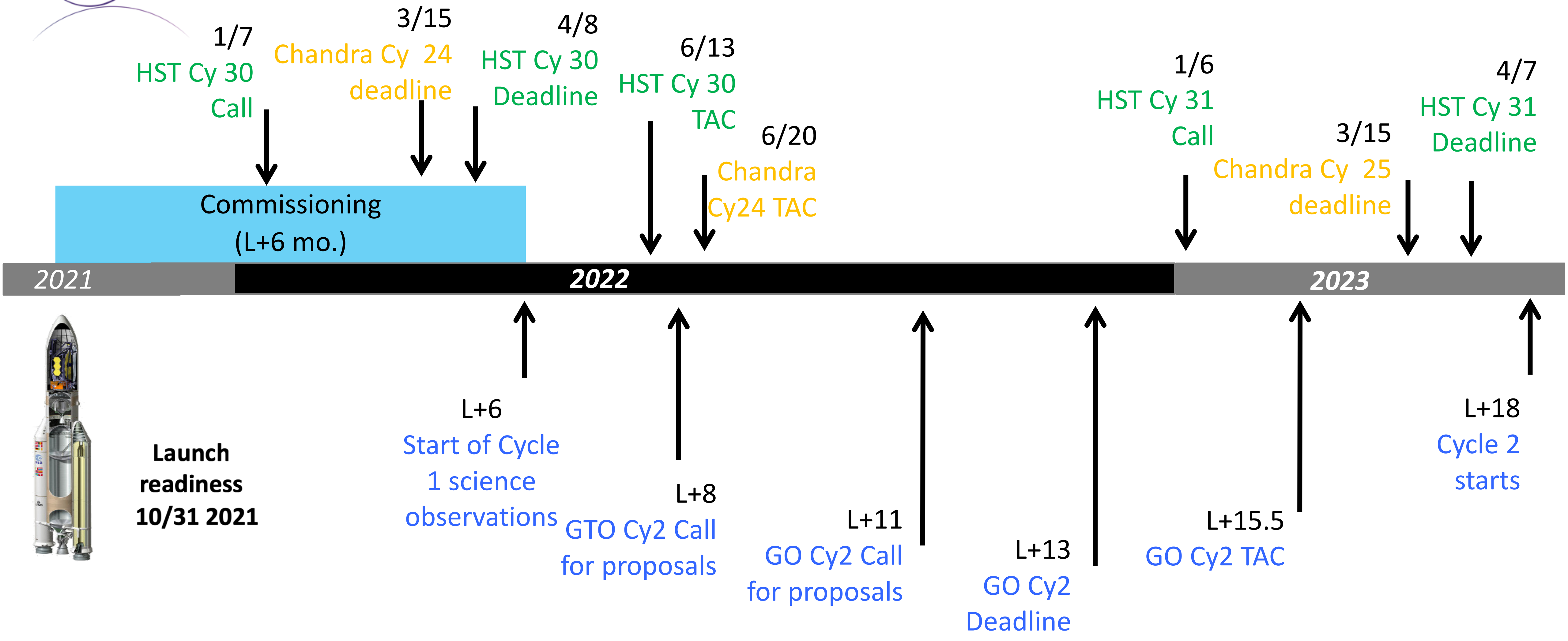
Europe's Spaceport in French Guiana

WEBB'S JOURNEY TO L2

Webb will orbit the second Lagrange point (L2), 1.5 million kilometres from Earth in the direction away from the Sun. At L2, Webb can always block light and heat from both the Sun and Earth with its sunshield to observe the Universe in infrared. L2 is not a fixed point, but follows Earth around the Sun – providing a stable orbit for Webb.



JWST Science Timeline



HST & Chandra dates are estimates

Data Analysis Training Classes

JWebbinars

- Hands-on instruction on common data analysis methods for JWST observations.
- Entirely virtual classes with ~40 participants
- Virtual programming environment
- All materials are made available after the class

Past Events

- Pipeline Information and Data Products
- Introduction to the JWST Data Analysis Tools
- Pipeline: Imaging Mode
- Pipeline: Spectroscopic Mode

Future Events

- MIRI and NIRSpec IFU
- NIRCam and MIRI Point-Source Imaging
- NIRSpec MSA

Register at https://www.stsci.edu/jwst/science-execution/jwebbinars

Simulated TSO Observations

Simulated data of each of the Transiting Exoplanet modes is available on-line and can be downloaded
https://www.stsci.edu/jwst/science-planning/proposal-planning-toolbox/simulated-data

Instrument	Mode	Observation Description	Data Stage	Notes
MIRI	LRS Slitless TSO	WASP-62	1, 2, 3	
NIRCam	Grism TSO	WASP-79b	1, 2, 3	
NIRISS	AMI	Binary point source AB Dor and calibrator HD 37093	1, 2	
NIRISS	SOSS	WASP-43b	1, 2	Notebook uses a slightly older simulated data set that is included with the notebook
NIRSpec	BOTS	GJ436b from Goyal et al. (2018)	2	

JWST Users Committee (JSTUC)

The Space Telescope Science Institute (STScI) and NASA Goddard Space Flight Center (GSFC) established the James Webb Space Telescope (JWST) Users Committee (JSTUC) to provide user advice to the observatory as a whole.

James Bullock, Chair	Stephane Charlot	Amanda Hendrix	Els Peeters
Kat Barger	Duncan Farrah	Tiffany Kataria	John Richard
Natalie Batalha	Alistair Glasse	David Lafreniere	Tommaso Treu
Saida Caballero-Nieves	Tom Greene	Mercedes Lopez-Morales	Dominika Wylezalek

The JSTUC welcomes the feedback from the astronomical community.

You can e-mail the JSTUC Chair from the JSTUC website: https://www.stsci.edu/jwst/science-planning/user-committees/jwst-users-committee