Following the αCen Ab candidate Using the Roman Coronagraph Instrument

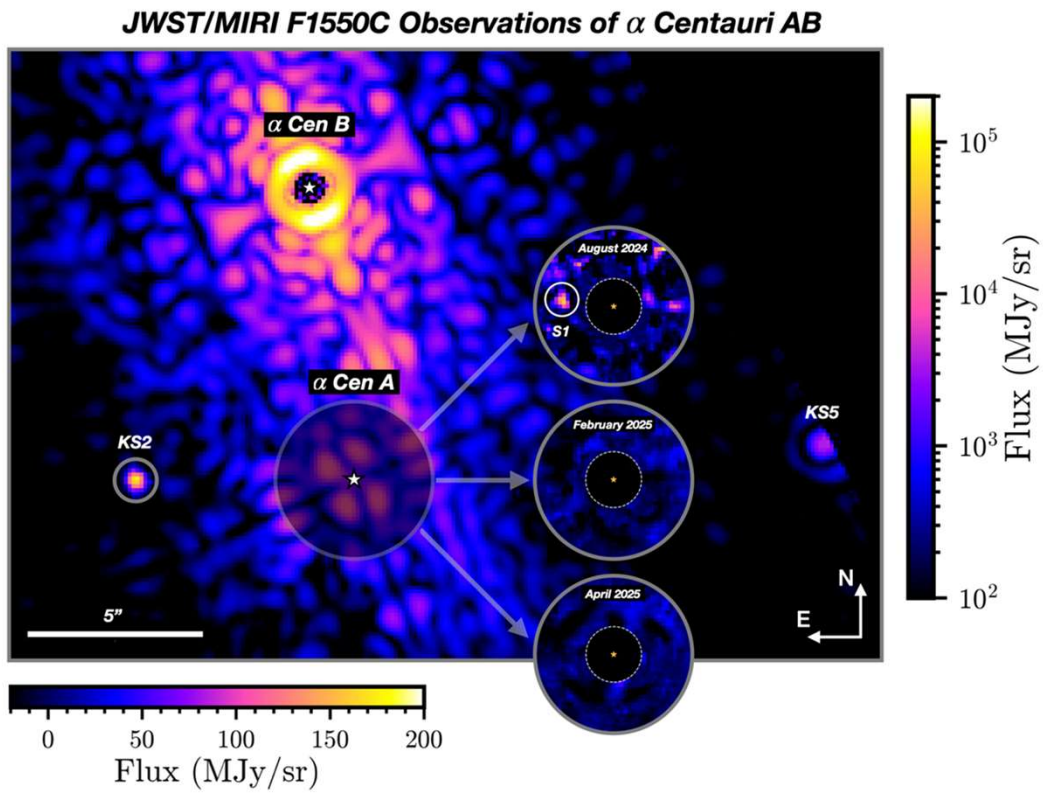
Eduardo Bendek[1,2], Ruslan Belikov[2], Dan Sirbu[2], Aniket Sanghi[3], Jack Lissauer[2], Chas Beichman[3], Billy Quarles[4], Pierre Kervella[5], Dimitri Mawet[3], Laurent Pueyo[6], Kevin Wagner[7], Renyu Hu[8], Hanying Zhou[8], David Marx[8]

1: SETI Institute
2: NASA Ames Research Center
3: California Institute of Technology / IPAC
4: East Texas A&M University
5: Observatorie de Paris
6: Space Telescope Science Institute
7: University of Arizona
8: Jet Propulsion Laboratory, California Institute of Technology

