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Coronagraphic JWST/NIRCam Images of a Young Planet-Hosting Debris Disk System

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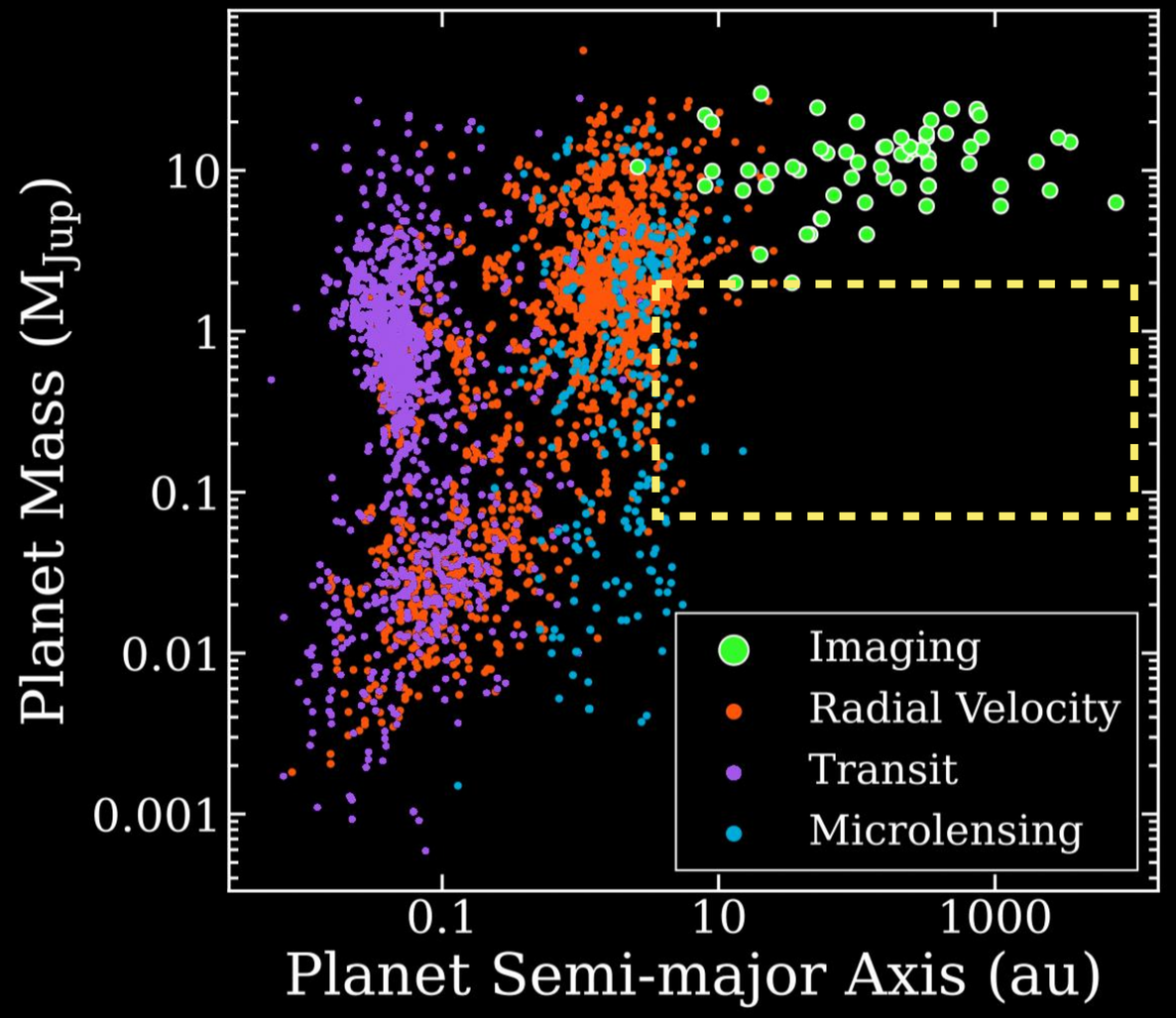
On behalf of the GTO 1184 Team

