Space Imaging and Optical Systems Laboratory

https://sioslab.com

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https://sioslab.com/research/

What We Do

Instrumentation

- Instrument Support
- Automated operation
- Wavefront sensing and control

Logistics

- Survey Planning
- Space Mission Design and Analysis
- Survey Analysis (inference)

Orbit Design and Analysis

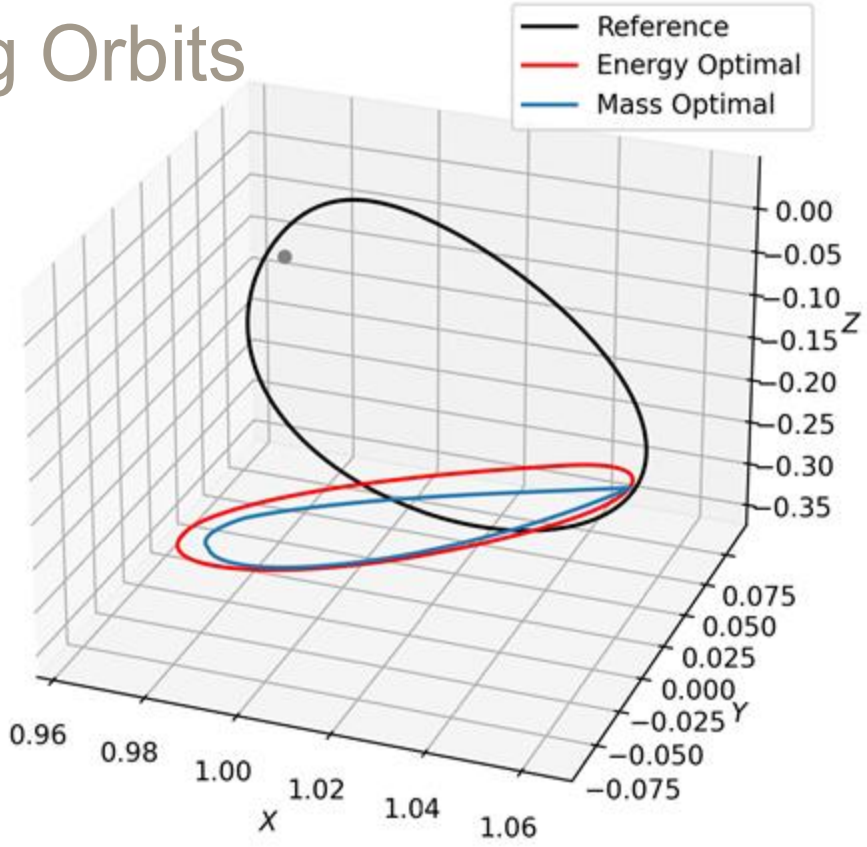
Data Analysis

- Image Post-Processing
- Weak Signal Detection
- Blind Source Separation
- Dynamics Studies
- Data Stream Integration

All sorts of engineering problems associated with astronomical surveys, space missions, the detection of exoplanets and control of optical systems.

