



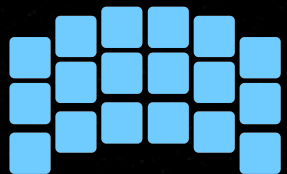
# The Roman Science Support Center at IPAC

December 11, 2020

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*L. Armus for the SSC team*

NANCY GRACE  
**R.ÖMAN**

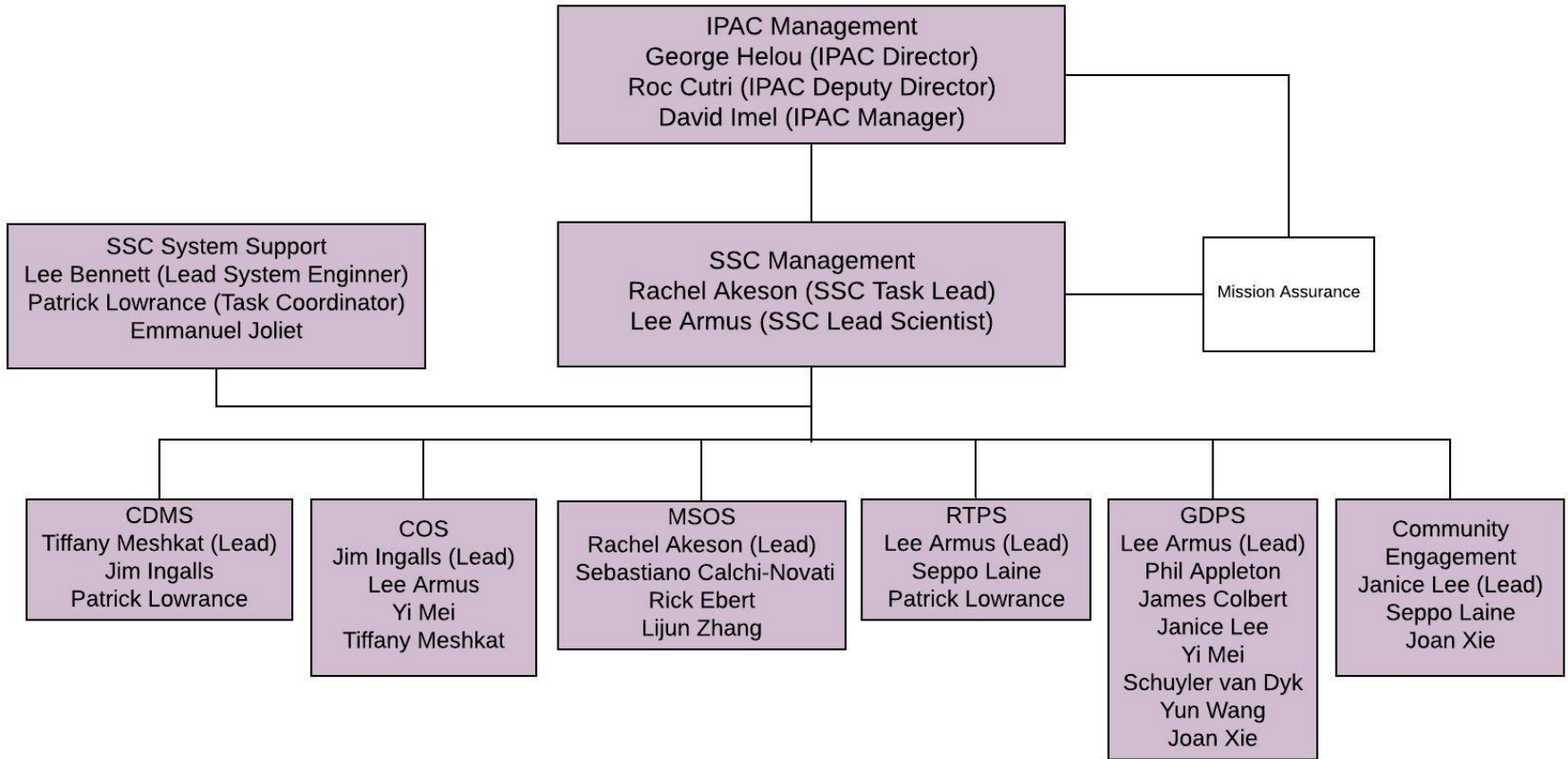


SPACE TELESCOPE

- The SSC at IPAC works with the other Ground System elements to support the scientific and operational goals of the Roman mission.
- Primary SSC Responsibilities include:
  - **Data pipeline implementation and operation**
    - Microlensing science data processing: Level 3 and 4 data products
    - Grism-Prism science data processing: Level 4 data products (in collaboration with Laboratoire d'Astrophysique de Marseille (LAM)).
    - CGI: Level 1 data products
  - **Support for CGI Operations**
    - Assess and trend CGI health, safety and instrument performance
    - Develop tools to create, format and validate CGI observation scripts
    - Develop and operate Data Analysis Environment for CGI data processing. Deliver higher order products to the Roman archive.
    - Support High Order Wave Front Sensor (deformable mirror) ground-in-the-loop operations
  - **Management of the peer review process and community grants**
    - Issue General Observer (GO) /Guest Investigator (GI)/Theory calls for proposals
    - Manage peer review and time allocation process for GO/GI/Theory proposals
    - Manage GO/GI/Theory grants
  - **Community engagement** for Roman Exoplanet science, Wide Field Spectroscopy and proposal submission

- **Roman Telescope Proposal System (RTPS):** Roman Telescope proposal ingest, time allocation committee review process, and grants management.
- **CGI Operations System (COS):** CGI operations support including validation of commanding products and instrument health, safety and performance trending, and support of the High Order Wavefront Sensor (HOWFS) ground in the loop operations.
- **CGI Data Management System (CDMS):** CGI instrument support including Level 1 data processing, user support, providing a Data Analysis Environment (DAE) which will be used to produce Level 2-4 data products by the CTC and PSP, validate and deliver L1-4 products to SOC.
- **Microlensing Science Operations System (MSOS):** WFI exoplanet microlensing data processing which will produce Level 3 and Level 4 science data products, starting with the Level 2 products produced by the WFI pipeline at the SOC.
- **Grism and Prism Data Processing System (GDPS):** WFI grism and prism data processing, which will produce Level 4 science data products, starting with the Level 2 grism and prism products and Level 4 imaging products produced by the WFI pipeline at SOC.
