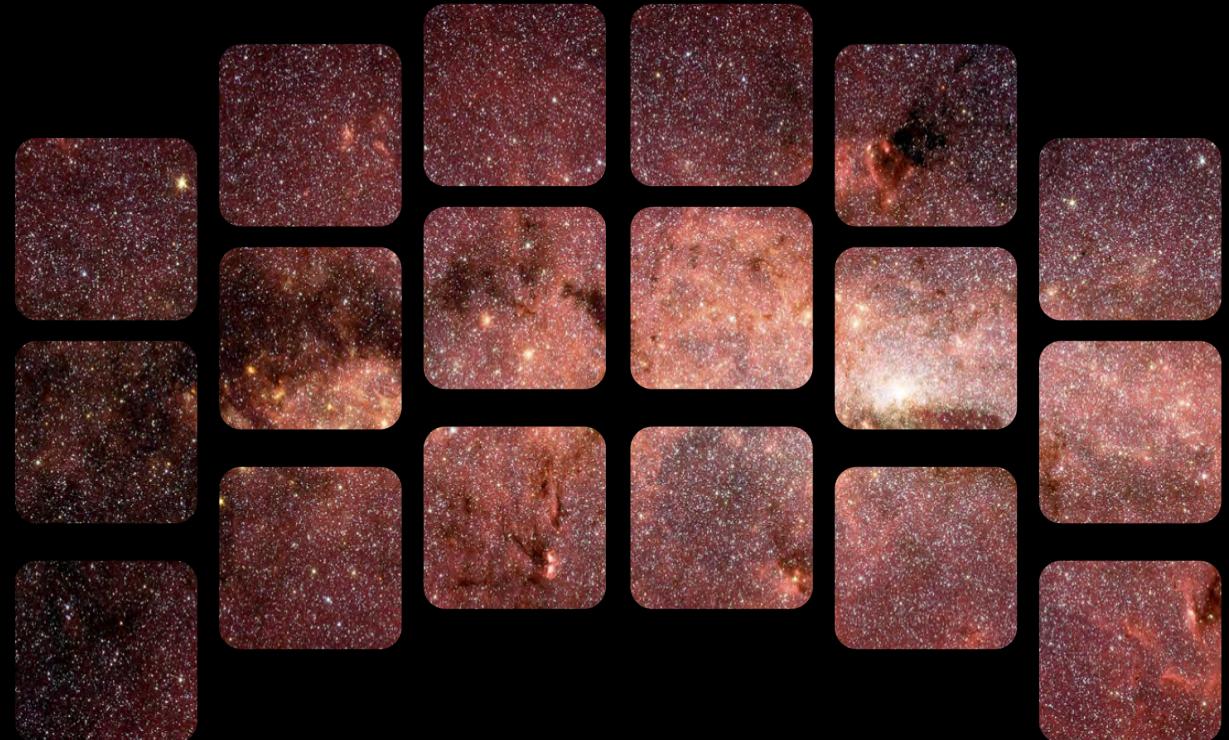


# R.roman

## Mission Overview



SPACE TELESCOPE

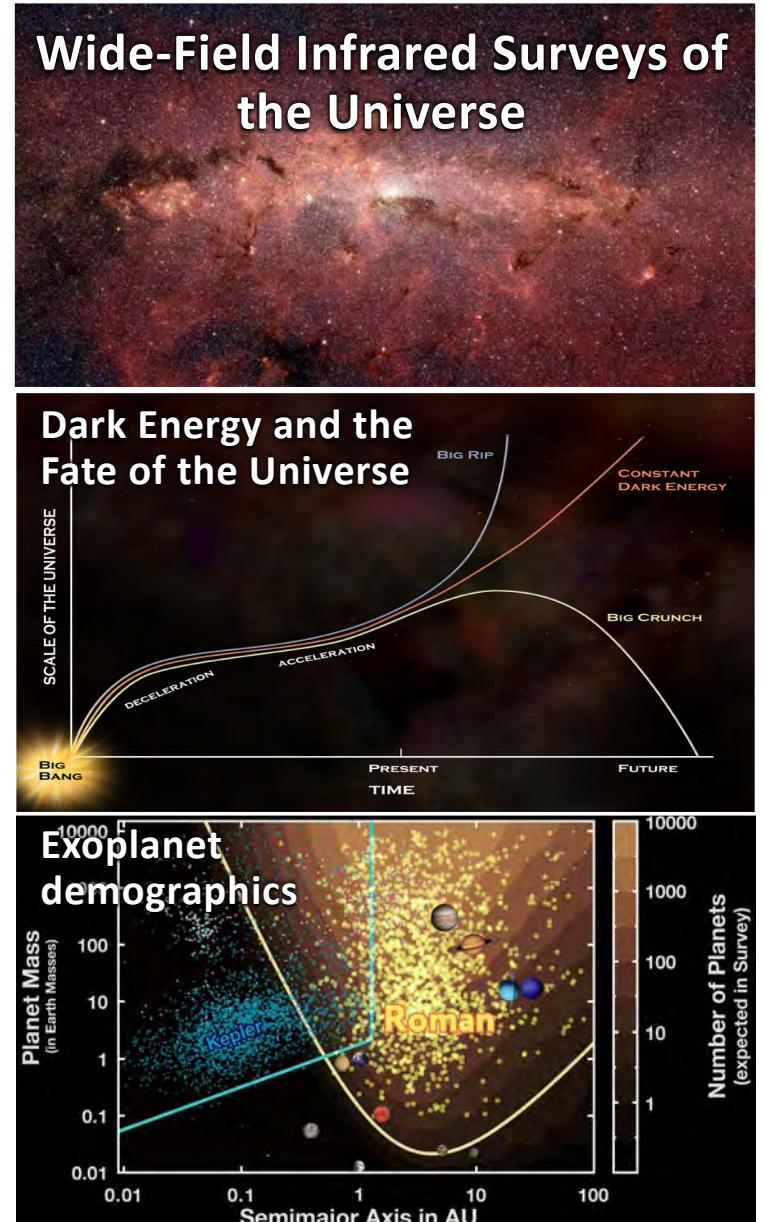
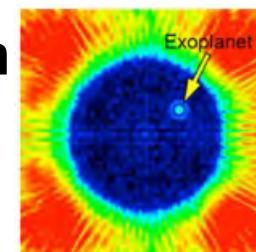
# Roman Science Investigation Teams

- **Supernova Cosmology:** Ryan Foley, Saul Perlmutter
- **Nearby Galaxies:** Ben Williams
- **Extragalactic:** Brant Robertson
- **Weak Lensing and Galaxy Redshift Survey:** Olivier Dore
- **Exoplanet Coronagraphy:** Bruce Macintosh, Margaret Turnbull
- **Archival Research:** Alexander Szalay
- **Cosmic Dawn:** James Rhoads
- **Exoplanet Microlensing:** Scott Gaudi
- **Milkyway:** Jason Tumlinson
- **~300 scientists in total**
  - scientific performance requirements related to the specific science area,
  - design of overall observational strategy concept,
  - science data analysis techniques,
  - ground and space calibration requirements,
  - science simulations, precursor observations,
  - ground calibration, observational needs, data processing, ancillary data collection/incorporation, analysis, dissemination and documentation of the proposed science investigation.
- **Current science team contracts expired this year**