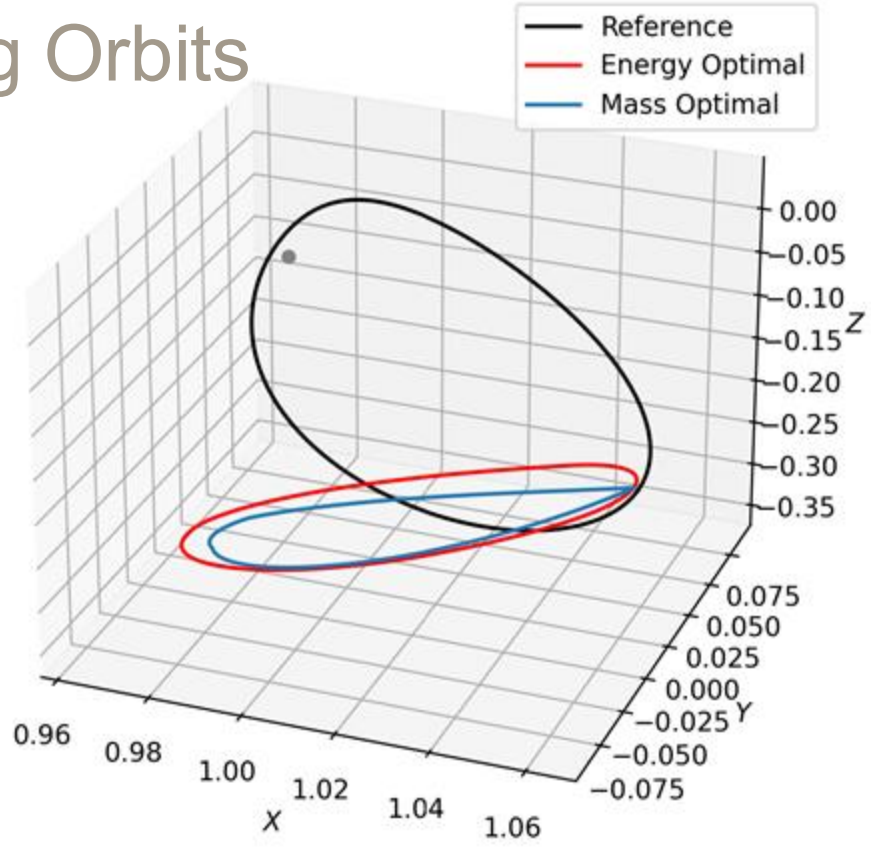
Colby's Project: Pole-Sitting Orbits

- We want trajectories that stay below (or above) the Moon's pole for their entire duration
- Forced Periodic Trajectories
  - Low-thrust optimization
- Currently we can:
  - Compute them
- We need someone to:
  - Compute 1000x as many as we have
- We intend to:
  - Learn about their convergence criteria
  - Learn about their feasible region