- **Community Engagement:** Interface with the scientific user community for Roman exoplanet science, proposal preparation and submission, and spectroscopic science.

# SSC Organization Chart





The SSC will manage the the Roman Telescope Proposal System (RTPS). The primary responsibilities of the RTPS are to:

- Issue the call(s) for GO, GI and Theory proposals
- Support the community in proposal submission, accept and ingest proposals
- Design and maintain proposal submission software
- Maintain proposer/proposal databases
- Manage the peer review process for all proposals
- Notify proposers of results and support post-selection process
- Manage General Observer, Guest Investigator, and Theory grants
- Support the proposal preparation and submission process via regular workshops, on-line documentation, and a helpdesk

The SSC will manage the the CGI Data Management System (CDMS) and CGI Operations System (COS). The primary responsibilities of the CDMS and COS are to:

- COS
  - Command and operate the CGI during commissioning and nominal operations
  - Develop tools to create, format and validate CGI programs and scripts (based on CTC design), and deliver to MOC/SOC
  - Perform High Order Wavefront Sensing/ Ground In The Loop (HOWFS/GITL) operations, processing and uplink
- CDMS
  - Process L0-L1 CGI data (creating raw FITS or equivalent files) and deliver to SOC
  - Develop and operate Data Analysis Environment (DAE) for CTC and CPP scientists
  - Validate, deliver L2-L4 CGI data (calibrated, higher products) produced by CTC and the participating scientists to SOC for archiving
- Assess and trend CGI health & safety and generate regular CGI health and safety reports
- Monitor Instrument performance during operations
- Support CTC in CGI I&T

The SSC will manage the the Microlensing Science Operations System (MSOS). The primary responsibilities of the MSOS are to:

- Implement and operate the microlensing light curve pipeline, starting from L2 images
- Identify microlensing events and derive stellar and planetary parameters
- Measure the microlensing pipeline detection efficiency
- Produce L3 and L4 imaging data products, including images, light curves, catalogs and detection efficiency, completeness and reliability products
- Perform DQA on all L3 and L4 data products
- Deliver L3 and L4 products to the Roman archive at the SOC
- Support the community in analyzing microlensing data
- Release pipeline modules (and associated pipeline documentation) to the community (via the HLPP or other community standard platforms, e.g. GitHub).