Direct Imaging of Exoplanet Systems with JWST

- Imaging exoplanets is difficult because of much brighter diffracted starlight
- JWST helps by providing:
    - a stable space-based platform
    - observations at infrared wavelengths

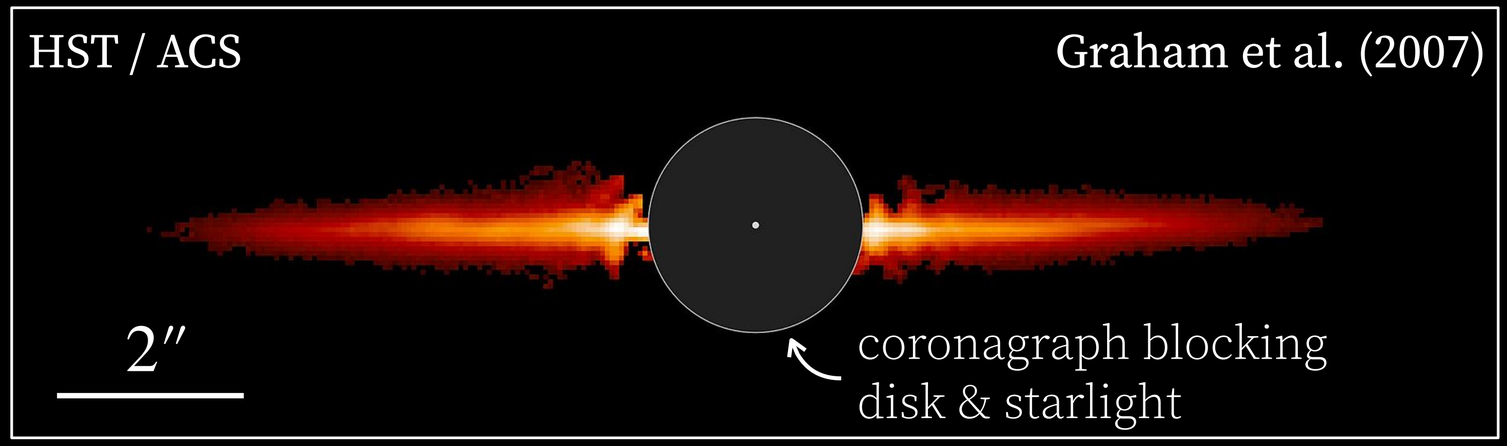