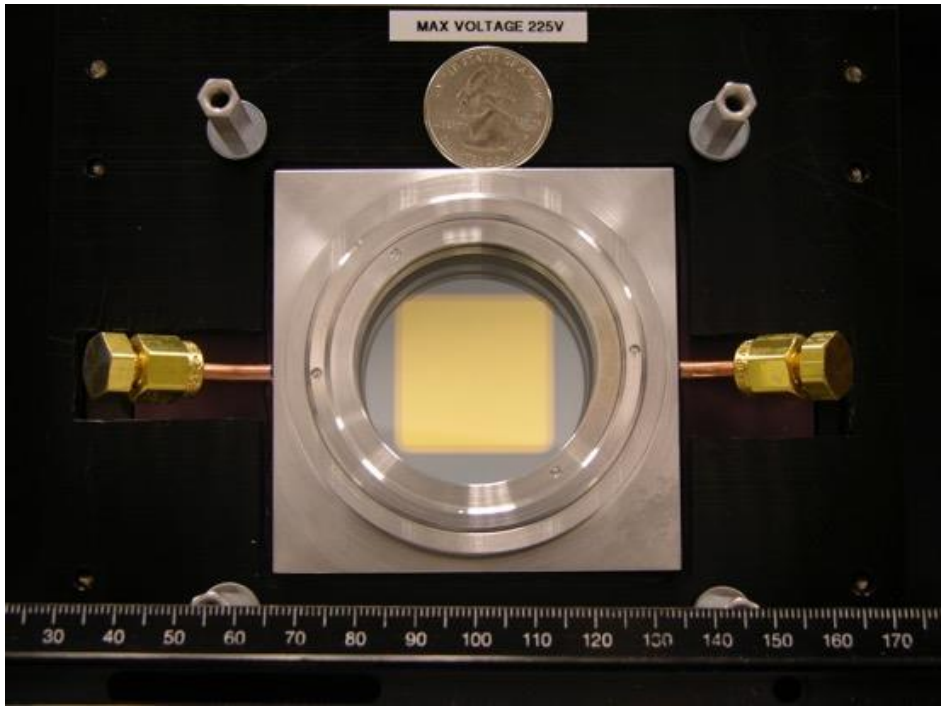


Colby's Project: Pole-Sitting Orbits

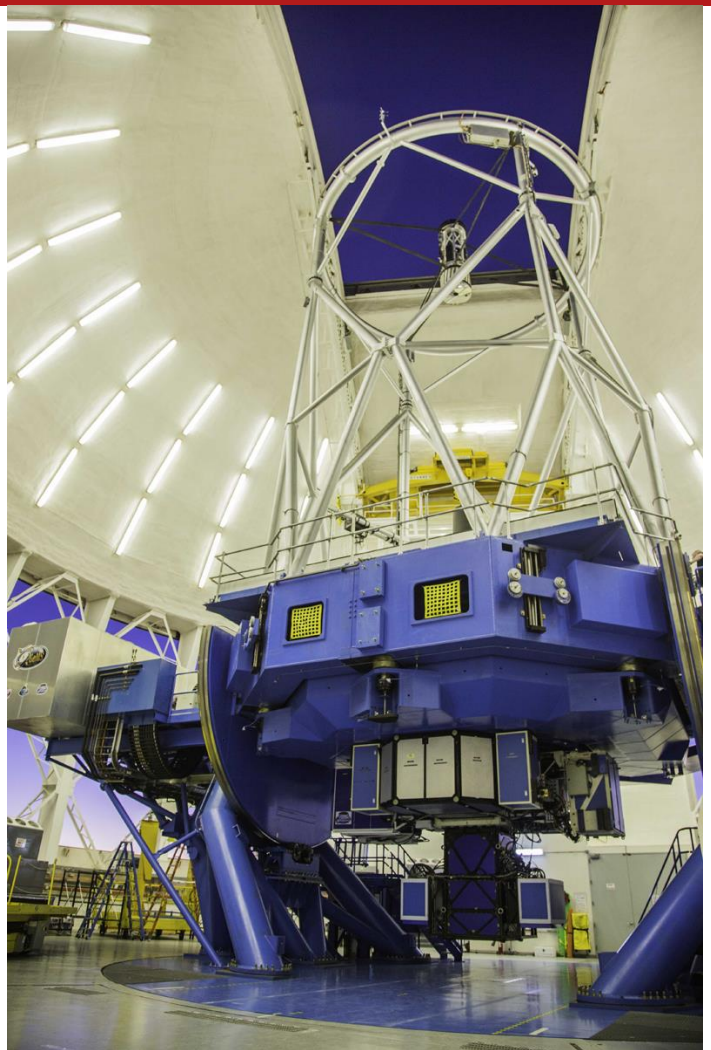
- Requirements:
  - Be able to run ASSET on your computer
  - Be comfortable with dynamics minimally at level of MAE 2030
  - Be open to asking questions
  - Meet with Colby weekly
- Contribute to a conference paper
  - December 3 (Nov 21 internal deadline)



