Space Imaging and Optical Systems Laboratory

https://sioslab.com

Dmitry Savransky

ds264@cornell.edu

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https://sioslab.com/research/

What We Do

Instrumentation

- Instrument Support
- New instrumentation
- Automated operation
- Wavefront sensing and control

Logistics

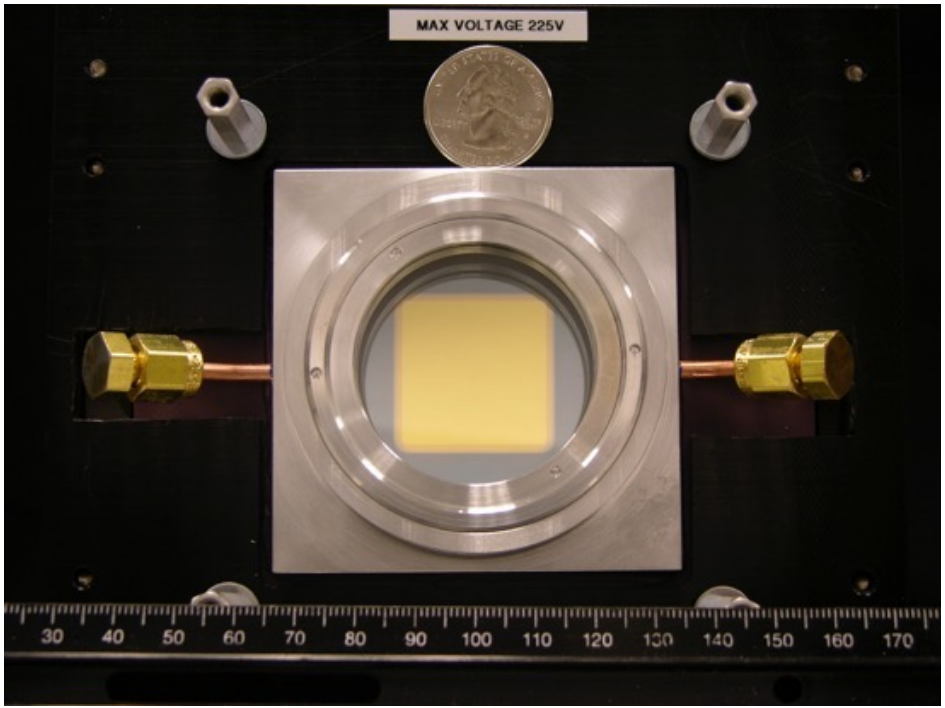
- Survey Planning
- Space Mission Design and Analysis
- Survey Analysis (inference)

Data Analysis

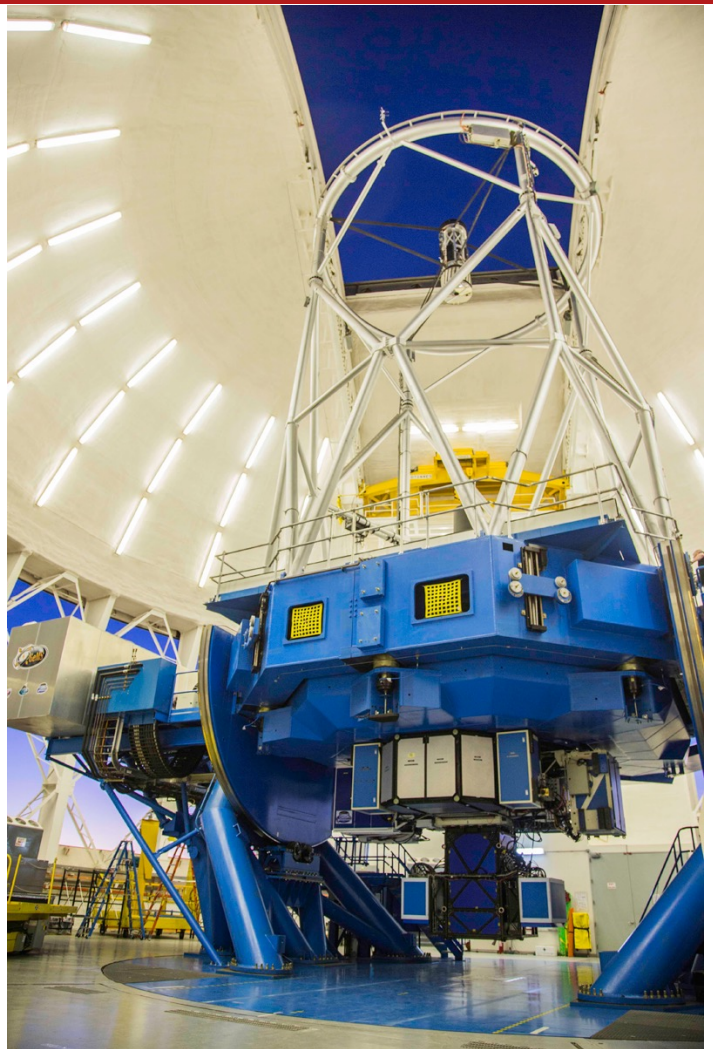
- Image Post-Processing
- Weak Signal Detection
- Blind Source Separation
- Dynamics Studies
- Data Stream Integration