AAS 247, Phoenix January 2026

The science case

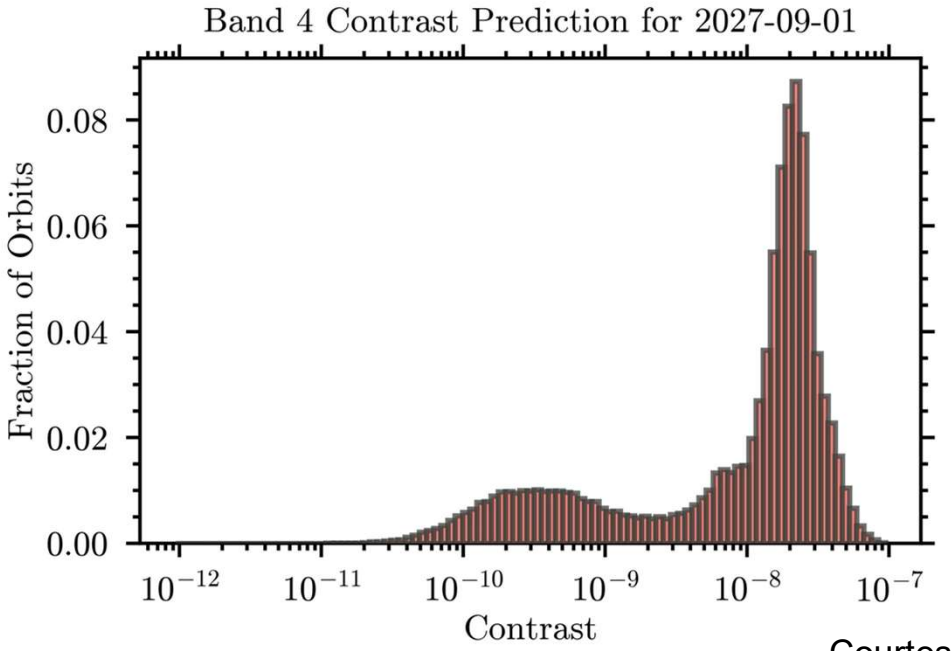
- JWST+MIRI found candidate S1: Saturn-mass gas giant at 1.1AU of αCen A (Beichman et al. 2025, Sanghi et al. 2025).
- VLT+NEAR found candidate C1 (Wagner et al. 2021).
- Uncertainty about the orbit and radius of the planet.
- Orbits fits assume S1&C1 are same object.

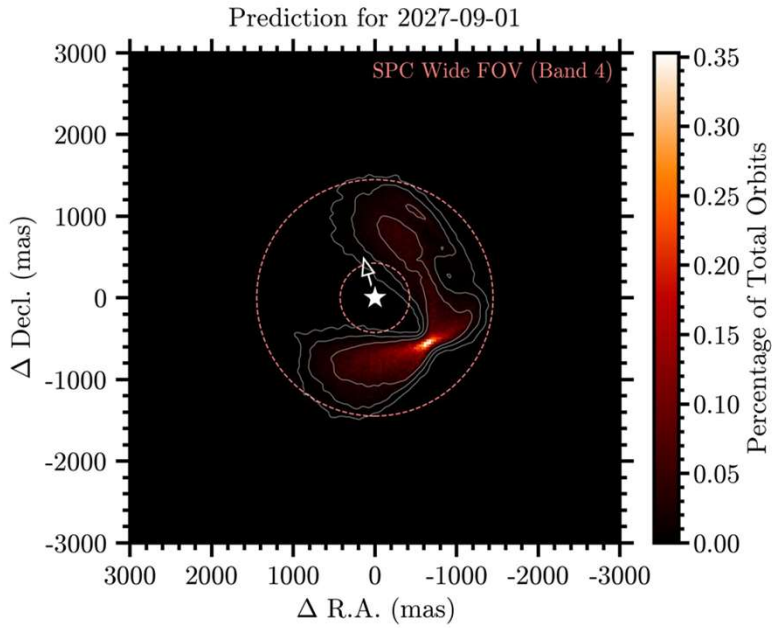


Beichman et al. 2025
Sanghi et al. 2025

Expected contrast in Band 4 (825 nm)

- Peak contrast w/r to aCen A of $2x10^{-8}$.
- Equivalent to an apparent magnitude of m_v=19.2 @ ~0.7” from the star.