JWST GTO Program 1184

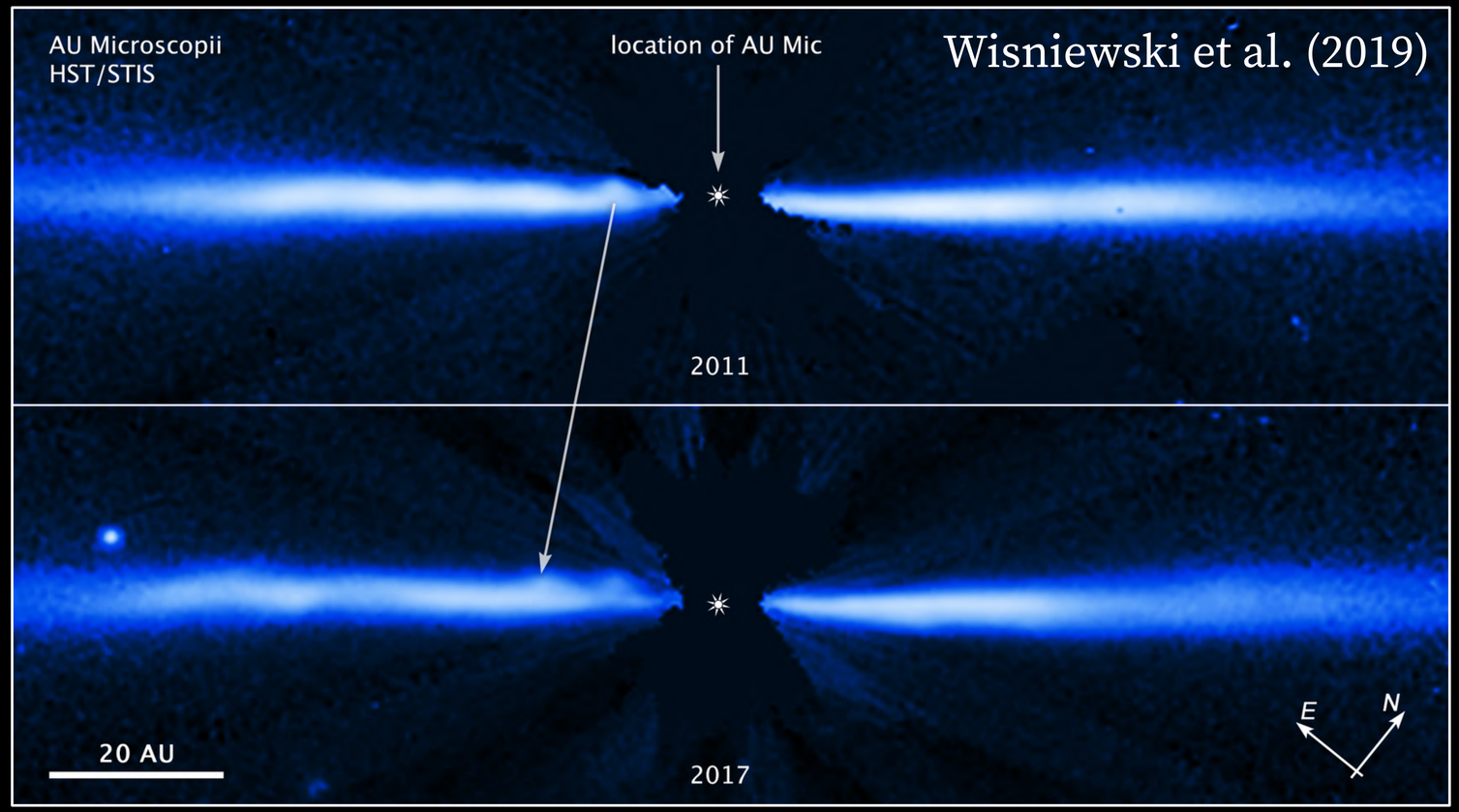
- Uses JWST's NIRCam to search for planets
- Targets 9 red dwarf stars
  → fainter stars → planets easier to detect
- Sensitive to sub-Saturn mass exoplanets on wide orbits