Adjutant Scientists  
David Spergel - WFI  
Jeremy Kasdin - CGI

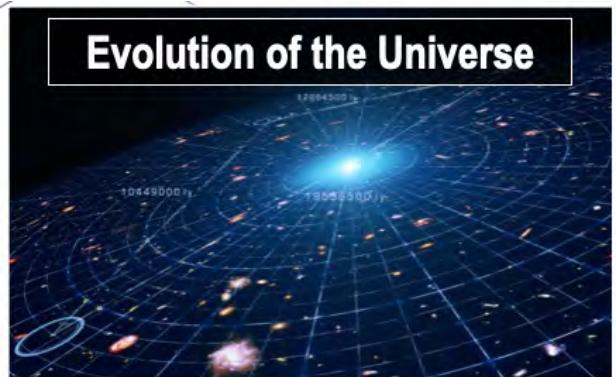
# Roman Mission Objectives

- **Wide Field Infrared survey**
  - Imaging and spectroscopy to  $>26.5$  AB mag
- **Expansion history of the Universe**
  - Using supernova, weak lensing and galaxy redshift survey techniques
- **Growth of Structure in the Universe**
  - Weak lensing, redshift space distortions and galaxy cluster techniques
- **Exoplanet Census**
  - Statistical census of exoplanets from outer habitable zone to free floating planets
- **General Astrophysics Surveys**
  - Devote substantial fraction of mission lifetime to peer reviewed program
- **Coronagraph technology demonstration**
  - Demonstrate exoplanet coronagraphy with active wavefront control