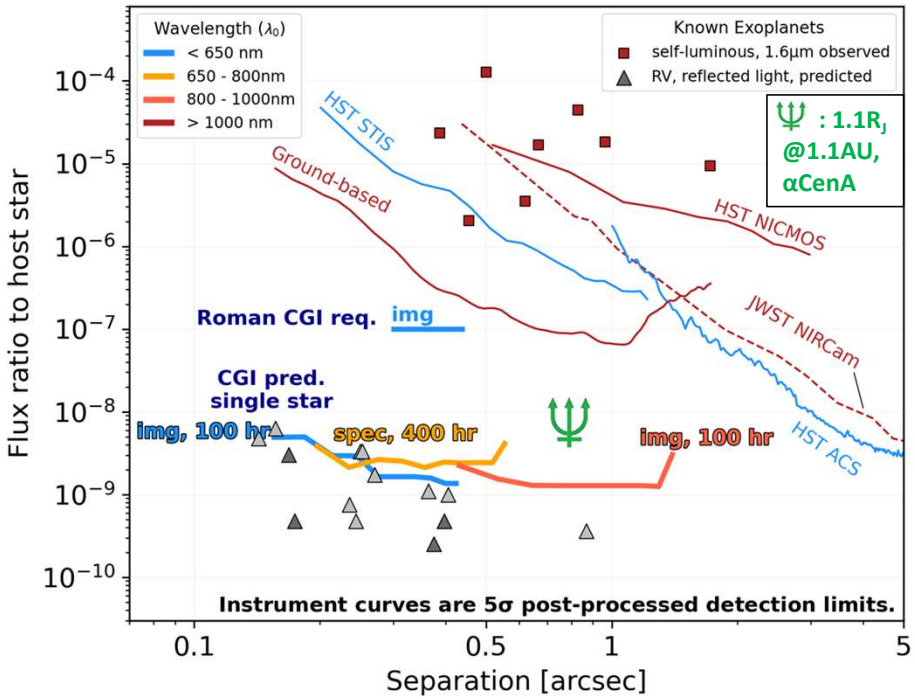


Courtesy Aniket Sanghi

The Roman CGI expected performance

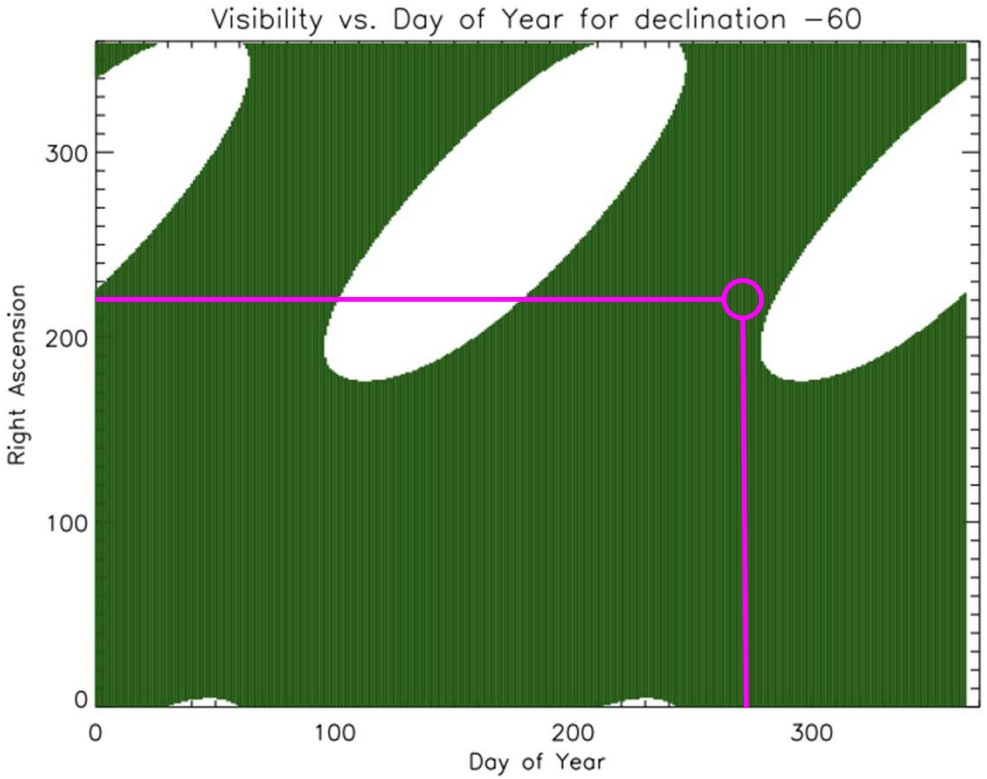
- Peak contrast w/r to aCen A of $2x10^{-8}$ @ ~0.7” from the star, well within CGI expected performance in Band 4.