The AU Mic System

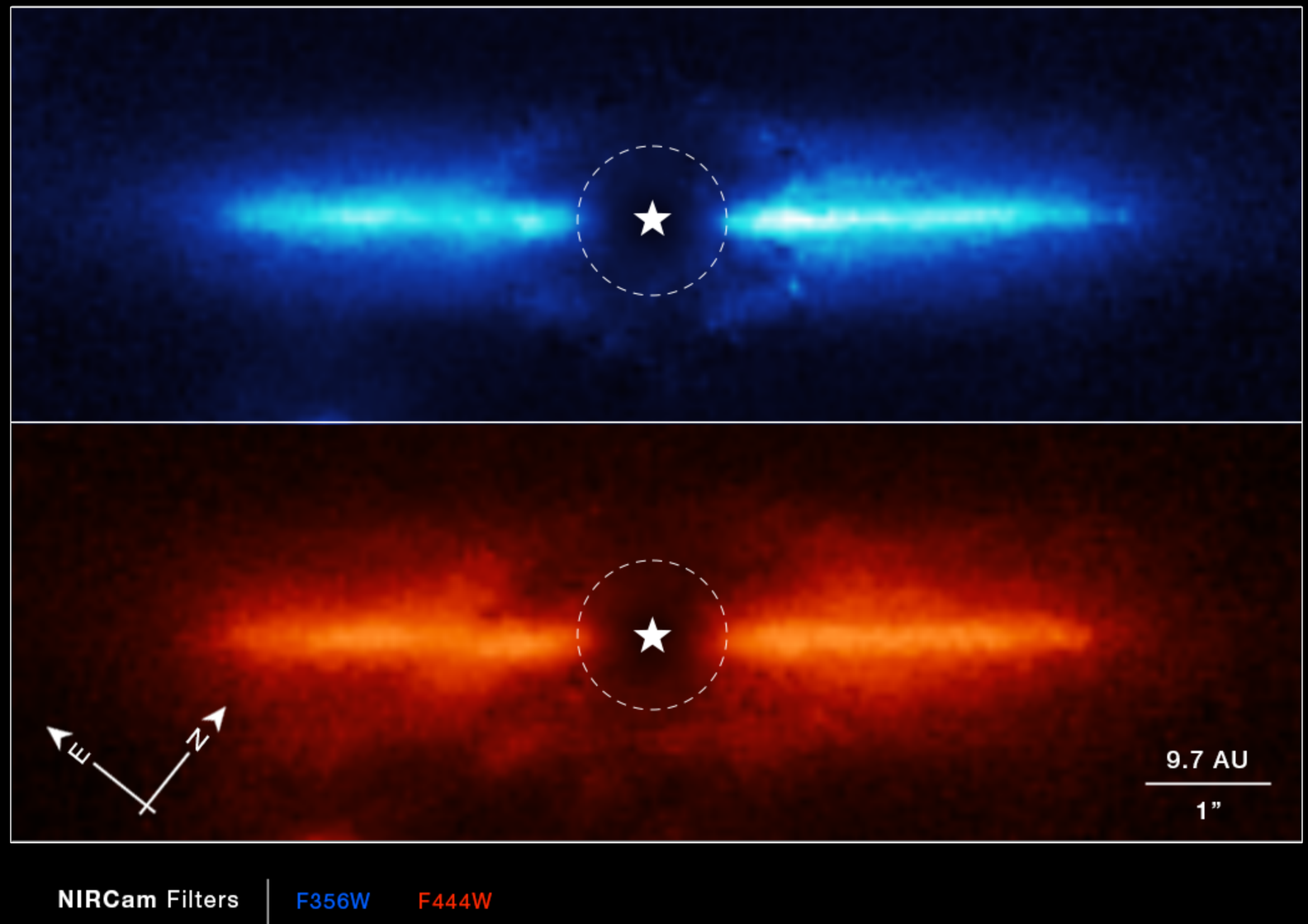
- 23 million year old red dwarf star
- 32 light years away
- Nearly “edge-on” debris disk
- Numerous fast-moving “clumps” in the disk
- Two small sep. planets detected via transit