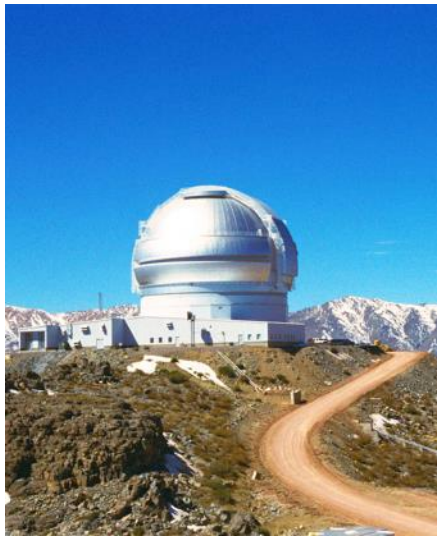
The Gemini Planet Imager



BMM 4096-actuator
MEMS deformable mirror



GPI 1.0



Gemini Telescope

GPI Now

GPI AO optics and DMs

Classical APLC coronagraph masks

IR tip/tilt camera

CAL relay optics

AO WFS

Lincoln Labs Fast CCD

IFS

existing optics, prisms, & pupil viewer

H2RG detector

Xeon GPI AO Realtime computer

Observatory Software

GPI Top-Level Software

GPI data pipeline

Exoplanet Survey

GPI 2.0

Gemini Telescope

GPI 2.0

GPI AO optics and DMs

Updated shaped-pupil coronagraph masks

Deeper contrasts & improved IWA

Fainter targets

CRED2 IR tip/tilt camera

CAL relay optics

AO pyramid WFS

E2V EMCCD

IFS

Faster & deeper sensitivity to planets

new prisms, optomech. upgrades, CRED2 IR pupil viewer

H2RG detector

Updated GPI AO Realtime computer

More sensitive, faster AO; enables fainter targets, & better performance on bright targets

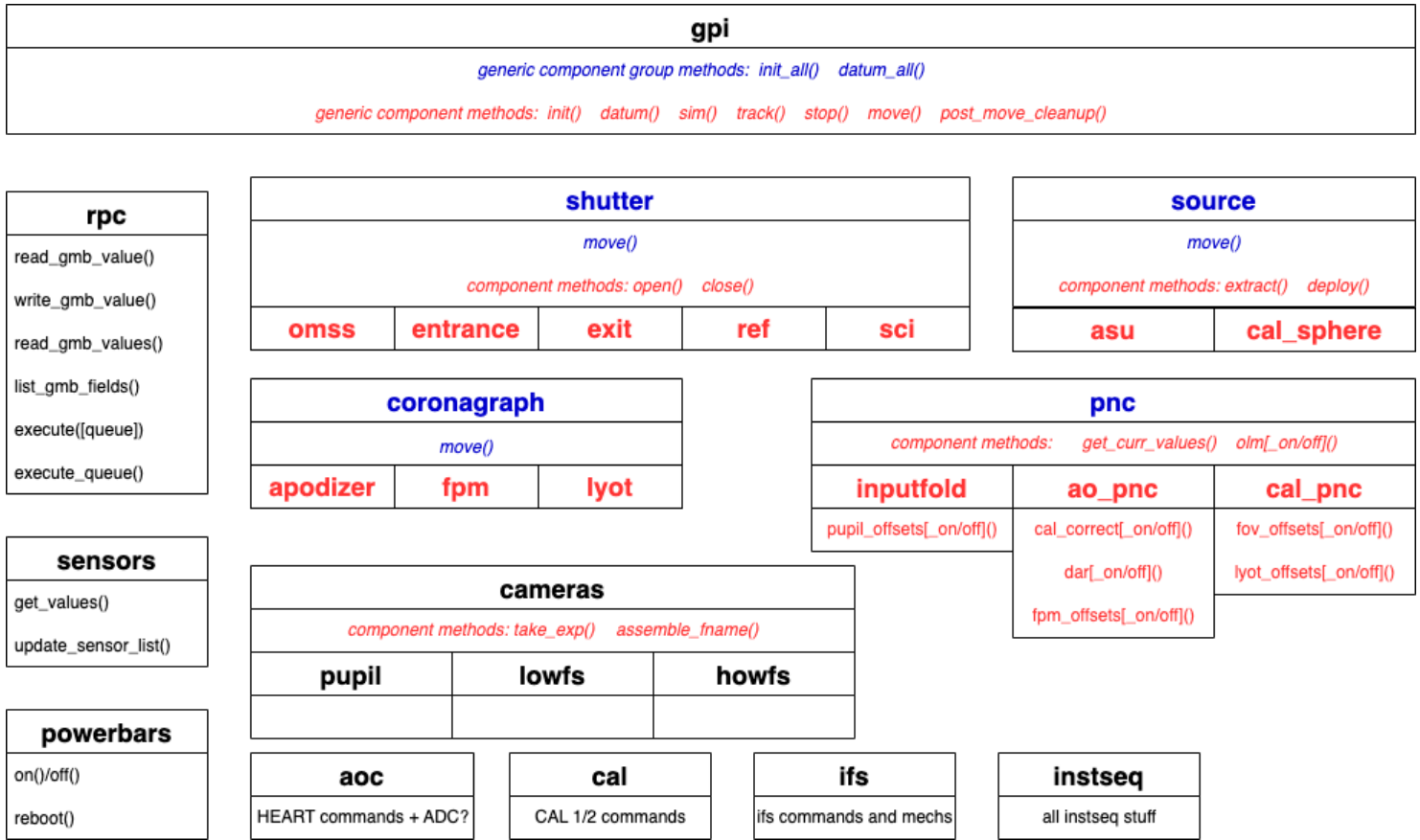
Enhanced efficiency and robust operations