# Roman's very Broad Science Menu includes:

**Evolution of the Universe**



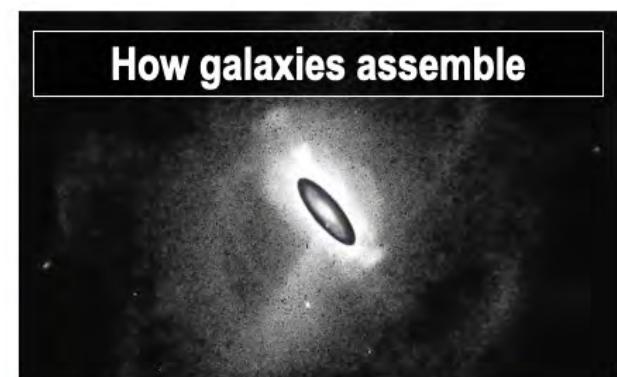
**Universe of galaxies**



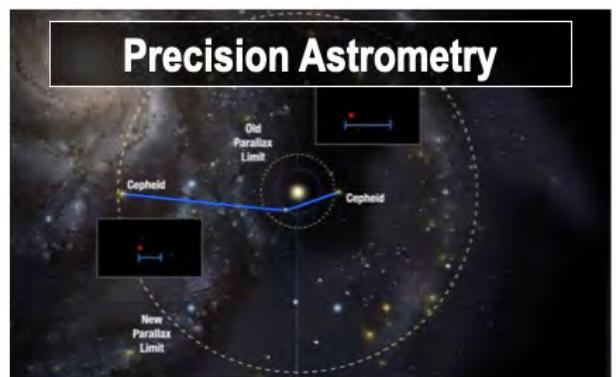
**Mapping dark matter**



**How galaxies assemble**



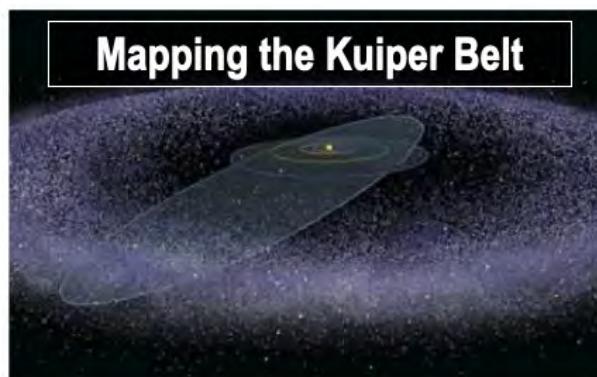
**Precision Astrometry**



**Resolved Stellar Populations**



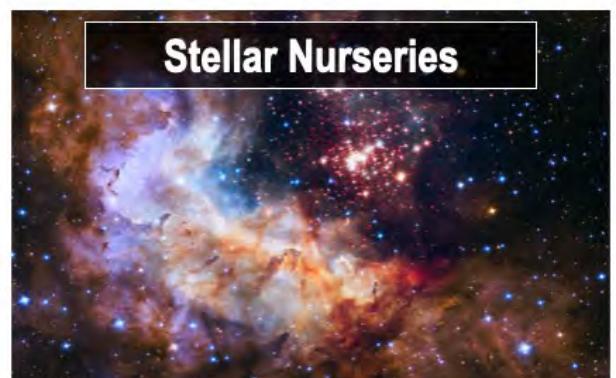
**Mapping the Kuiper Belt**



**Gravitational Wave Counterparts**



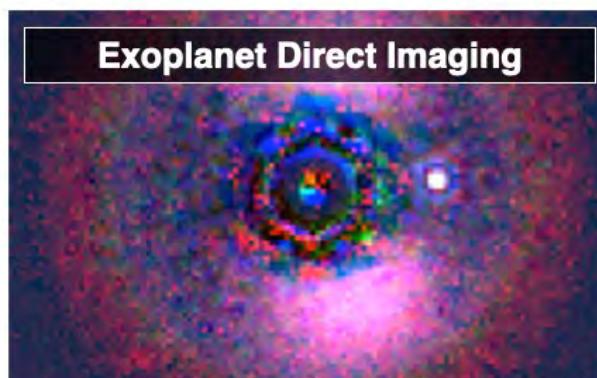
**Stellar Nurseries**



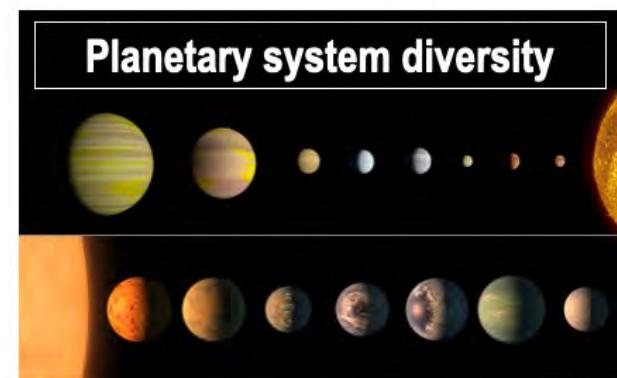
**Asteroseismology**



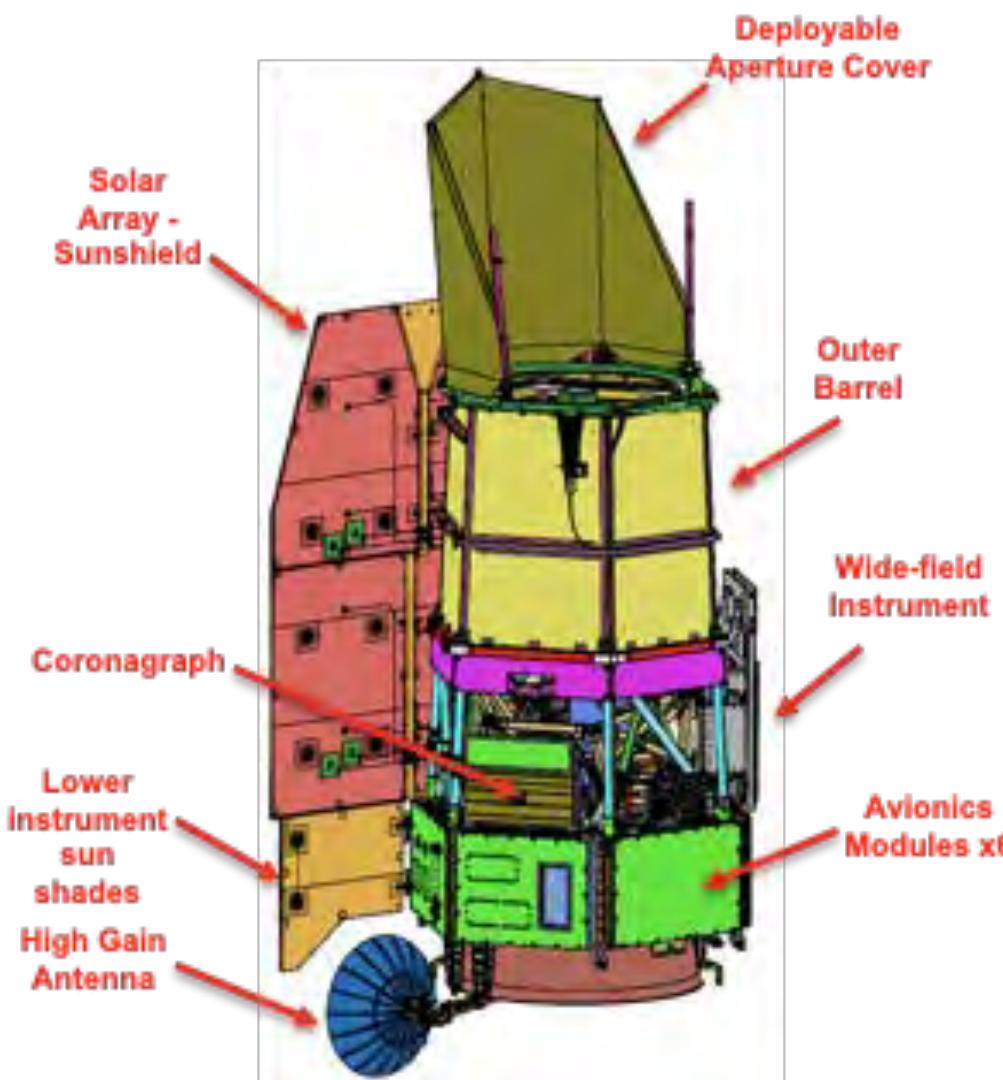
**Exoplanet Direct Imaging**



**Planetary system diversity**



# Roman Observatory and Instruments



**Telescope: 2.4m aperture**

**Two Instruments:**  
**Wide Field Imager / Slitless Spectrometer**

- Vis/Near IR bandpasses (0.48 – 2.3 micron)
- Field of view  $0.281 \text{ deg}^2$  ( $\sim 200 \times$  HST WFC3-IR)
- 18  $4\text{k} \times 4\text{k}$  detectors (288 Mpixels)