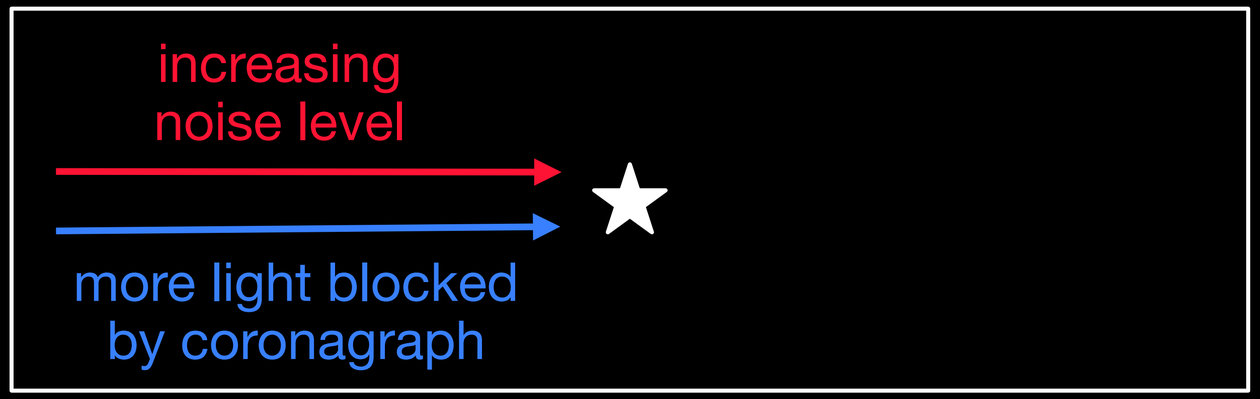
AU Mic: As Seen by JWST

- Targeted AU Mic as part of GTO 1184
- Observed at two near-infrared wavelengths (3.5 & 4.4 microns)
- Detect the disk with high significance
- First detection of the disk at these wavelengths
- Reveals significant “blue” disk color

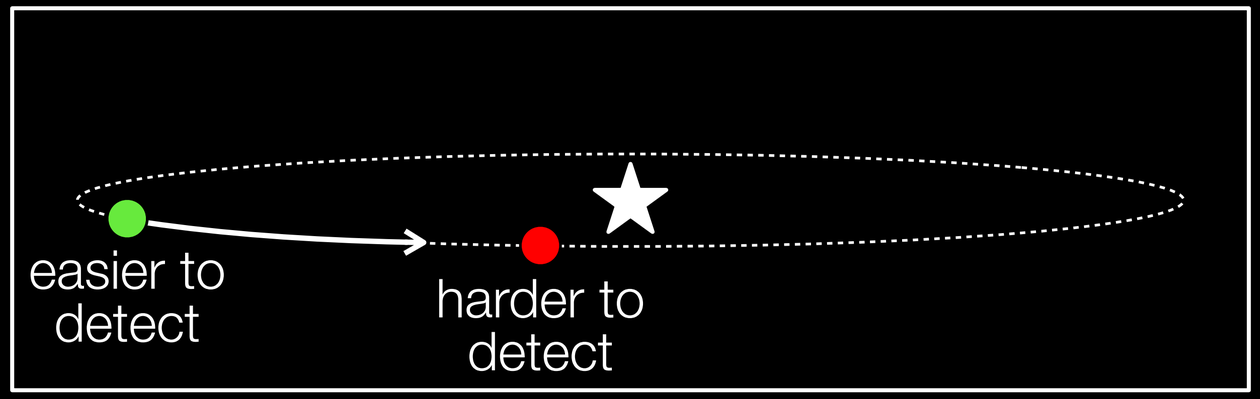


AU Mic: The Search for Planets

- No planets detected
- Measure sensitivity to determine planets we would have seen
- Planets' orbits should be aligned with the disk
- In infrared: more mass = more heat = brighter
- **Compute chance of detection vs orbital radius & planet mass**



