National Aeronautics and Space Administration

FY24 Strategic Initiatives Research and Technology Development (SRTD)

A Pasadena working group to prepare for science with Roman Coronagraph and beyond

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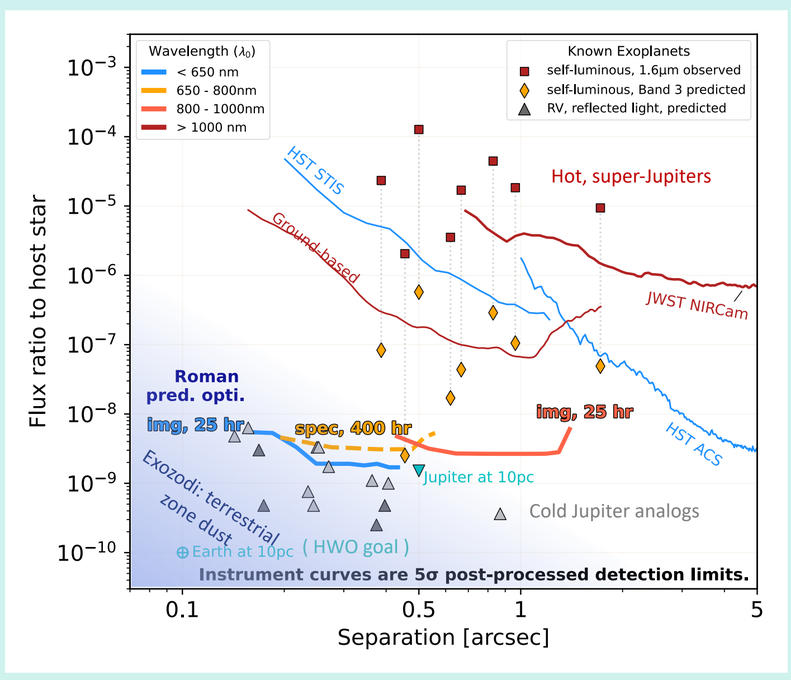
Strategic Focus Area: Starlight Suppression | **Strategic Initiative Leader:** David W Miller

Background

Astro2020 prioritized the Habitable Worlds Observatory (HWO) concept, which would search for biosignatures on nearby earth-like planet by directly imaging them. The Nancy Grace Roman Space Telescope Coronagraph Instrument, built at JPL and launching in 2026-7, matures multiple technologies in preparation for HWO.
Although Roman Coronagraph is a “technology demonstrator,” it still has exciting scientific potential.



Flux ratios and projected separations of giant exoplanets & circumstellar dust disks with respect to their host stars, compared to detection limits of current facilities, Roman Coronagraph predictions, and HWO goal

Corgisims

(lead: Llop-Sayson)

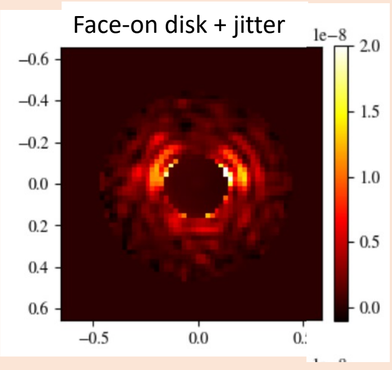
- Open-source more user-friendly wrapper to Roman Coronagraph image simulation tools [1,2]
- Inject your favorite astrophysical scene, adjust telescope jitter control, extract polarization information, …
- https://github.com/jorgellop/corosims

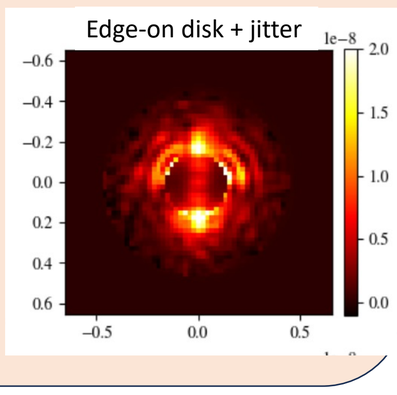
[1] https://github.com/roman-corgi/emccd_detect
[2] https://sourceforge.net/projects/cgisim/