CGI during integration with the Roman Space Telescope. Credit: NASA/Sydney Rohde



Target Visibility

- aCen A: coords: RA: 14h 39m 37s, Dec: -60° 50’ 2”.
- Two windows per year.
- September is at the end of the second observing Window.
- Telescope roll constraints to be considered.
- Plan to use αCen A as reference star to dig and touch up dark hole and later observe it as target.

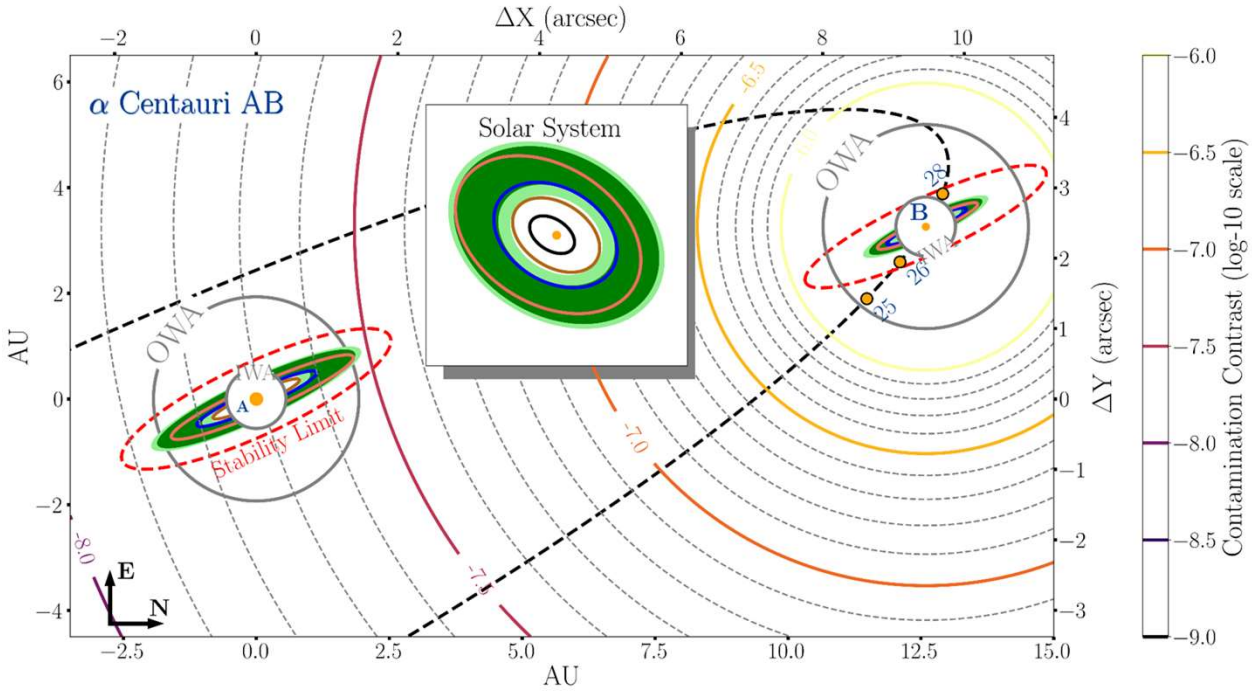


Acquisition and Exposure time

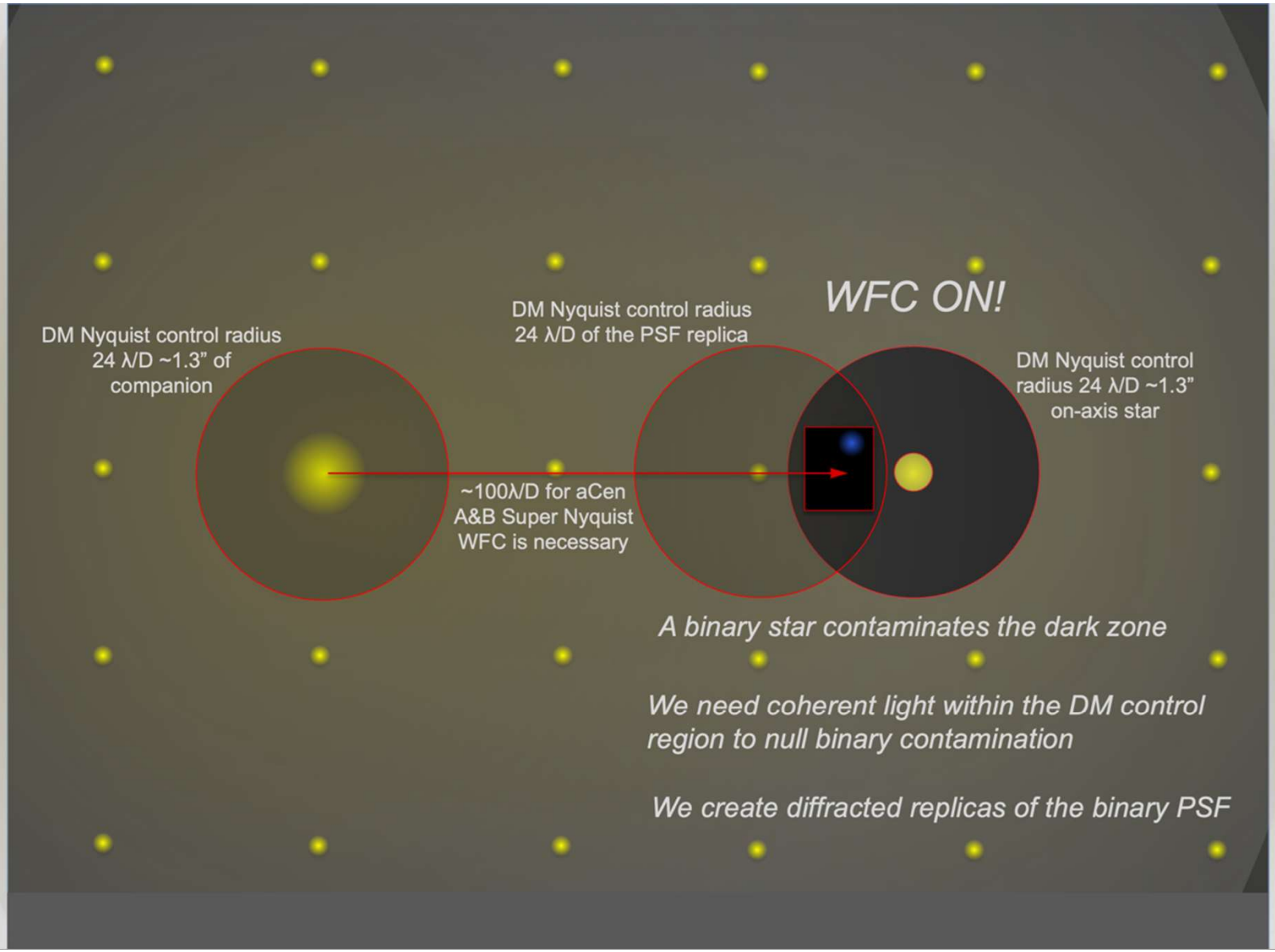
- We anticipate standard slew and acquisition time.
- Proximity to αCen B (~10”) might pose a challenge for acquisition.
- A best solution will be applied to the deformable mirror followed by eight dark hole “touch-up” iterations.
- Corgietc exposure time for optimistic SPC WFOV in Band 4.
- Planet located at 10 λ/D (0.7”) from αCen A with m_v = 19.2.
- Resulting in integration times of 455 s per observation to reach SNR=5.
- **Companion (αCen B) leakage** could increase exposure time as it will create more speckles increasing the noise.

