

# JWST's Unexpected New View of the Beta Pictoris Debris Disk



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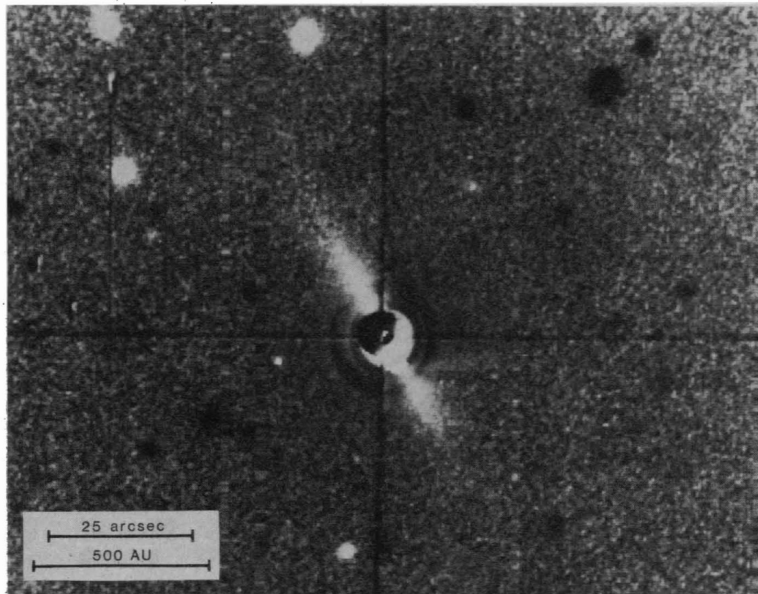
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*Paper will appear on arXiv on 1/10/24*

Image credit: NASA/JPL-Caltech

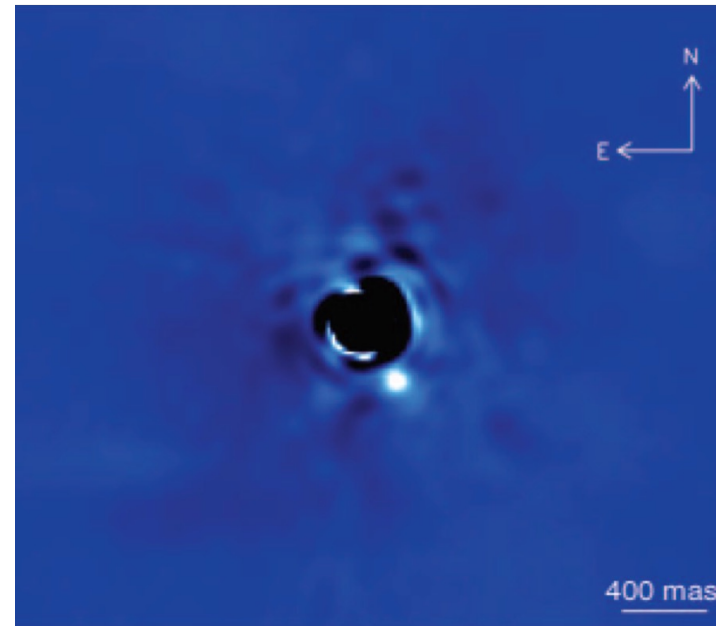
# Beta Pic is a nearby star that hosts a rich planetary system