A planet is harder to detect closer to the star



A planet on an inclined orbit is harder to detect at some parts of its orbit

AU Mic: The Search for Planets

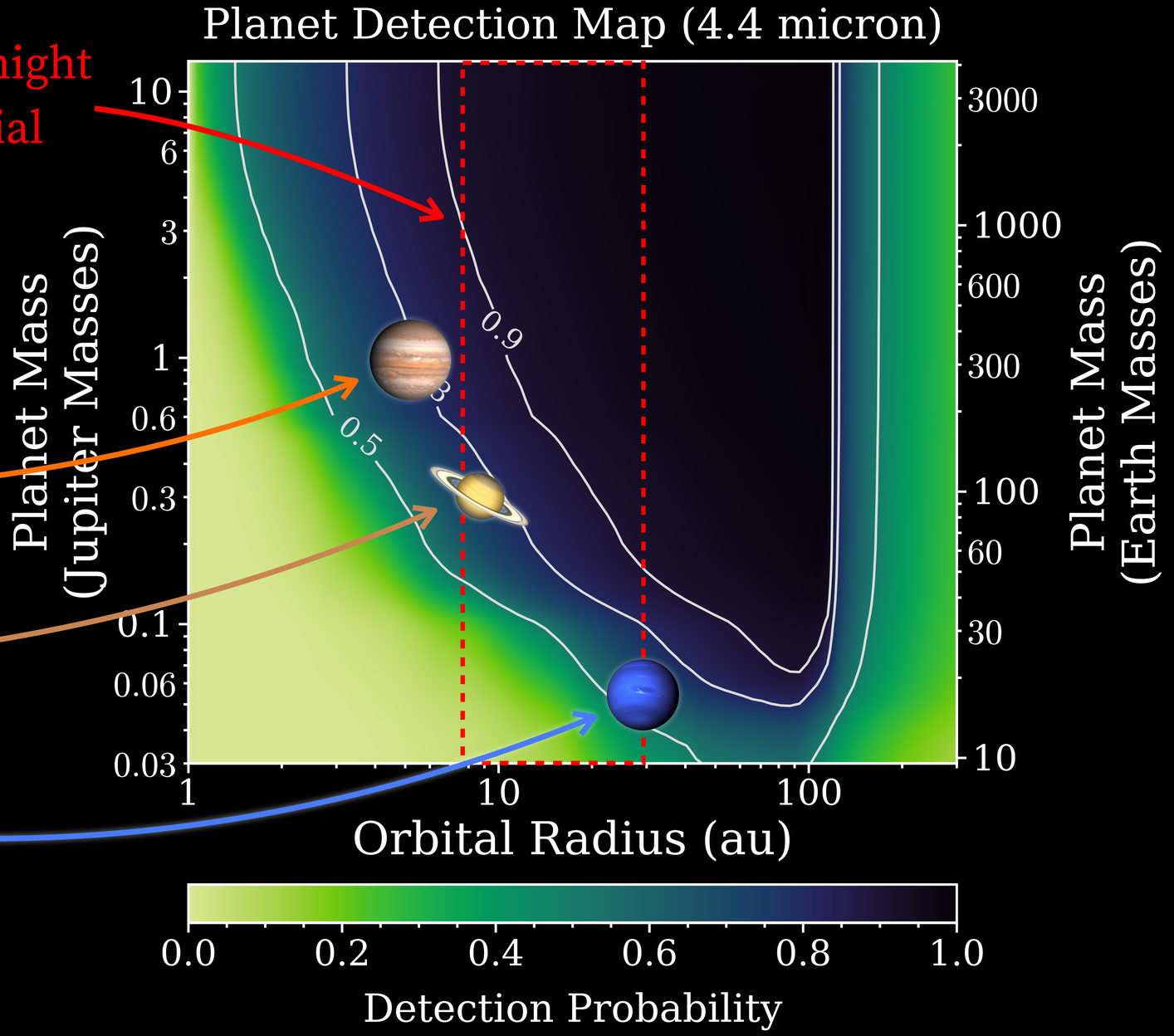
Helps to better understand what might be ejecting the clumps of material

Sensitive to solar-system-mass planets… *at solar-system scales*!

$P(a_{Jup}, M_{Jup}) \approx 80\%$

$P(a_{Sat}, M_{Sat}) \approx 75\%$

$P(a_{Nep}, M_{Nep}) \approx 60\%$



Summary & Conclusions

1) JWST's NIRCam easily recovers the first 3–4 *μm* images of AU Mic's disk

2) Blue disk color at 3–4 *μm*

3) Data are sensitive to solar-system-analog planets

JWST's sensitivity & wavelength coverage allow us to explore previously uncharted territory for direct imaging of wide separation planets and faint circumstellar disks.

Thank you!