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

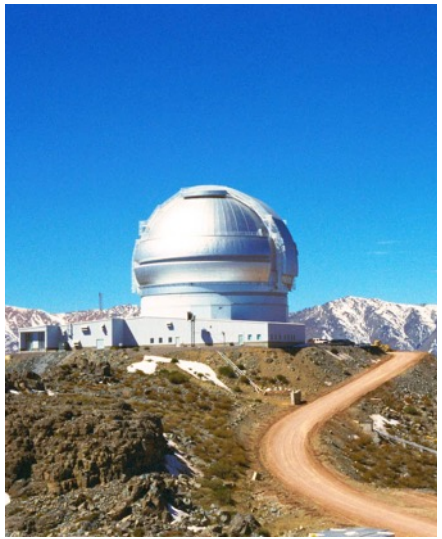
The Gemini Planet Imager



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

Faster & deeper sensitivity to planets

IFS

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

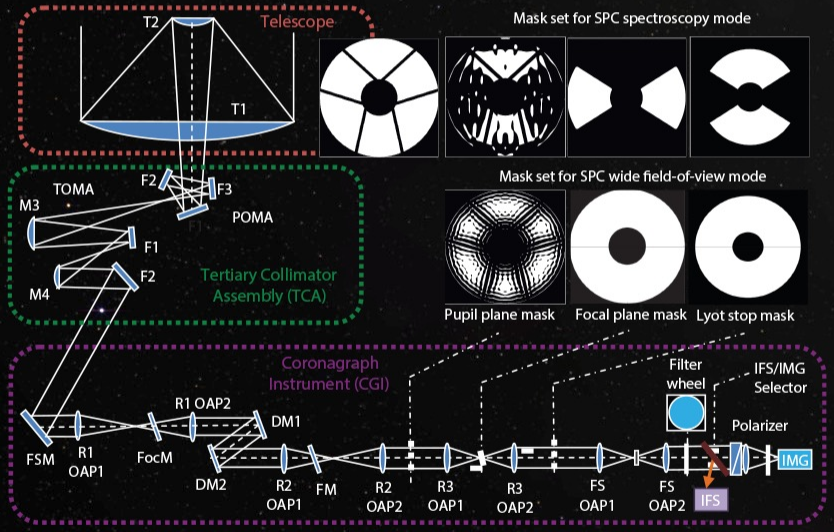
GPI data pipeline