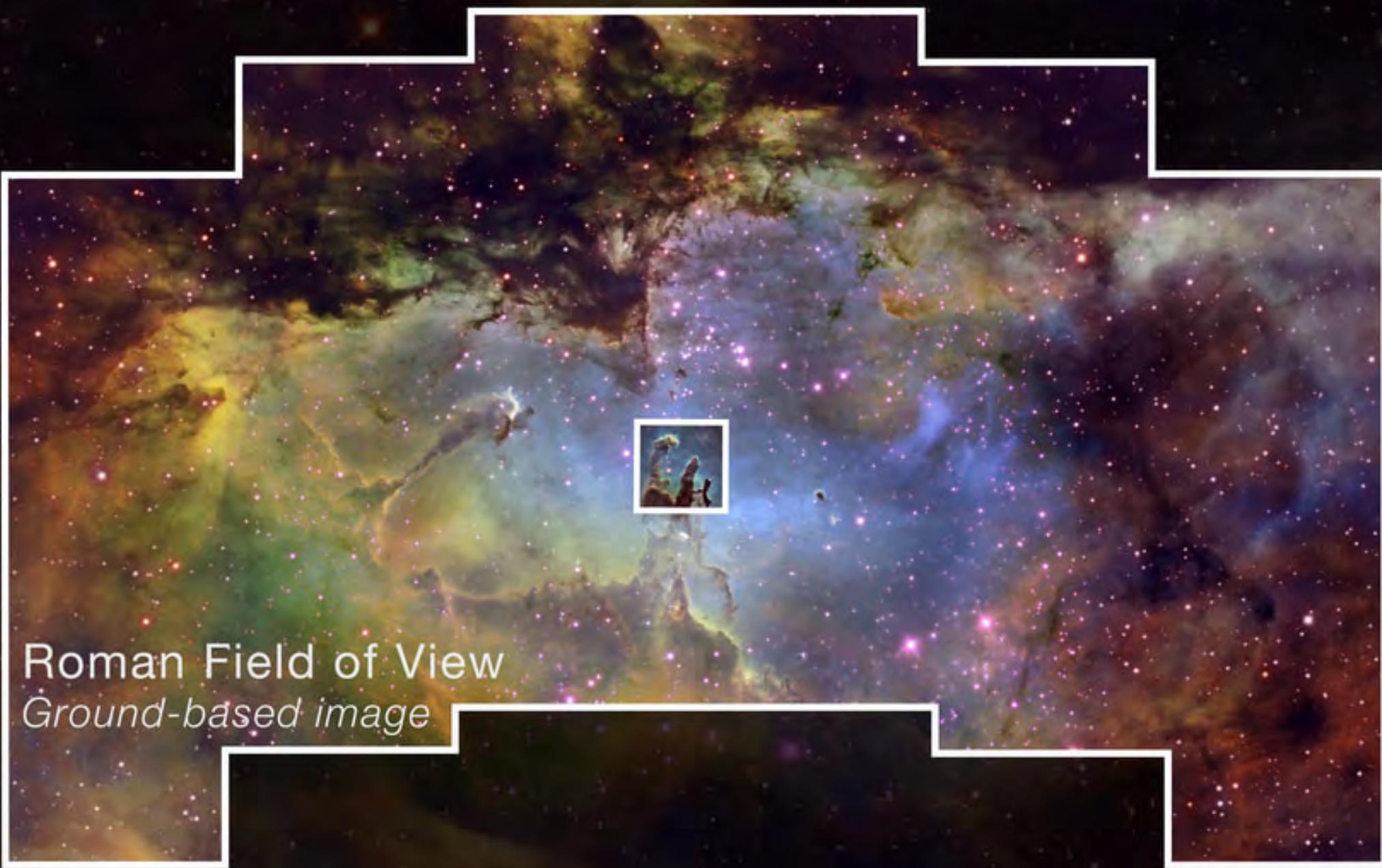
**Coronagraph**

- Visible bandpass
- Contrast  $10^{-8}$ - $10^{-9}$

**Data Volume: 11 Tb/day**

**Orbit: Sun-Earth L2**

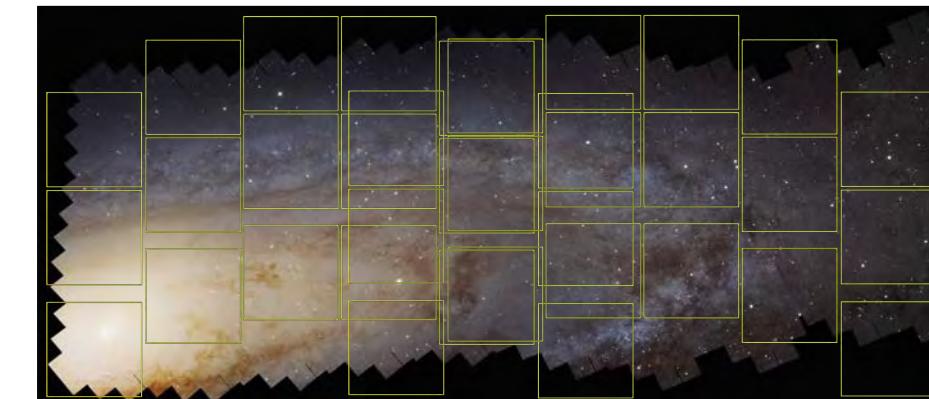
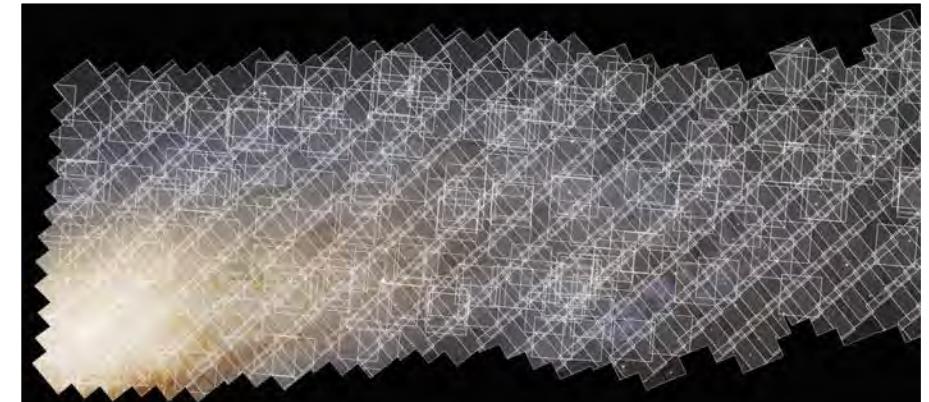
**Mission Duration: 5 yr, 10yr goal**



Roman Field of View  
*Ground-based image*

# Roman as a Precise Survey Facility

- The power of Roman is not *just* that it has a large field of view:
  - Very efficient observations
    - Rapid slew & settle
    - no Earth occultations
    - no South Atlantic Anomaly
  - Well understood and stable PSF
    - Stable thermal environment (L2 orbit, thermal control of all parts of the optical system)
    - Rigid optical structure with vibration isolation from the spacecraft
    - Stable attitude control
  - Excellent flux calibration
    - Relative calibration system



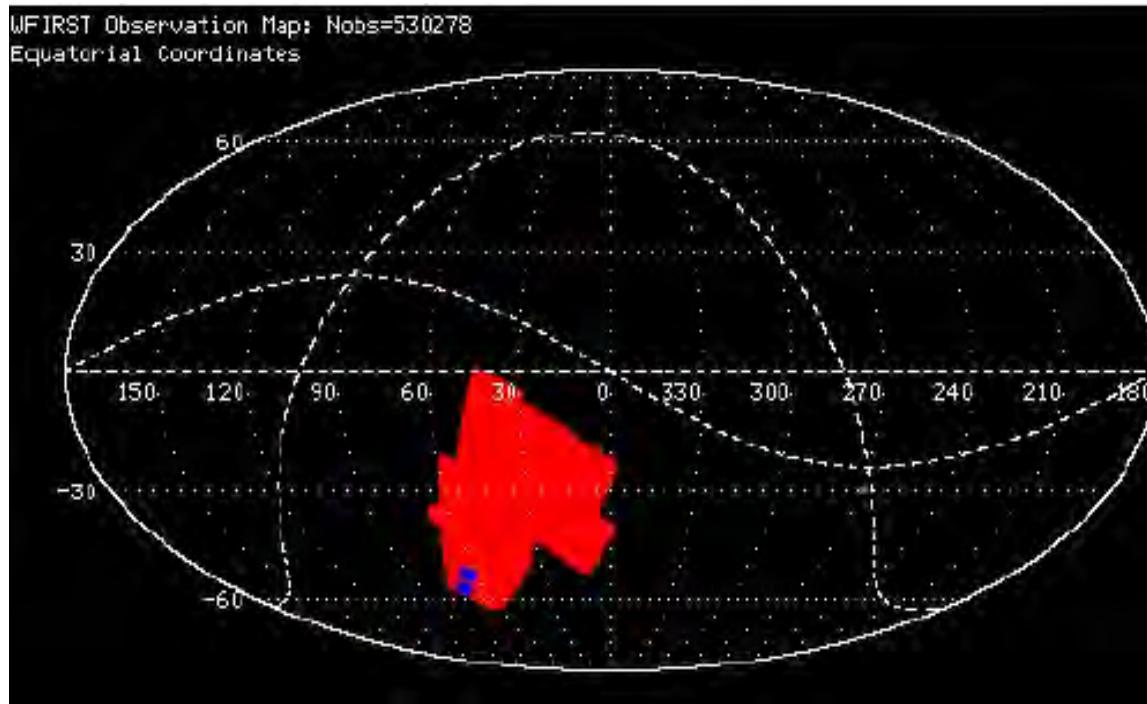
For details, see Akeson et al. 2019 <https://arxiv.org/abs/1902.05569>

# Roman Surveys

- **Core Community Surveys:** a significant fraction of the prime mission used for revolutionary surveys of unprecedented scale
  - Three Core Community Surveys to address 2010 Decadal Survey science goals
    - [High Latitude Imaging and Spectroscopic Surveys](#)
    - [High Latitude Time Domain Survey](#)
    - [Galactic Bulge Time Domain Survey](#)
  - The definition of these surveys will be established via an open community process, with a goal of maximizing the overall science return while simultaneously meeting the cosmology and exoplanet science requirements
- **~>25% of time devoted to General Astrophysics Surveys**
  - Issued White paper call to collect science case for pre-defining a General Astrophysics Survey (up to one month observations for one survey to be executed within first two years)
    - Would enable a program that would benefit from early definition
  - The remainder would be assigned via traditional proposal process and/or additional community process close to launch
- **3 months of coronagraph observations in first 18 months of mission**

# Design Reference Mission: Roman Surveys

To verify that it is possible to meet Roman science requirements within the mission lifetime, we have defined a design reference mission with candidate survey definitions.



