SET TO SURVEY THE SKY

Ranked as the highest scientific priority for a large space-based mission in the Astro2010 Decadal Survey, the Nancy Grace Roman Space Telescope will play a pivotal role in astrophysics in the 2020s and beyond.

EXPANDING OUR VIEW

Roman's WFI will survey the sky 1,000 times faster than Hubble, collecting near-infrared imaging and spectroscopic data with Hubble-quality resolution and sensitivity over fields of view 200 times greater than Hubble's WFC3/IR.

SPANNING ALL OF ASTROPHYSICS

Roman WFI data, collected through General Astrophysics Surveys as well as planned Core Community Surveys, will enrich research across astrophysics by enabling studies of nearly every class of astronomical object, phenomenon, and environment across the observable universe.

OPEN DATA ACCESS

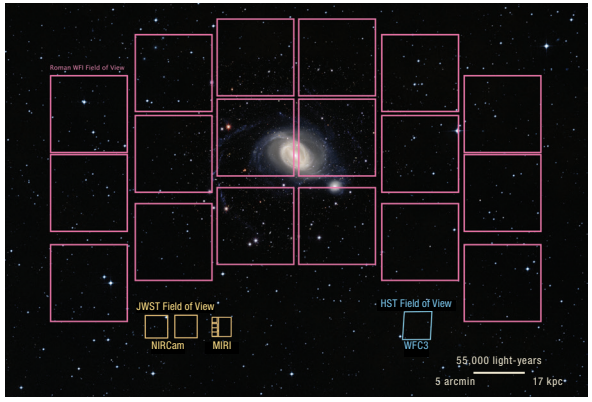
All data collected by Roman will be non-proprietary, available to all via the Mikulski Archive for Space Telescopes (MAST). The Roman mission will host mosaics, catalogs, and other data products in the cloud, and will partner with the astronomical community to create open-source data reduction and analysis tools.

COMPLEMENTING OTHER OBSERVATORIES

Roman will provide a unique window into astrophysical phenomena that complements other space and ground-based observatories, including the Vera C. Rubin Observatory, NASA's Hubble and Webb space telescopes, NASA's Kepler and TESS missions, and ESA's Euclid mission.

PROPELLING FUTURE DISCOVERIES

Roman's Coronagraph Instrument will conduct a high-contrast imaging technology demonstration designed to pave the way for large space-based missions discussed in the Astro2020 Decadal Survey, helping scientists develop future instruments capable of directly imaging Earth-sized exoplanets orbiting Sun-like stars.



Roman's Wide Field Instrument (WFI) consists of 18 near-infrared detectors that cover a total field of view of 0.281 square degrees. Background image of NGC 1512 and NGC 1510 from the DSS, Dark Energy Survey /DOE/FNAL, DECam/CTIO/NOIRLab/NSF/AURA.

A NEW NASA FACILITY FOR THE SPACE SCIENCE COMMUNITY

- Hubble-Like Resolution: ~0.1''
- Near-Infrared Imaging and Spectroscopy: 0.48–2.3 μm
- High-Contrast Coronagraph Demonstration: Potentially 10^{-9} Post-Processed Contrast
- Expansive Field of View: 0.281 deg^2
- All Data Nonproprietary: ~4 PB/yr
- Complementing Other Observatories: HST, JWST, Rubin, Gaia, Euclid, TESS, and more
- Propelling Future Discoveries: Across Astrophysics

LEARN MORE ABOUT THE ROMAN SPACE TELESCOPE

The Nancy Grace Roman Space Telescope is managed by NASA's Goddard Space Flight Center (Mission Operations Center), with participation by the Space Telescope Science Institute (Science Operations Center), Caltech/IPAC (Science Support Center), NASA's Jet Propulsion Laboratory (Coronagraph Instrument), and a team of scientists from various research institutions. The primary industrial partners are Ball Aerospace and Technologies Corporation, L3Harris Technologies, and Teledyne Scientific & Imaging.

Goddard Space Flight Center — roman.gsfc.nasa.gov

STScI — stsci.edu/roman

ipac — roman.ipac.caltech.edu

JPL — jpl.nasa.gov/missions/the nancy-grace-roman-space-telescope

January 2024

ROMAN SPACE TELESCOPE

Nancy Grace Roman Space Telescope
SCIENCE AND TECHNICAL OVERVIEW

Formerly known as the Wide Field Infrared Survey Telescope (WFIRST), the Nancy Grace Roman Space Telescope is named for NASA's first Chief of Astronomy.

SCIENCE WITH ROMAN

Roman's unprecedented ability to survey vast swaths of the sky at high spatial resolution and efficiency in the near-infrared will support investigations across nearly all areas of astrophysics, from Solar System studies to cosmology.

PLANETS BY THE THOUSANDS

Roman will have the power to detect thousands of planetary bodies in the Milky Way, filling significant gaps in our understanding of the demographics of both exoplanets and small bodies in our own Solar System.

- Microlensing detection of exoplanets
- Transit detection of exoplanets
- High-contrast direct imaging demonstration
- Surveys of small bodies in the Solar System

STARS BY THE BILLIONS

Roman will resolve billions of stars, providing detailed observations and the large number statistics needed to expand our knowledge of stellar astrophysics in the Milky Way and neighboring galaxies.