Observatory Software

Enhanced Top-Level Software

GPI data pipeline

gpilib Status

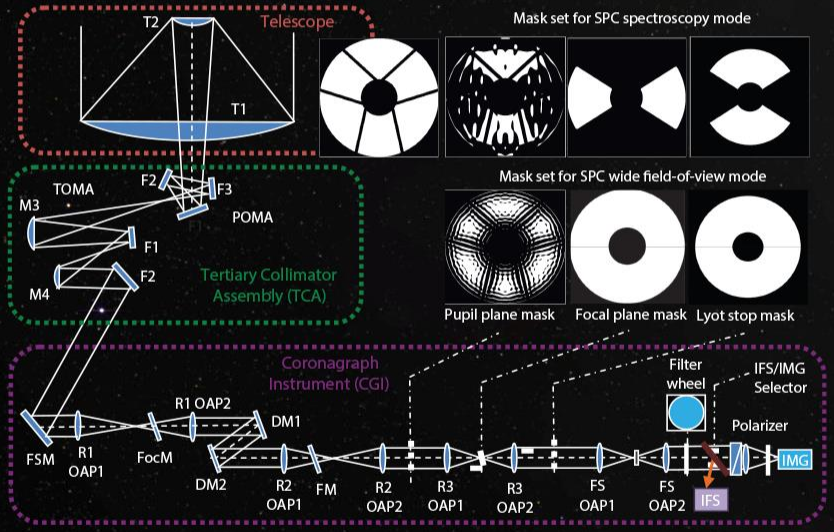


GPI 2.0 Positions

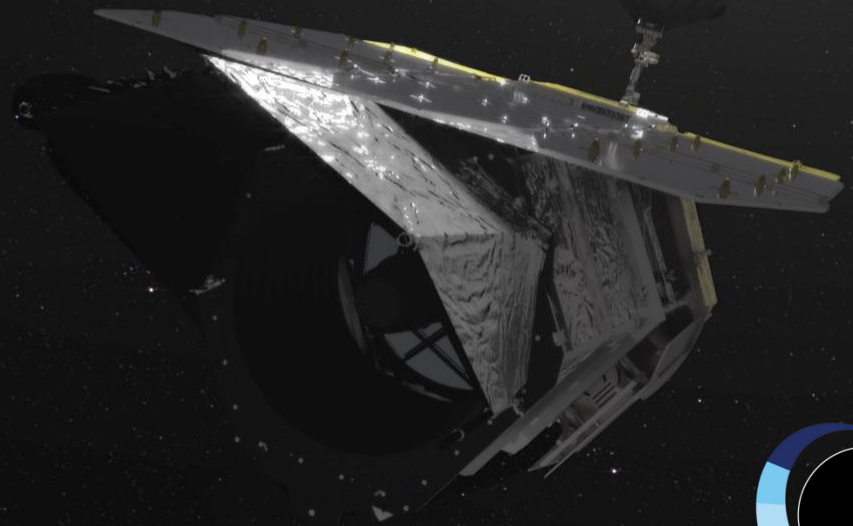
- GPI 2.0 Top-Level Software and alignment
- gpilib porting