**Galactic Bulge Time Domain Survey:** 2 deg<sup>2</sup>, 15 min cadence with W filter, 12 hour cadence for R or Z and Y or J for 60 – 72 day seasons; 6 seasons

**High Latitude Time Domain Survey:** 16 deg<sup>2</sup>, (wide), 5 deg<sup>2</sup> (deep), 4 filters (R, Z, Y, J – wide) /(Z, Y, J, H – deep), 5 day cadence, and prism spectroscopy

**High Latitude imaging/spectroscopy:** 2000 deg<sup>2</sup> (wide), 20 deg<sup>2</sup> (deep), 4 filters (Y, J, H, F) for wide and deep fields and grism spectroscopy

**General Astrophysics Surveys:** TBD

	HLS Wide	HLS Deep	HLTD Wide	HTTD Deep	GBTD
5 sigma J-band sensitivity	Per Visit	-	25.5	26.6	24.9
	Integrated	26.95	28.2	28.3	27.6 (60d)

# Community input on pre-selection of an Astrophysics Survey

- **Considering option to pre-select one survey of up to one month of observations notionally to be executed within the first two years of the mission**
  - Provides opportunity for observations that would substantially benefit from multi-year preparatory activities (precursor observations, simulations etc)
  - Allows for a substantive survey, but does not commit to a large amount of early observation time
  - Leaves most of the general astrophysics survey time to be assigned closer to launch (and after the core community surveys are defined)
  - Science topic/justification is open

# Community input on pre-selection of an Astrophysics Survey

- **Two Step Process**
  - 1) **Light weight white paper request for information (deadline Oct 22)**
    - Short (~2 pages) focusing on science case, science benefit from pre-definition and brief outline of strawman concept / or describe why we should NOT proceed
    - Determine whether to proceed with pre-selection of a survey
    - Which scientific area(s)/survey concept(s) to focus on
    - 20 white papers received on a broad range of topics
  - 2) **Community process to define/optimize the survey**
    - Opportunity for additional people/groups to provide input on implementation of the survey concept
    - Community owned (no PI)
    - Support for preparatory activities available via multiple ROSES calls between now and launch

# New Roman Science Teams and Support

- **What are we trying to achieve**

- Variety of award sizes and durations
  - Providing opportunities for regular and large awards may make it easier for new people to join the Roman community
- Multiple funding opportunities between now and launch for support for people at US institutions to work independently or with existing science teams
- Longish term stable support of teams to allow development of software/pipelines etc
- Ability for people to engage with Roman project/science teams independently of funding

# Three Opportunities

- **Wide Field Instrument Science**
  - This provides opportunities to work on a broad range of science preparation efforts, including simulations, science feasibility studies, supporting observations, analysis software development, activities related to mission performance verification, hosting or participating in data challenges, and science operations preparation.
- **Infrastructure Teams**
  - This opportunity will provide funding to develop infrastructure needed to pursue ambitious science goals including the cosmology and exoplanet demographics studies that demonstrate *Roman* meets its mission success criteria.
- **Coronagraph Community Participation Program (CCPP)**
  - This provides an opportunity for proposers to work with the coronagraph instrument team to plan and execute its technology demonstration observations.

# Roman Space Telescope Hardware Status

- **Telescope (L3Harris):**

- Successful telescope CDR in December 2020
- All optics coated and meet specs
- Primary mirror is mounted on the aft metering structure
- Secondary mirror assembly is integrated and completed optical testing
- Thermal control and alignment drive electronics being assembled



Tertiary Mirror Assembly  
in ambient optical test

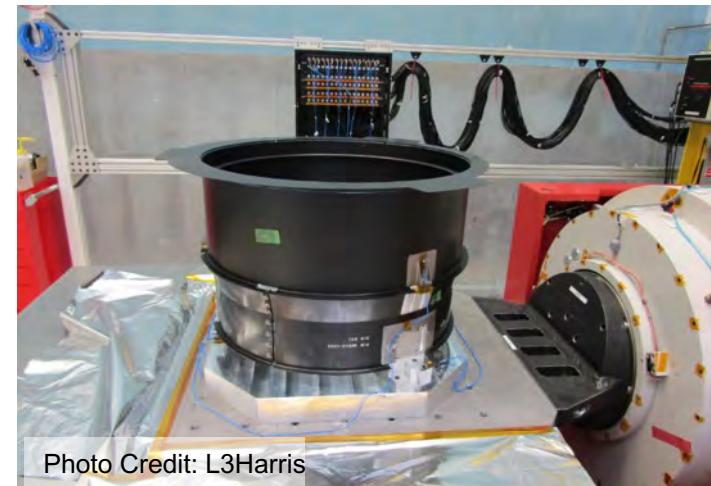
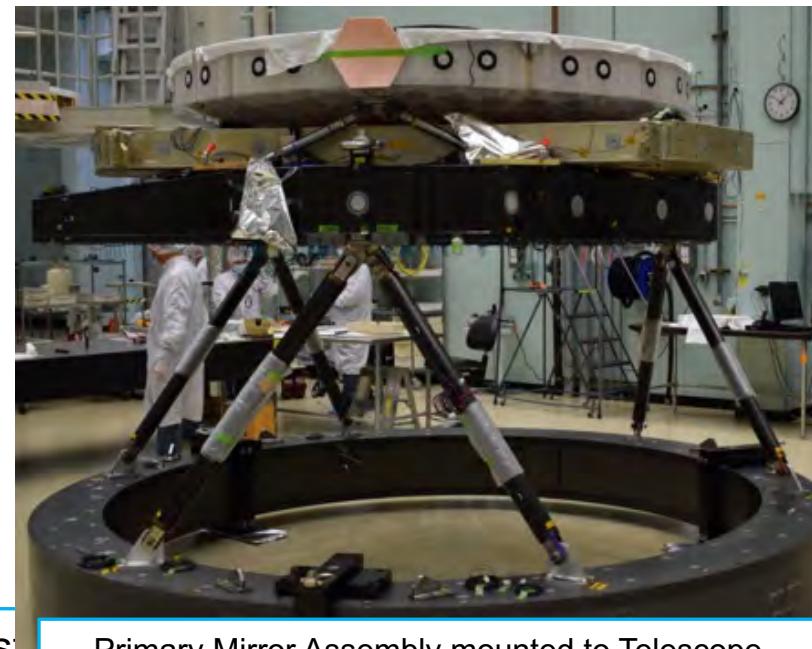
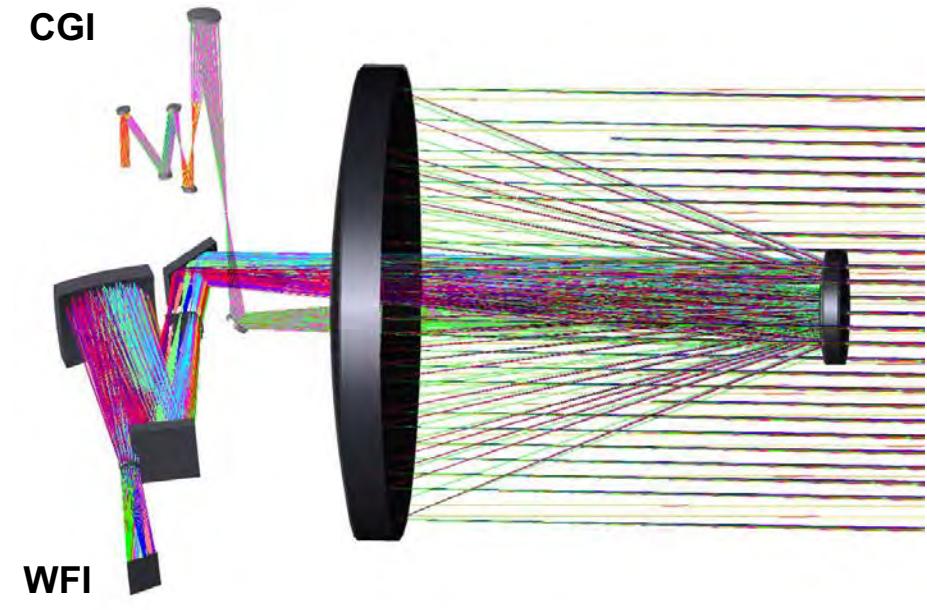