GPI 2.0 Positions

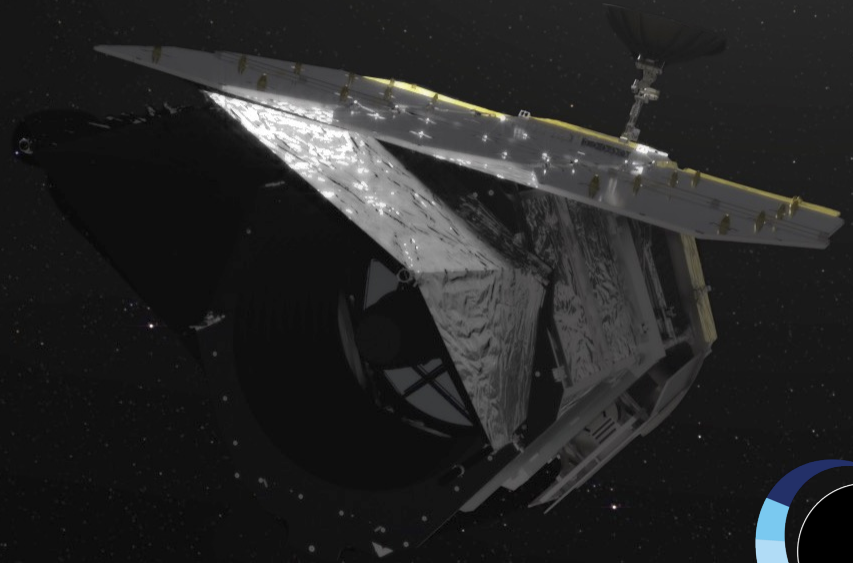
- GPI 2.0 Top-Level Software and alignment
- gpilib porting

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

The Nancy Grace Roman Space Telescope



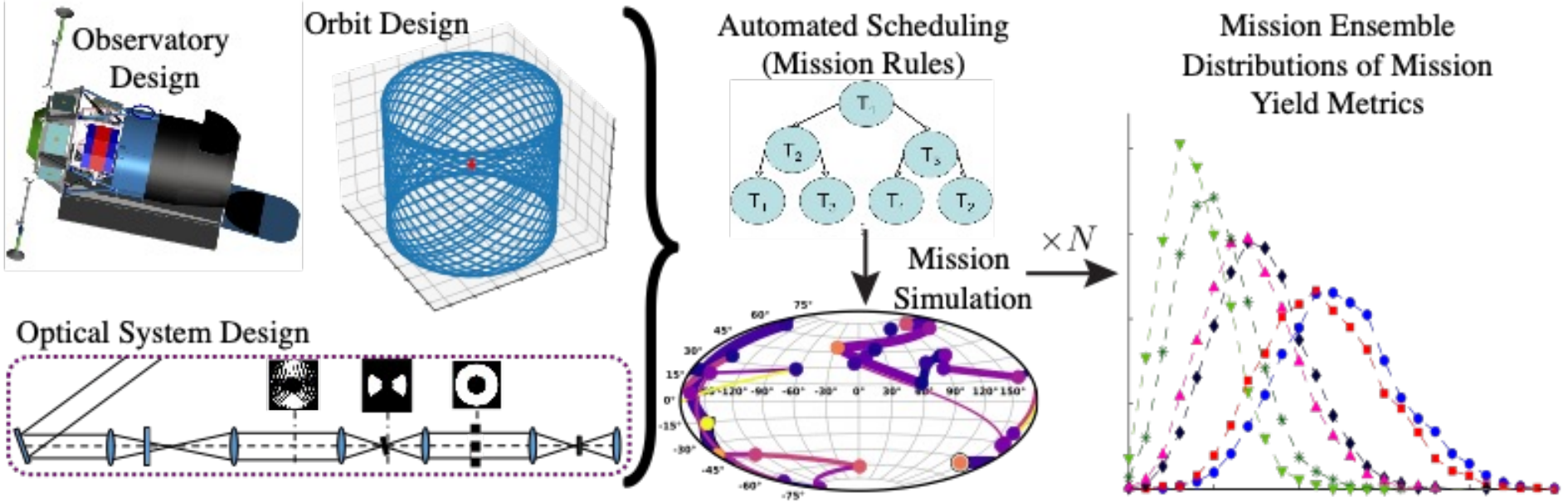
Roman Coronagraphic Instrument.
Adapted from Zhou et al. (2018)