Companion leakage

- αCenB will be ~ 10” away.
- Leakage estimates: 2.5×10^{-8} to 1.6×10^{-8}.
- Far side is better for observing.
- Target estimate is 2.0×10^{-8} => MSWC likely will be needed to dig a dark zone.



Courtesy Billy Quarles


WFC ON!
DM Nyquist control radius
24 λ/D ~1.3" of
companion
DM Nyquist control radius
24 λ/D of the PSF replica
DM Nyquist control
radius 24 λ/D ~1.3"
on-axis star
~100λ/D for aCen
A&B Super Nyquist
WFC is necessary
A binary star contaminates the dark zone
We need coherent light within the DM control region to null binary contamination
We create diffracted replicas of the binary PSF

Other background objects: Star S5

- Candidate peak contrast of $2x10^{-8,}$ equivalent to an apparent magnitude of m_V=19.2
- Background star S5 would be ~ m_V=18.4 in Band 4 (825 nm).
- S5 will be **outside** coronagraph OWA for an observation during 09/2027.
- Complicate observations between 03/2028 and 07/2028.

		STAR S5		
Bessel V	0.54	21.53 ± 0.95	0.9 ± 0.9	K07
Bessel R	0.64	20.00 ± 0.41	2.2 ± 1.0	K07
Bessel I	0.79	18.66 ± 0.27	3.9 ± 1.1	K07
Bessel Z	0.84	18.00 ± 0.22	6.9 ± 1.6	K07
2MASS J	1.25	11.60 ± 0.03	717 ± 20	K07

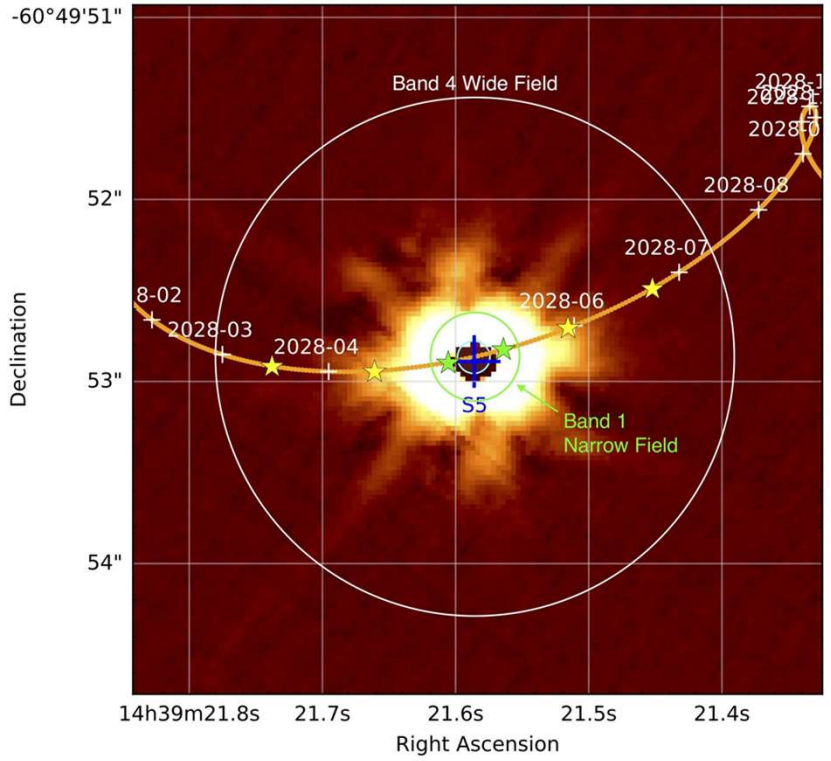


Figure provided by Pierre Kervella

Conclusion and other considerations

- Observing αCen A with Roman CGI will be challenging but extremely interesting scientifically as it will provide image in reflected visible light of the αCen A candidate.
- Timing of the observation is critical for success.
- Novel wavefront control techniques such as Multi-Star Wavefront Control might be needed to suppress companion speckles.