The SSC and LAM will collaborate to create the Roman Grism-Prism Data Processing System (GDPS). The primary responsibilities of the GDPS are to:

- Create and maintain Roman Wide Field Spectroscopy mode (WSM) calibration and science data pipelines at SSC
- Derive WSM calibration reference files and create L4 grism and prism science data products from L2 grism/prism and L2-L4 WFI imaging data
- Deliver L4 science data products and calibration reference files to Roman archive at SOC
- Perform Data Quality Assessment on all L4 science data products and calibration reference files
- Support the community in the preparation of WSM science observations and data analysis
- Release pipeline modules (and associated pipeline documentation) to the community (via the HLPP or other community standard platforms, e.g. GitHub).



- SSC works with the relevant Science Investigation Teams for microlensing, WFI spectroscopic and CGI observations to:
  - Understand science requirements
  - Define operational and processing scenarios
  - Discuss potential roles and contributions of future Science Teams
- IPAC and SSC scientists are directly involved in current Roman Microlensing, CGI, High Latitude Survey and Supernovae SITs
- SSC participates in a number of Roman working groups, including calibration, wide field spectroscopy, data formats, simulations, etc.
- SSC participates in the FSWG and RSIG
- The SSC team includes scientists with expertise in:
  - Microlensing data reduction and analysis
  - Direct exoplanet imaging and coronagraphy
  - Wide field Infrared spectroscopic data reduction, analysis and simulations
  - Cosmology, supernovae, MW and galaxy evolution (theory and observation)

## General implementation approach:

- Collaborate with ground system partners and other Roman project elements on key SSC functions
- Partner with SITs and science community on algorithms and methods for data processing, testing and validation and simulations
- Leverage heritage and relevant experience from other projects, e.g. IRAS, 2MASS, Spitzer, Kepler, WISE, Planck and Euclid
- Use existing astronomical software packages, public domain or commercial software where possible
- Build integrated teams of scientists, software developers and system/ database engineers to deliver and operate SSC systems

## Recent/Upcoming ground system milestones:

- Ground System PDR (July 2020) ✓
- CGI HOWFS/GITL EPR (Feb 2021)
- CGI CDR (April 2021)
- Ground System CDR (July 2021)
- First Ground System build (Aug 2022)

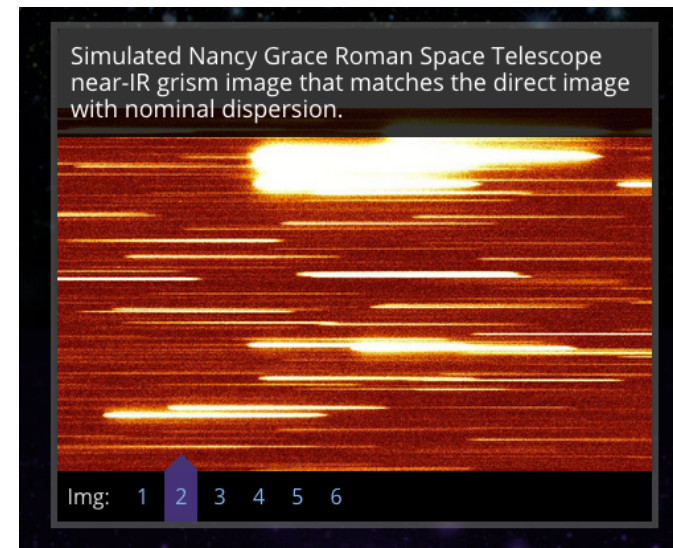
- Interface with the scientific user community for Roman exoplanet science, WFI spectroscopy, CGI operations and observations, and proposal submission
- Develop and maintain SSC Roman website and helpdesk system
- Support and organize Roman science conferences and workshops for the astronomical community
- Support the general public and provide educational and public outreach products in these areas, in coordination with and following the procedures of, the Roman Communications Board.

June 18 - 20, 2019  
Caltech's Hameetman Auditorium

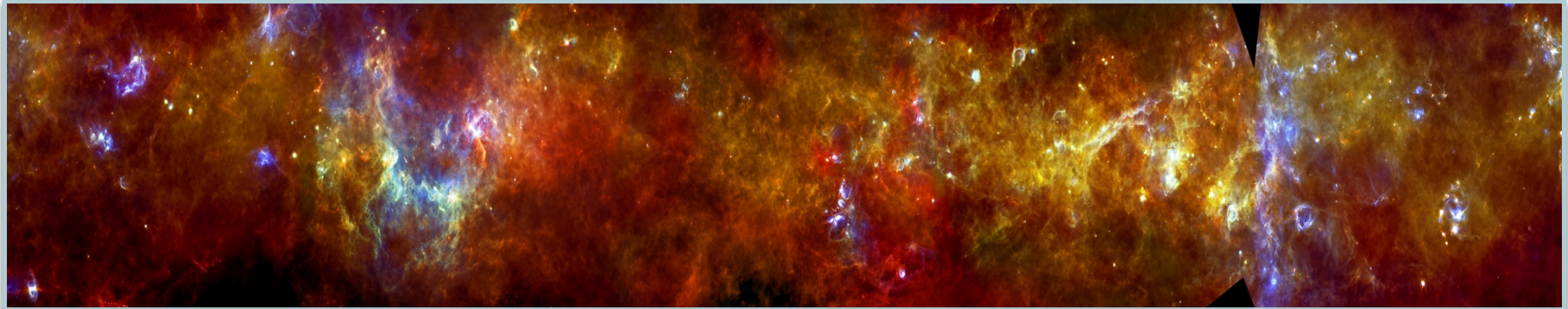
## Science in Our Own Backyard: Exploring the Galaxy and the Local Group with WFIRST

