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.
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.

- Micro-lensing 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

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<th>Imaging Filter</th>
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<td>F062 (R)</td>
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GENERAL ASTROPHYSICS SURVEYS

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 Mikiulski 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.

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