GTO 1184 Team

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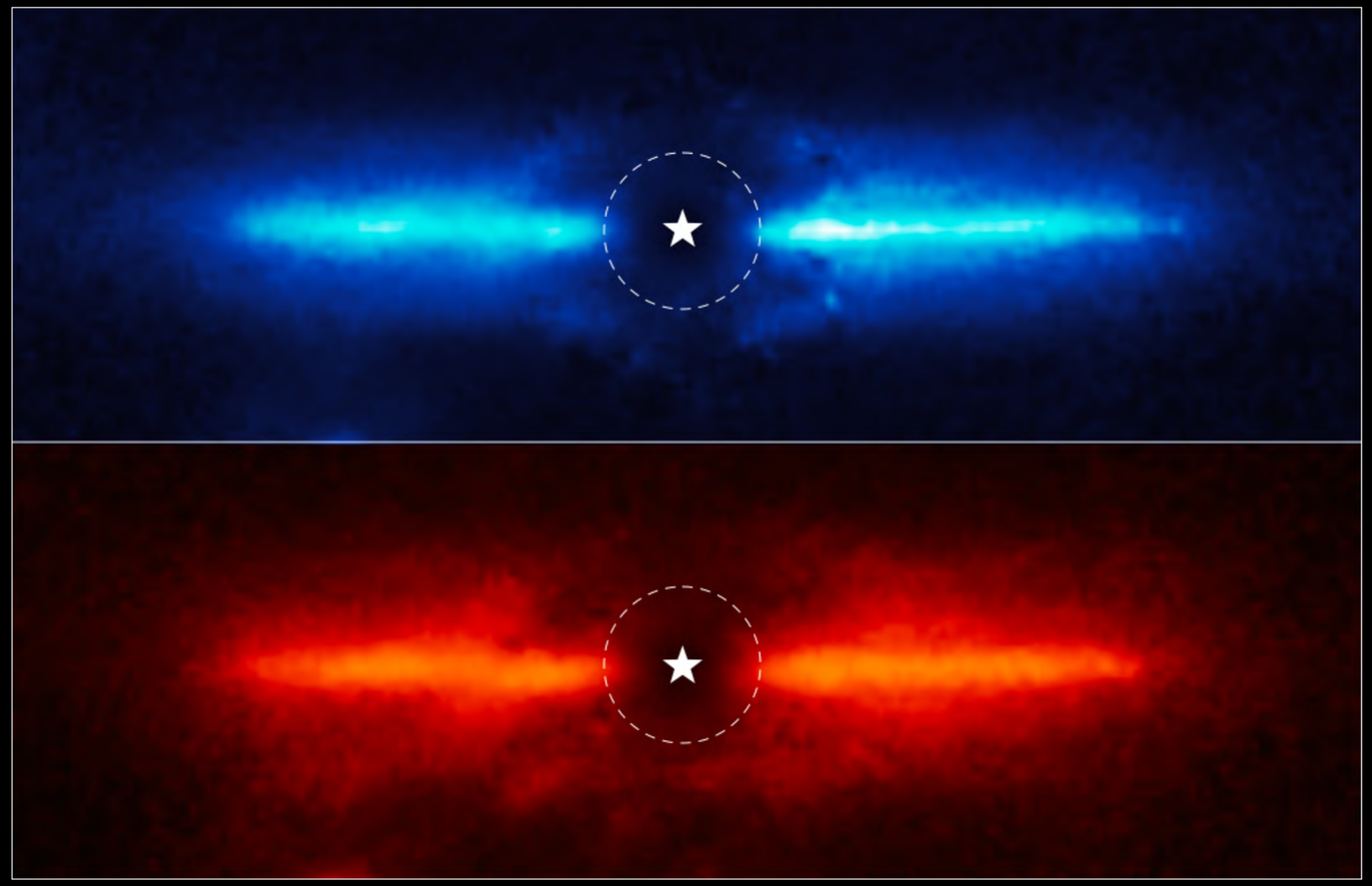

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