- Required skills:
  - Coding in Python, coding in C/C++, reading IDL
  - Familiarity with git/github

The Nancy Grace Roman Space Telescope



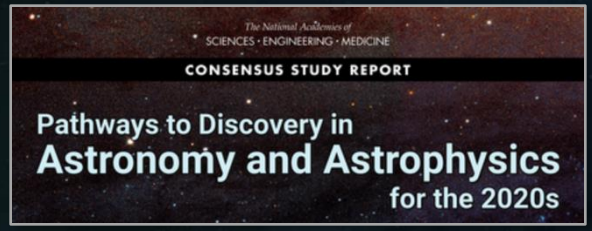
Roman Coronagraphic Instrument.
Adapted from Zhou et al. (2018)

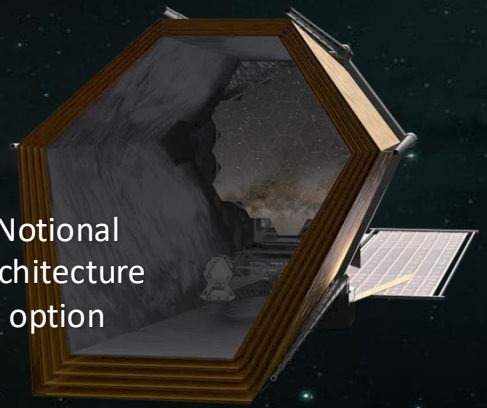


https://roman.gsfc.nasa.gov/
https://romancgi.sioslab.com/

The Habitable Worlds Observatory (HWO)

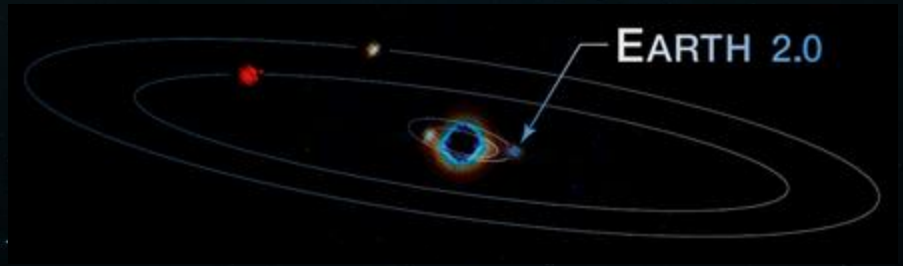
NASA's next flagship mission concept recommended by Astro2020 Decadal Survey