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

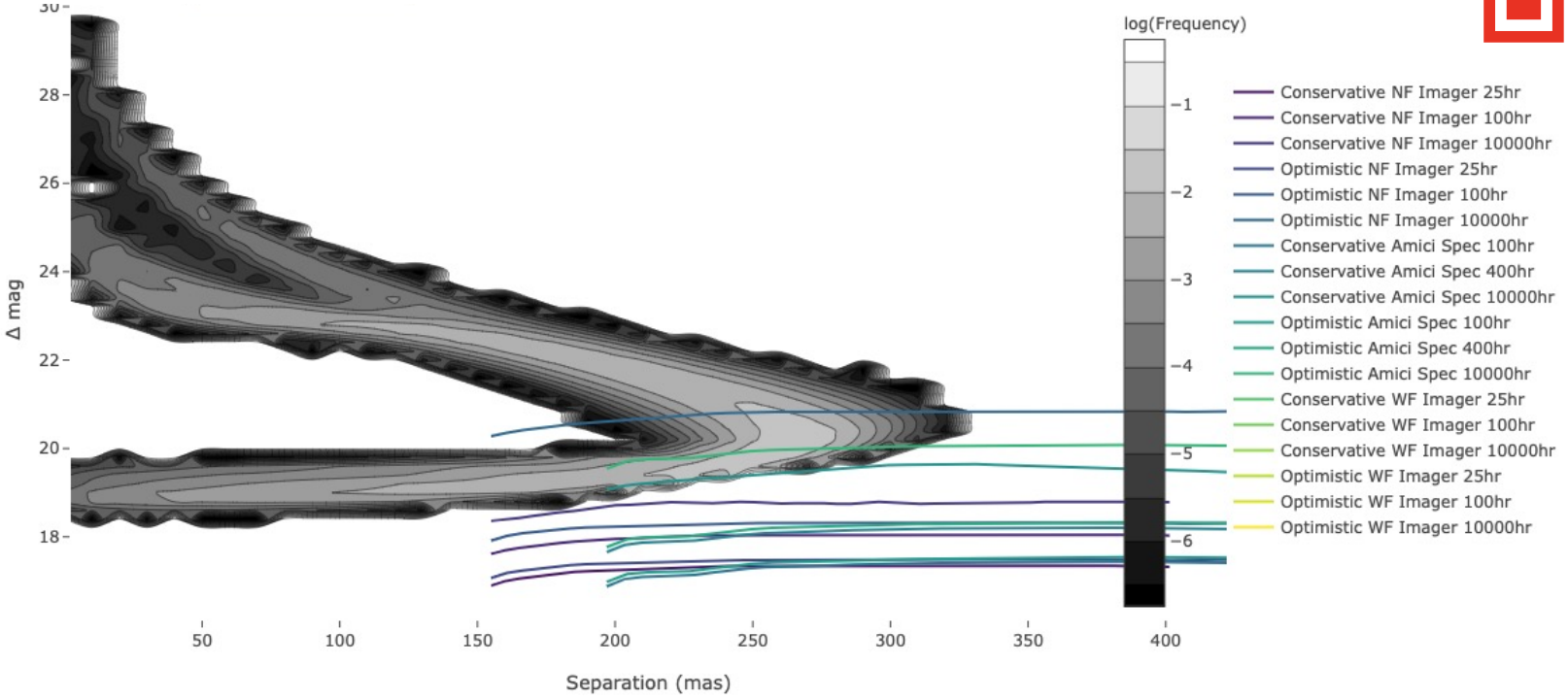
EXOSIMS

https://github.com/dsavransky/EXOSIMS



Imaging Mission Database

https://plandb.sioslab.com/

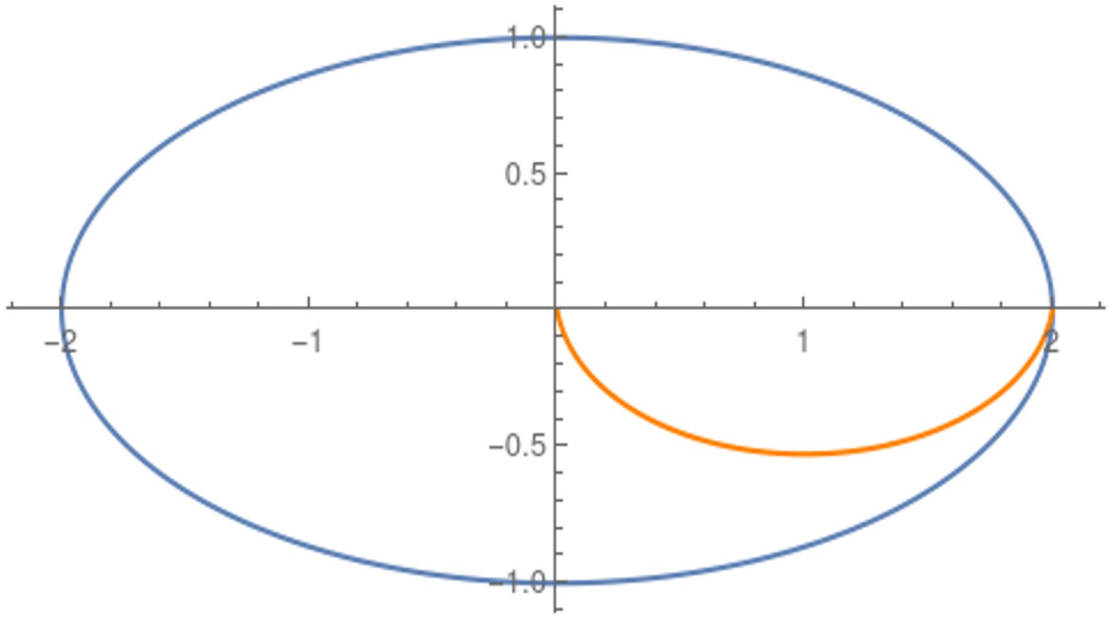


EXOSIMS & PlanDB Projects

- Automating database backend updates
- Updating database frontend
- Implementing planetary albedo spectra
- Writing unit tests
- Anything in the issue tracker

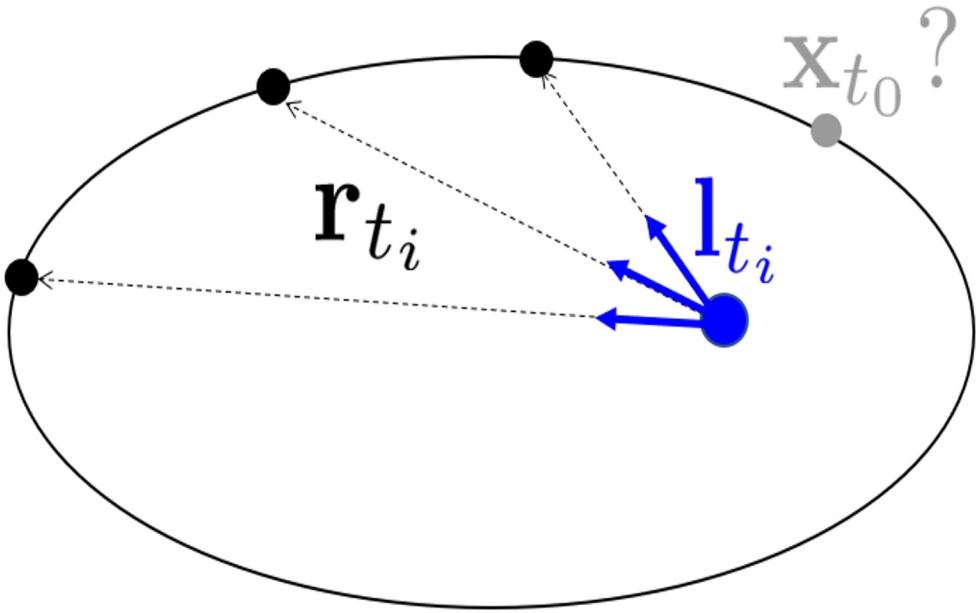
- Required skills:
  - Coding in Python, SQL, PHP, Javascript
  - Familiarity with git/github

Analytical Non-Convex Optimization of Satellite Formation Reconfiguration



Do you like linear algebra? Ever heard of a generalized eigenvalue problem?

Optical Tracking in Proximity with Linear Measurements



Do you have a background in statistics? Know what an extended Kalman filter is?

Espresso!

- Design and implement a closed-loop feedback controller for an optimal shot
- Minimally PID, but your choice
- Drink Coffee!

- Pre/coreq: MAE 4780/5780 or equivalent
- Prefer a team of at least 3

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 9/1