Last in-person SSC-led science conference held in 2019. Previous conferences focused on GO science and microlensing.

Example WSM data simulation available to community

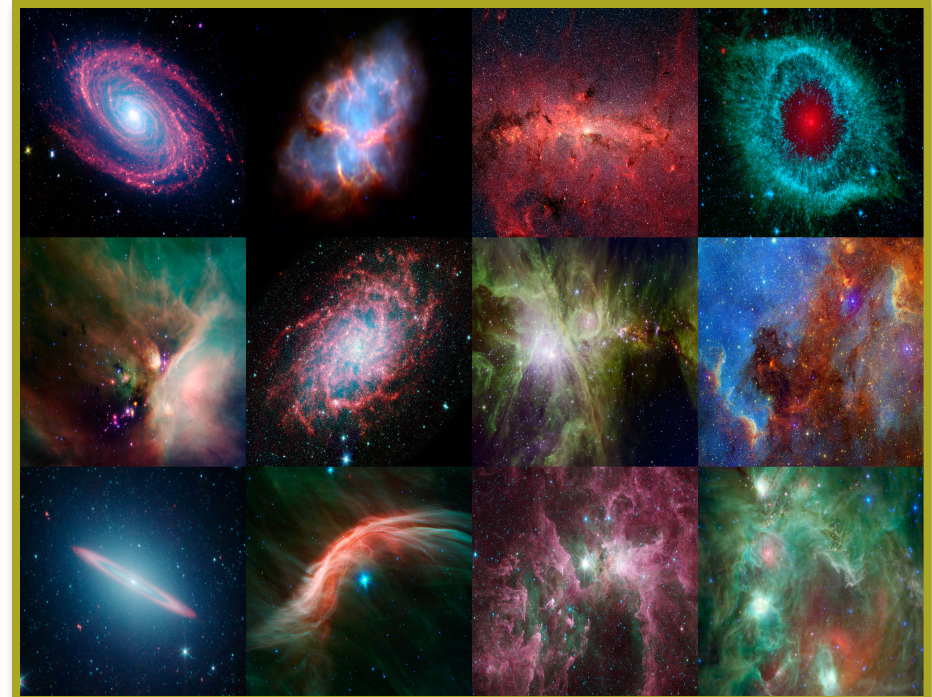






Herschel

- **1980s:** IPAC established as “Infrared Processing & Analysis Center” to support **IRAS** research; NASA/IPAC Extragalactic Database (**NED**)
- **1990s:** Two-Micron All-Sky Survey (**2MASS**), NASA/IPAC Infrared Science Archive (**IRSA**), Infrared Space Observatory (**ISO**, ESA/NASA)
- **2003:** **Spitzer** launch, NASA Great Observatory
- **2009:** **Herschel**, **Planck** and **WISE** launch; NASA Exoplanet Science Institute (**NExSci**); support for **Kepler**



Spitzer

- **Exoplanets:** Transits, microlensing, precision radial velocity, host star characterization
- **Solar System:** Near-Earth objects and asteroids
- **The Galaxy:** Hidden star formation, dust properties, young stellar objects, debris disks, evolved stars, Galactic structure, tidal streams, nebulae, low-mass stars and brown dwarfs
- **Nearby Universe:** Star formation in the Local Volume, stellar streams, the circumgalactic intergalactic medium, luminous infrared galaxies, starbursts, AGN, mergers and galactic feedback
- **High-redshift Universe:** Galaxy formation and evolution, the Epoch of Reionization, cosmology
- **Time Domain Astrophysics:** Transients and variable sources, supernovae, multi-messenger astronomy

IPAC Research Themes are well aligned with the Roman mission