Photo Credit: L3Harris

SM baffle & shade sine vibe burst test



Primary Mirror Assembly mounted to Telescope  
System Support Ring



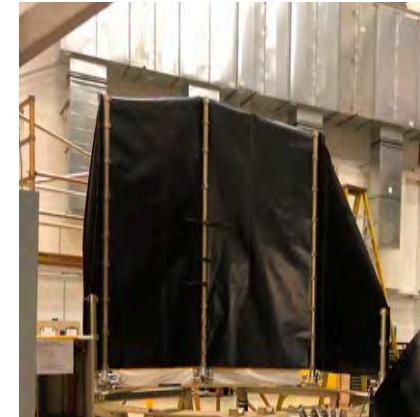
# Roman Space Telescope Hardware Status

- **Spacecraft**
  - Procurement of flight subsystems well underway
  - Engineering units for systems built and tested

Deployable  
Aperture Cover  
(DAC)  
Engineering  
Development  
Unit



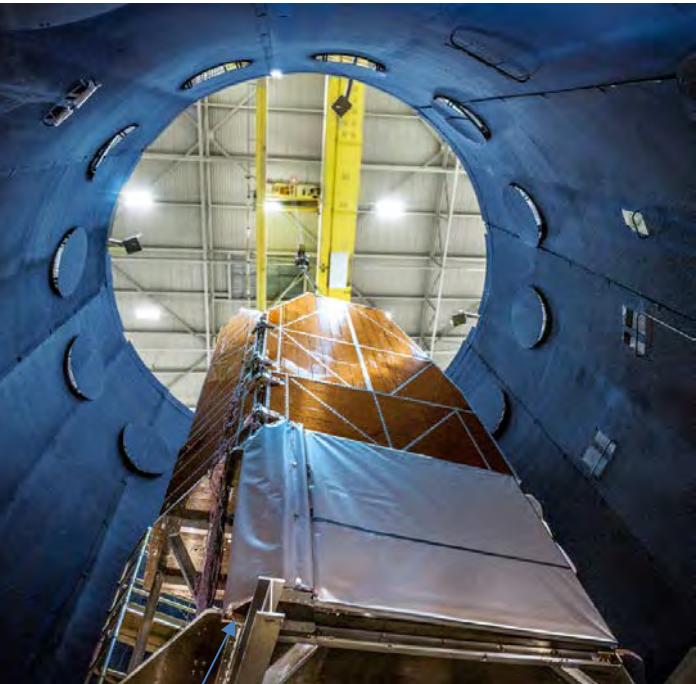
stowed



Deployed

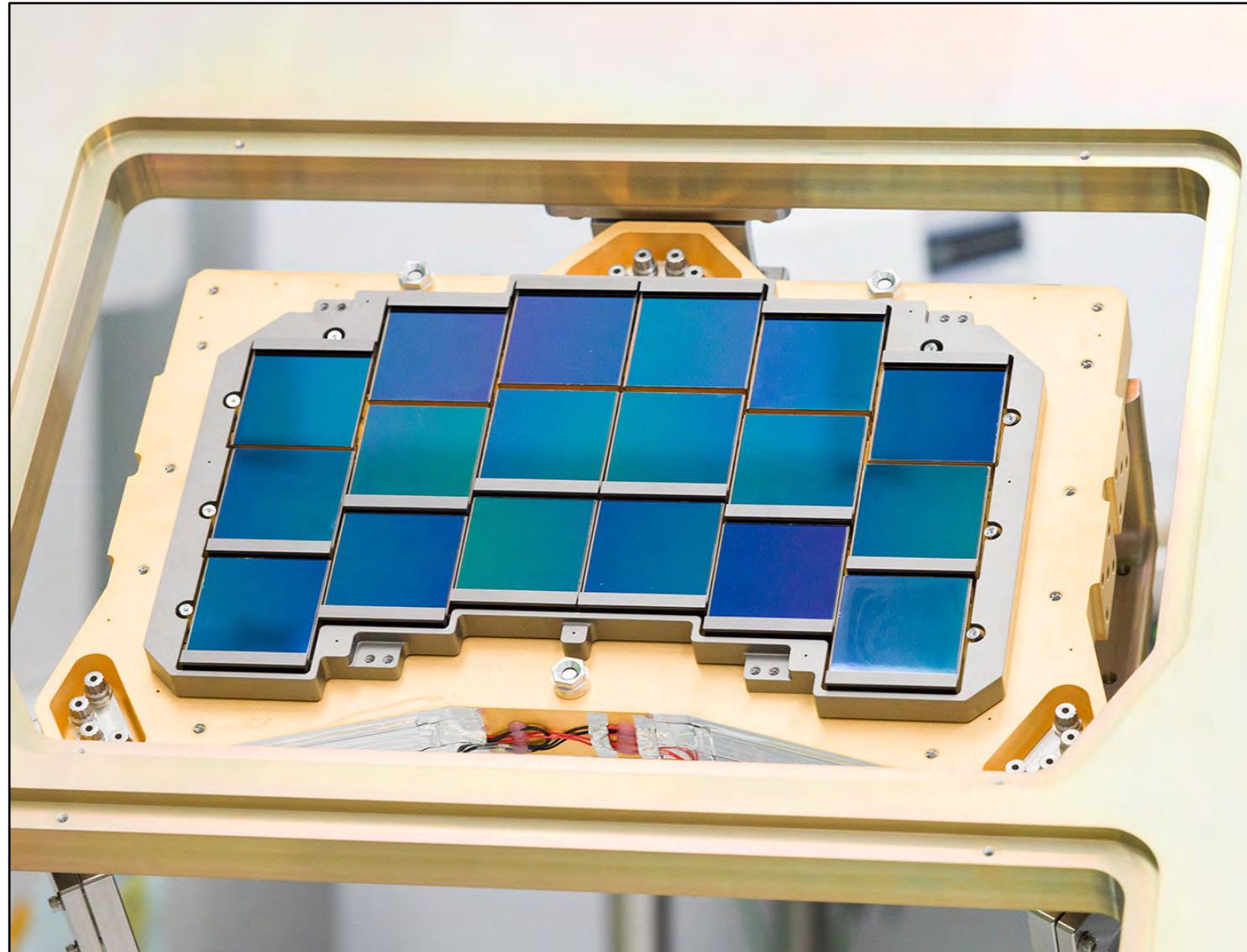


Deployed



Solar Array Sun Shield (SASS)  
Engineering Development Unit

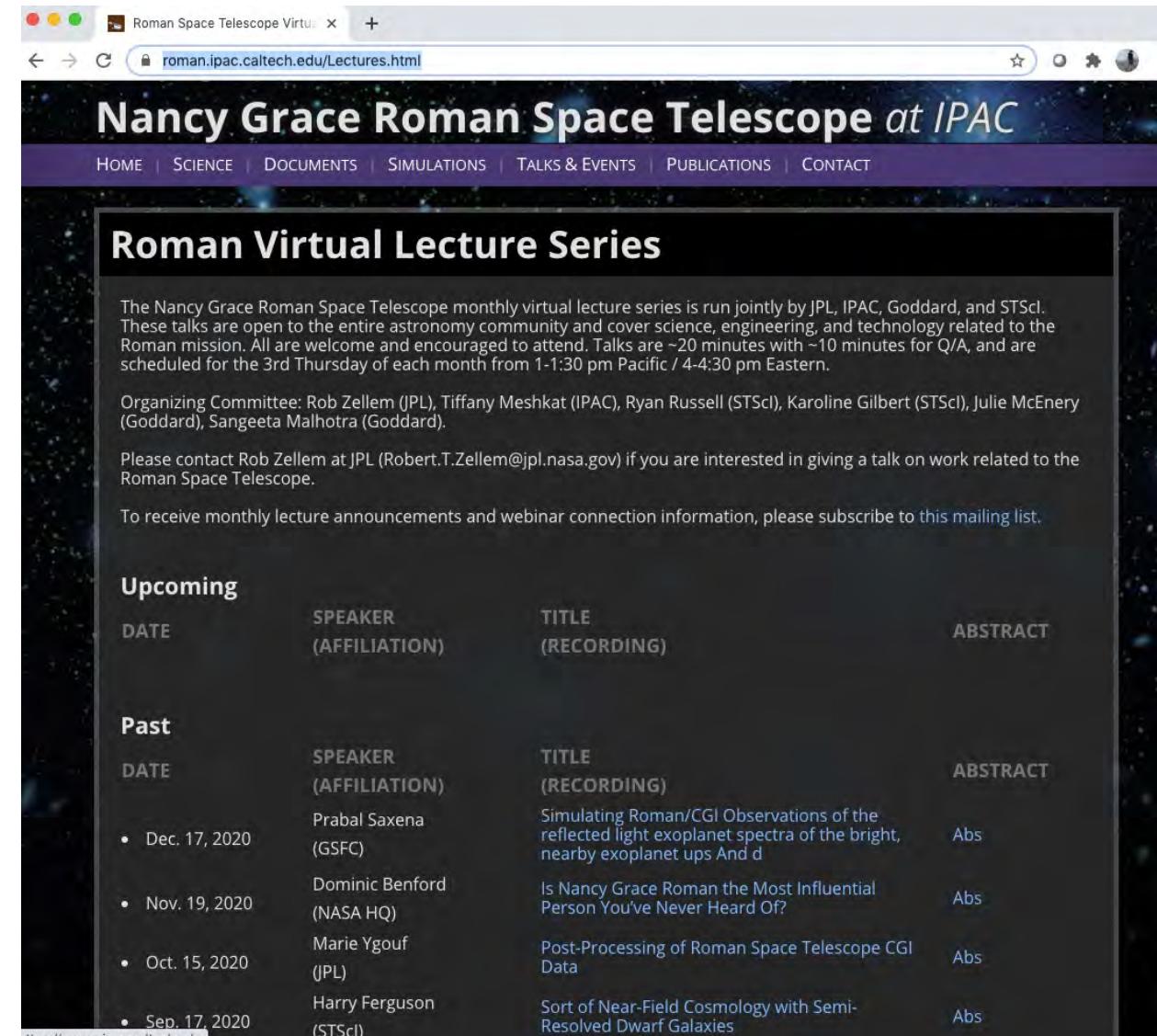
## Focal Plane Array and Mosaic Plate ETU



# Roman Virtual Lecture Series

<https://roman.ipac.caltech.edu/Lectures.html>

- Monthly lecture series jointly run by JPL, IPAC, STScI, and GSFC
- Please join us
- Speaker suggestions welcome



The screenshot shows a web browser window for the "Roman Space Telescope Virtual" website, specifically the "Lectures" page. The URL in the address bar is "roman.ipac.caltech.edu/Lectures.html". The page title is "Nancy Grace Roman Space Telescope at IPAC". The main content area is titled "Roman Virtual Lecture Series". It includes a brief description of the series, the organizing committee, contact information, and a mailing list for announcements. Below this, there are two tables: "Upcoming" and "Past".