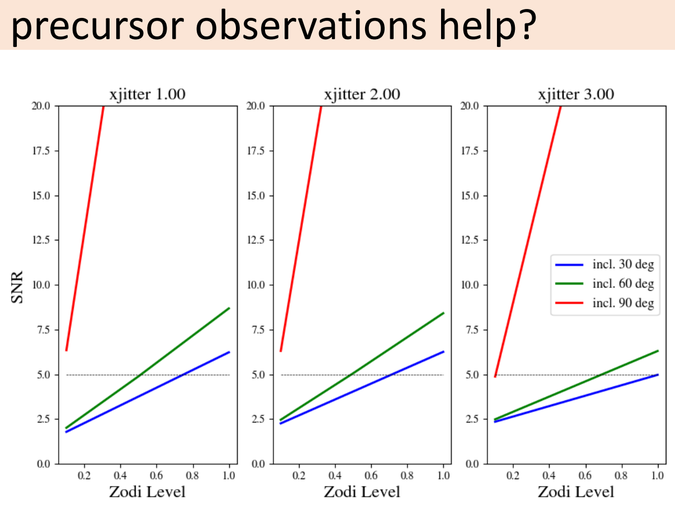
Question : Did I just detect an exozodi (terrestrial zone dust disk) or telescope jitter?

(leads: Llop-Sayson, Bryden)

- Telescope jitter causes light “leaks” around the coronagraph mask that can mimic circumstellar disks.
- Jitter control is worse for fainter stars
- How does jitter variability degrade our sensitivity to disks?
- Next: Can we mitigate? Can JWST precursor observations help?

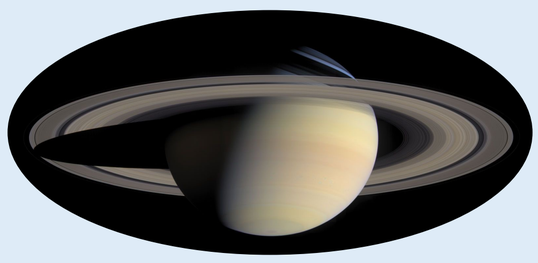




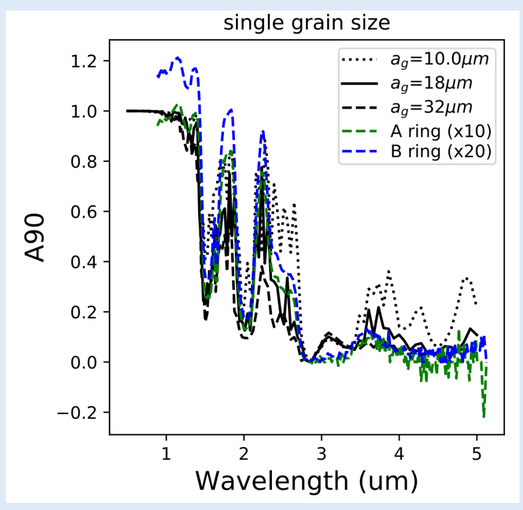


Question: Are giant exoplanet rings detectable in reflected light?

(leads: Hasler, Greenbaum, Bryden)



- Cold gas giant planets top out at ~1 $R_{jupiter}$
- Ring systems add reflecting area
- Planet albedo & ring size can be degenerate
- Can color or phase curves break the degeneracy?
- Exoplanet ring system model loosely based on Saturn’s



Question : What compelling use cases exist beyond exoplanetary system science?

(lead: Gorjian)

- Gas infalling into Active Galactic Nuclei (AGN) is obscured by the glare from the AGN
- Limitations of current facilities:
  - HST STIS is white light coronagraphy
  - AGN are faint by high-contrast imaging standards
    - Ground-based NIR instruments with adaptive optics can only image AGN with nearby guide stars
- 12 nearby “bright” AGN where Roman Coronagraph would have spatial resolution ≤6pc
  - Next: simulate AGN imaging with degraded jitter

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