- Stellar populations of the Milky Way bulge, disk, and halo
- Resolved stellar populations in neighboring galaxies
- Transient and variable phenomena

GALAXIES BY THE MILLIONS

Roman will collect an unprecedented volume of high-resolution, near-infrared imaging and spectroscopic observations of galaxies across vast fields of view and spans of time, providing the large data sets needed to understand how different types of galaxies form, grow, and evolve over time.

- Galaxy properties, formation, and evolution
- Black holes, quasars, and active galactic nuclei
- Interactions between galaxies and their environments
- High-redshift galaxies and structure of the early universe

COSMOLOGY AND FUNDAMENTAL PHYSICS

Roman will have the near-infrared sensitivity, high-resolution imaging, grism and prism spectroscopy, expansive field of view, precise pointing control, and high survey speed required to collect the big data needed to address the most important questions driving cosmological research today.

- Detecting and monitoring Type Ia supernovae
- Mapping the distribution of galaxies over space and time
- Weak lensing measurements of galaxy shapes and dark matter density

ROMAN TECHNICAL SPECIFICATIONS

GENERAL SPECIFICATIONS

- 2.4-meter (Hubble-sized) primary mirror, 3-mirror anastigmat
- Heliocentric orbit at Earth-Sun Lagrange Point 2
- 5-year nominal mission with 10-year goal
- Data collection rate of 4 petabytes (4,000 terabytes) per year
- 100% data open-access

WIDE FIELD INSTRUMENT (WFI)

- 18 near-infrared 4k-by-4k detectors (300 megapixels)
- Field of view covering 0.281 square degrees
- Angular resolution of 0.1 arcseconds
- Imaging mode covering 0.48–2.3 microns

Imaging Filter	λ (μm)	Sensitivity*
F062 (R)	0.48-0.76	27.9
F087 (Z)	0.76-0.98	27.6
F106 (Y)	0.93-1.19	27.5
F129 (J)	1.13-1.45	27.5
F146 (I/H)	0.93-2.00	27.9
F158 (H)	1.38-1.77	27.4
F184 (H/K)	1.68-2.00	26.7
F213 (Ks)	1.95-2.30	25.4
Spectrograph	**λ (μm)**	**R**
G150 (Grism)	1.00-1.93	461
P127 (Prism)	0.75-1.80	80-180

*Point-source sensitivity (AB Mag) 5σ in 1 hour

CORONAGRAPH INSTRUMENT (DEMONSTRATION)

- High-contrast requirement of at least 10^{-7}
- Imaging, polarimetry, and slitted spectroscopy modes

Mask FOV	λ FWHM (μm)	Mode	Support Status
Hybrid Lyot 0.14''–0.45'' 360°	0.57 0.06	Narrow FOV Imaging	Required
		Polarimetry	Best Effort
Shaped Pupil 0.18''–0.55'' 2 × 65°	0.73 0.12	Slit + R~50 Prism Spectroscopy	Best Effort
Shaped Pupil 0.45''–1.4'' 360°	0.83 0.10	Wide FOV Imaging	Best Effort
		Polarimetry	Best Effort

For additional instrument details and access to simulation tools, visit Roman User Documentation (RDox) at roman-docs.stsci.edu.

OBSERVATION PROGRAMS

CORE COMMUNITY SURVEYS

Approximately 75% of Roman's five-year nominal mission will be devoted to a set of Core Community Surveys using Roman's Wide Field Instrument. The three surveys will be optimized to support a broad range of astrophysical research, serving as invaluable resources for archival research on a wide variety of topics, including cosmology, planetary and exoplanetary science, stellar populations, and galactic evolution. Survey details are being determined through a community process.

The **High Latitude Wide Area Survey** may include imaging and low-resolution (grism) spectroscopy covering approximately 2,000 square degrees for a total observing time of about two years. The survey was originally designed for studies of dark energy, cosmic lensing, high redshift galaxies, and galactic halo substructure in nearby galaxies, and is now being optimized for studies across astrophysics.

The **High Latitude Time Domain Survey** may include high-cadence imaging (every ~5 days) and slitless spectroscopy in three tiers: shallow (~27 square degrees), medium (~9 square degrees), and deep (~5 square degrees). The survey was originally designed for detection and light-curve characterization of supernovae of redshifts up to 1.7, and is now being optimized to support a broad range of astrophysical research.

The **Galactic Bulge Time Domain Survey** may include high-cadence imaging (~ every 15 min) of multiple fields of the Milky Way bulge over six contiguous 72-day seasons, for a total observing time of approximately one year. The survey was originally conceived for a census of exoplanets and free-floating planets, and is now being optimized for a broader range of research, including studies of stellar populations in the Milky Way and structure of the Galaxy.

GENERAL ASTROPHYSICS SURVEYS

At least 25% of Roman's five-year nominal mission will be devoted to General Astrophysics Surveys. Opportunities to propose a General Astrophysics Survey will be available to everyone through regular calls for proposals.

ARCHIVAL RESEARCH

Funding will be available to use data from the Core Community and General Astrophysics Surveys for any area of research, including cosmology and exoplanets. All data will be non-proprietary and will be available via the Mikulski Archives for Space Telescopes (MAST).

CORONAGRAPH INSTRUMENT PROGRAM

A Coronagraph Instrument observing program will be performed as part of the Technology Demonstration. Additional observations aided by an enhanced Community Participation Program may focus on characterization of planets around pre-selected target stars. Some planets may be targeted for full spectral resolution observations to enable planet characterization.