Notional architecture option

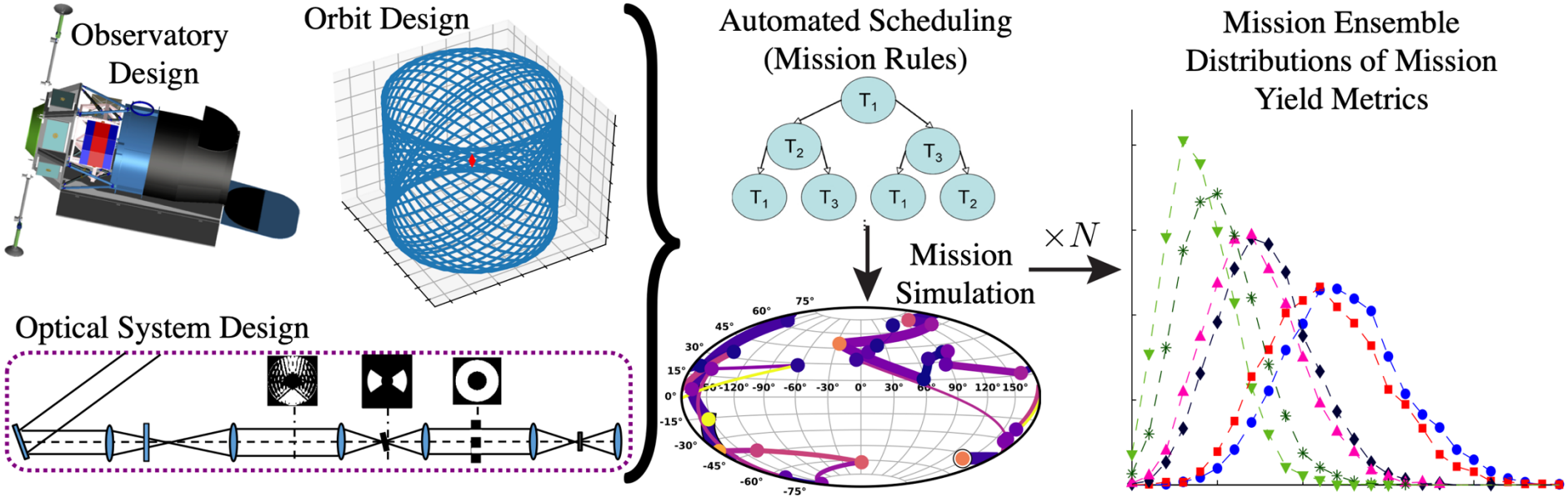
First telescope designed to search for signs of life on planets outside our solar system



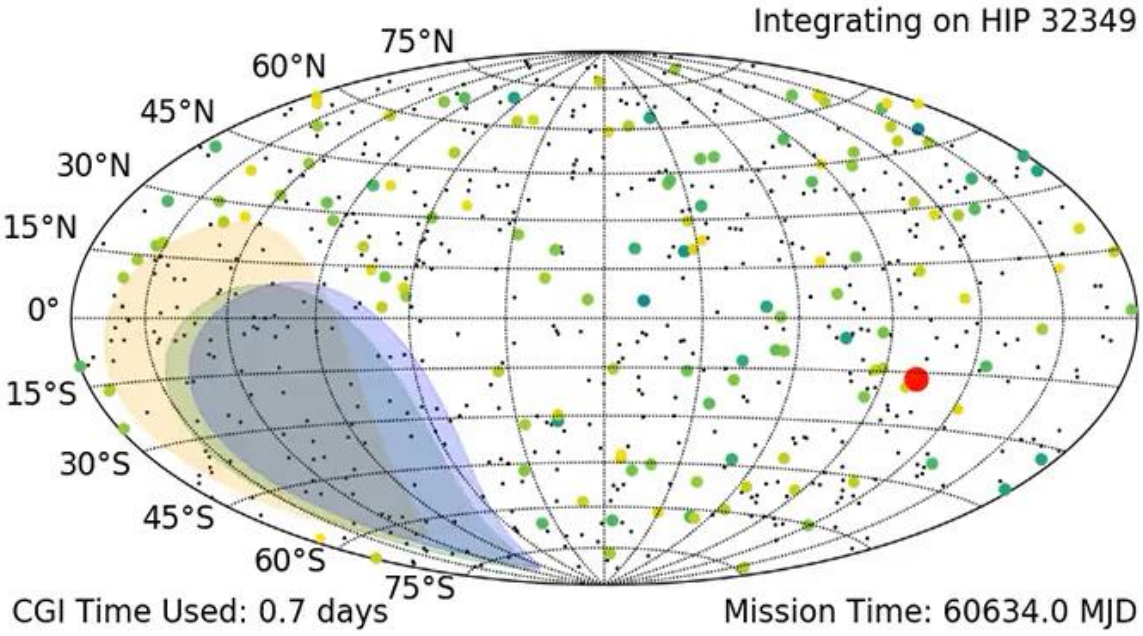
Large-aperture UV / Optical / NIR space observatory performing transformative astrophysics