DATE	SPEAKER (AFFILIATION)	TITLE (RECORDING)	ABSTRACT
Dec. 17, 2020	Prabal Saxena (GSFC)	Simulating Roman/CGI Observations of the reflected light exoplanet spectra of the bright, nearby exoplanet ups And d	Abs
Nov. 19, 2020	Dominic Benford (NASA HQ)	Is Nancy Grace Roman the Most Influential Person You've Never Heard Of?	Abs
Oct. 15, 2020	Marie Ygouf (JPL)	Post-Processing of Roman Space Telescope CGI Data	Abs
Sep. 17, 2020	Harry Ferguson (STScI)	Sort of Near-Field Cosmology with Semi-Resolved Dwarf Galaxies	Abs

# Exploring the Transient Universe with the Nancy Grace Roman Space Telescope

February 8 - 10, 2022 • On the Caltech campus and online

[Home](#)

[Pre-registration](#)

[Invited Speakers](#)

[Venue & Local Information](#)

[Important dates](#)

[Agenda](#)

[Posters](#)

[Instructions for Presenters](#)

[Code of conduct](#)

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Time-domain astrophysics comprises a vast array of phenomena, that span the range from our own Solar System to high-redshift galaxies, from asteroids and comets to novae, supernovae, active galactic nuclei, and gamma-ray bursts. We are now at the dawn of multi-messenger astrophysics, with the electromagnetic signatures of gravitational-wave sources within our observational grasp, most recently illustrated by the binary neutron-star merger GW170817. The Nancy Grace Roman Space Telescope will be a powerful observatory for exploring the time-varying Universe. Via its core surveys, it will search for supernova explosions at cosmological distances, as well as for the microlensing signatures of planets orbiting stars in our Galaxy. Roman will naturally enable serendipitous discoveries and analyses of many other time-variable phenomena during the course of its mission, through new surveys and a vigorous archival research program. This 3-day conference will bring together inclusively members of the community to discuss the exciting time-domain astrophysics that will be investigated with the Roman Space Telescope.

Themes will include:

- Multi-messenger astrophysics
- Tidal disruption events
- Supernovae
- Cepheids, Miras, and other periodic variables
- Novae and related phenomena
- Massive-star eruptions and outbursts
- Gamma-ray bursts
- Fast radio burst counterparts and hosts
- Active Galactic Nuclei
- Microlensing
- Solar System objects
- Time-domain data mining software and tools
- Alerts and brokers
- Synergies with other missions and facilities (Rubin, ELTs, Euclid, JWST, etc.)



*Credit: NASA and ESA.*

# The Road Ahead

- **Successful Mission Critical Design Review, Sept 2021**
  - Observatory design is complete, proceeding with building flight hardware
- **Opportunities to engage with Roman**
  - Monthly lecture series
  - Planning to start monthly project status updates
  - Town hall + 2 splinter sessions at AAS meeting (<https://roman.gsfc.nasa.gov/AAS239/>)
  - Workshop on Transient Universe, Caltech Feb 8-10, 2022
  - Draft ROSES proposal call out in few weeks, deadline in Spring
  - Community process to define a General Astrophysics Survey kicking off Spring/Summer 2022 (if recommended by RFI evaluation committee)
- **Astro2020**
  - Recommendation for non-advocate review of balance of observing time between core community surveys and general astrophysics surveys
    - Working with NASA HQ to set up this review
- **Exciting to see things coming together**

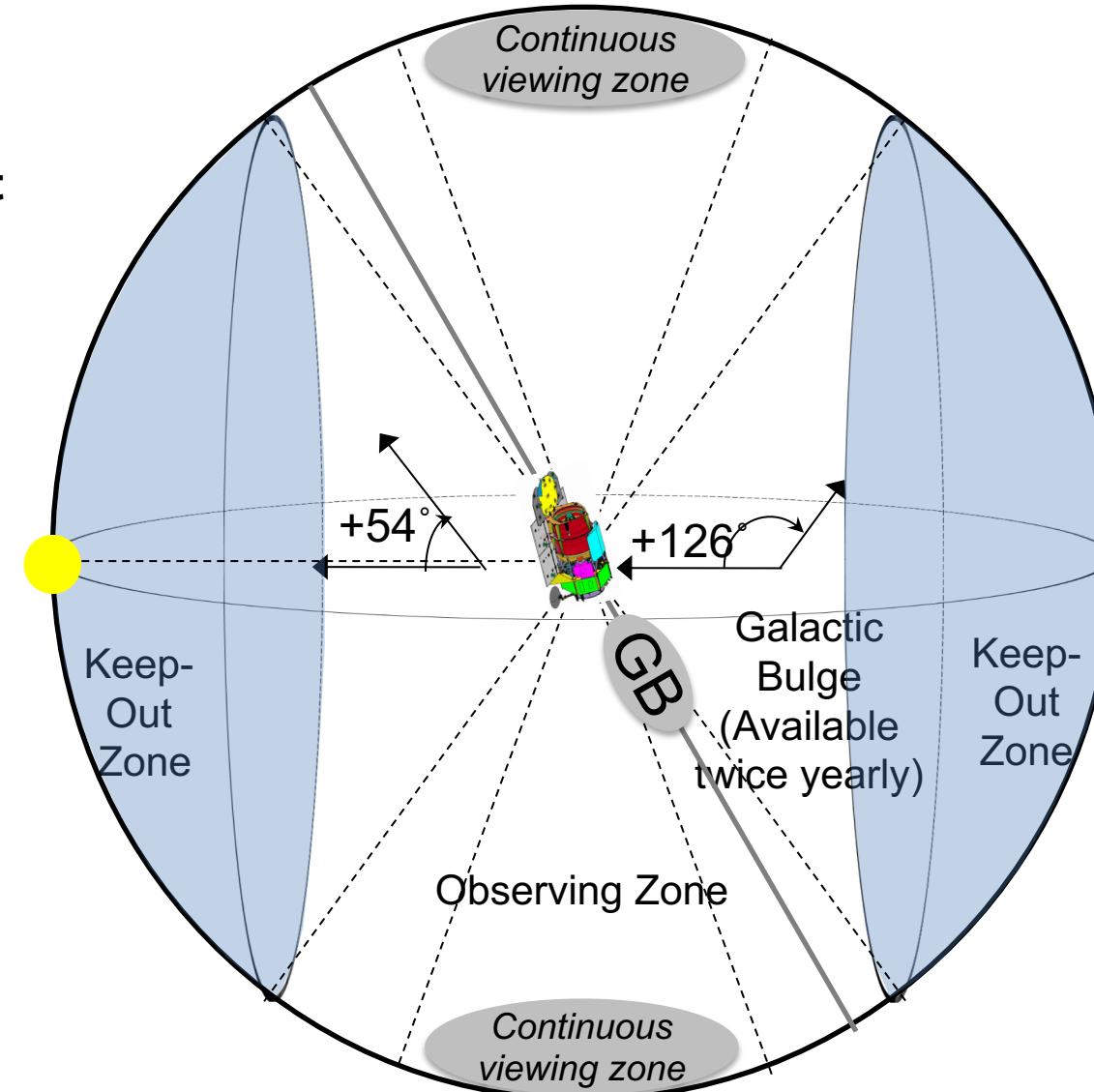
# Roman Field of Regard

## Observing Zone:

- $54^\circ$ - $126^\circ$  off Sun Line
- $360^\circ$  about Sun Line
- $\pm 15^\circ$  about line of sight

Slew/settle times are rapid – typically  $\sim 1$  min for adjacent field of view

Earth/Moon avoidance angles are a minor sporadic constraint



**Extragalactic Time Domain Survey** in fields within  $20^\circ$  of the ecliptic poles, located in continuous viewing zone(s)

**Extragalactic Wide Area Survey** (also GAS & Coronagraph) observations can be located within the full Observing Zone

**Galactic Time Domain Survey** can observe inertially fixed fields in the Galactic Bulge (GB) for 72 days twice a year