EXOSIMS

https://github.com/dsavransky/EXOSIMS



EXOSIMS Products



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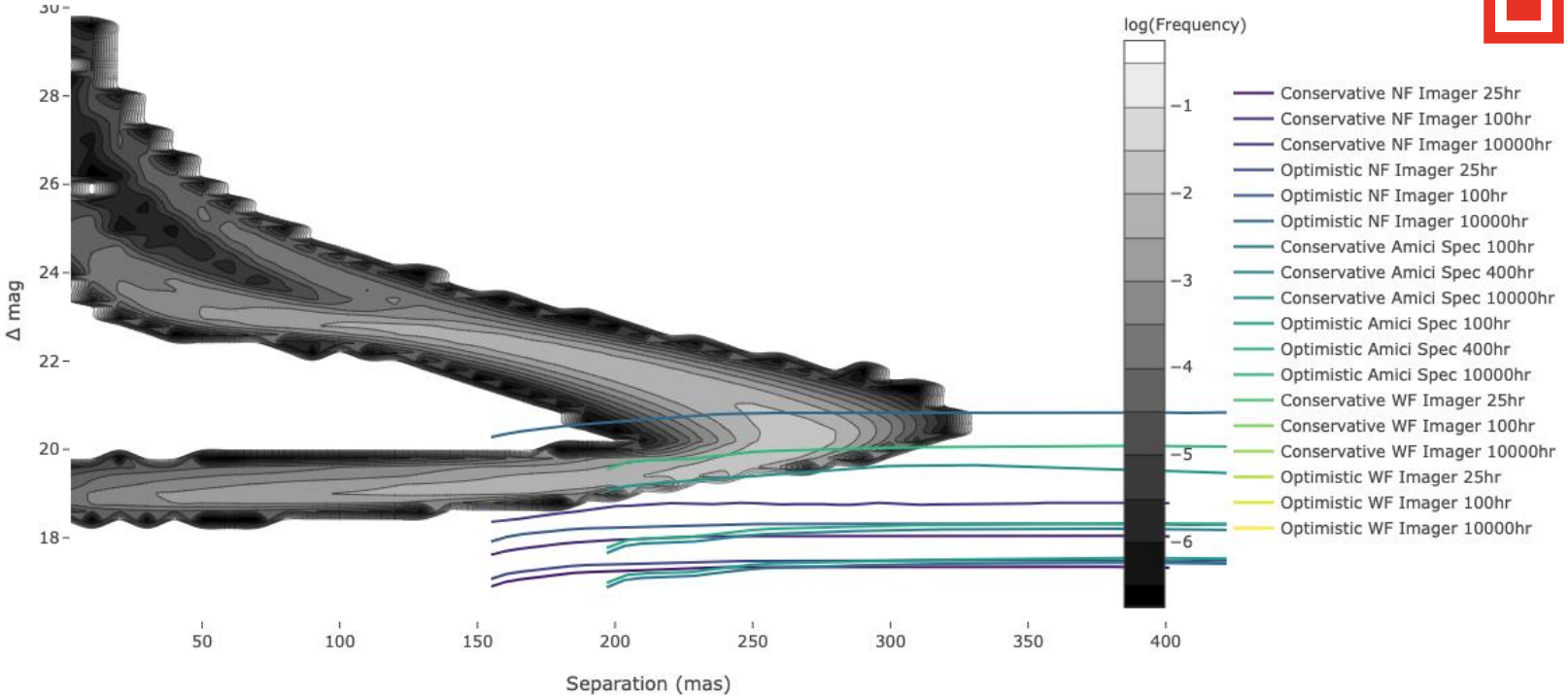
Imaging Mission Database

https://plandb.sioslab.com/



EXOSIMS & PlanDB Projects

- Automating database ingestions for new data
- Updating database frontend
- Writing unit tests
- Anything in the issue tracker

- Required skills:
  - Coding in Python, SQL, PHP, Javascript
  - Familiarity with git/github

What Happens Next

- Take a look at the resources provided and determine if there's a project you want to participate in
- Email ds264@cornell.edu by end of day **Friday 9/12**