## Beta Pic is well-studied



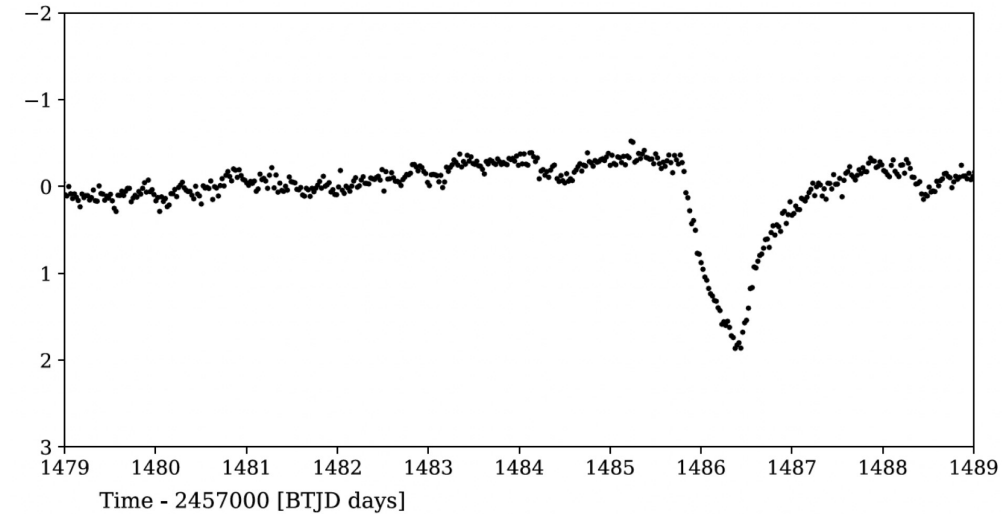
Smith & Terrile (1984)

## Beta Pic has exoplanets



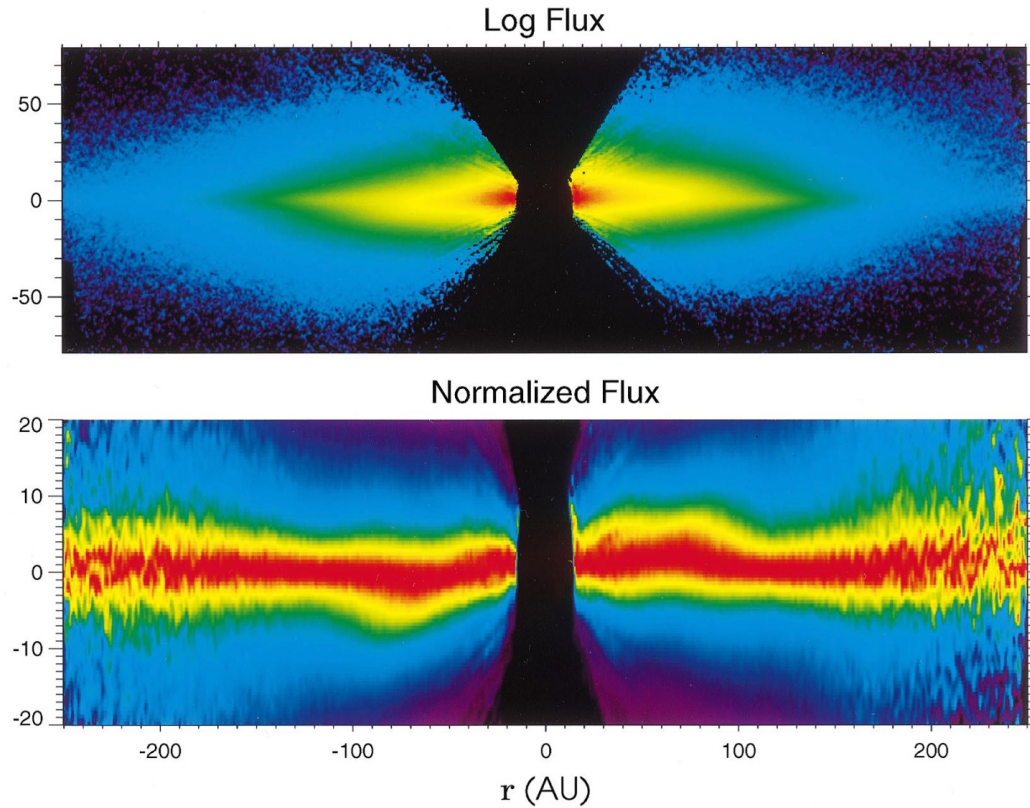
Lagrange (2008)

## Beta Pic has exocomets



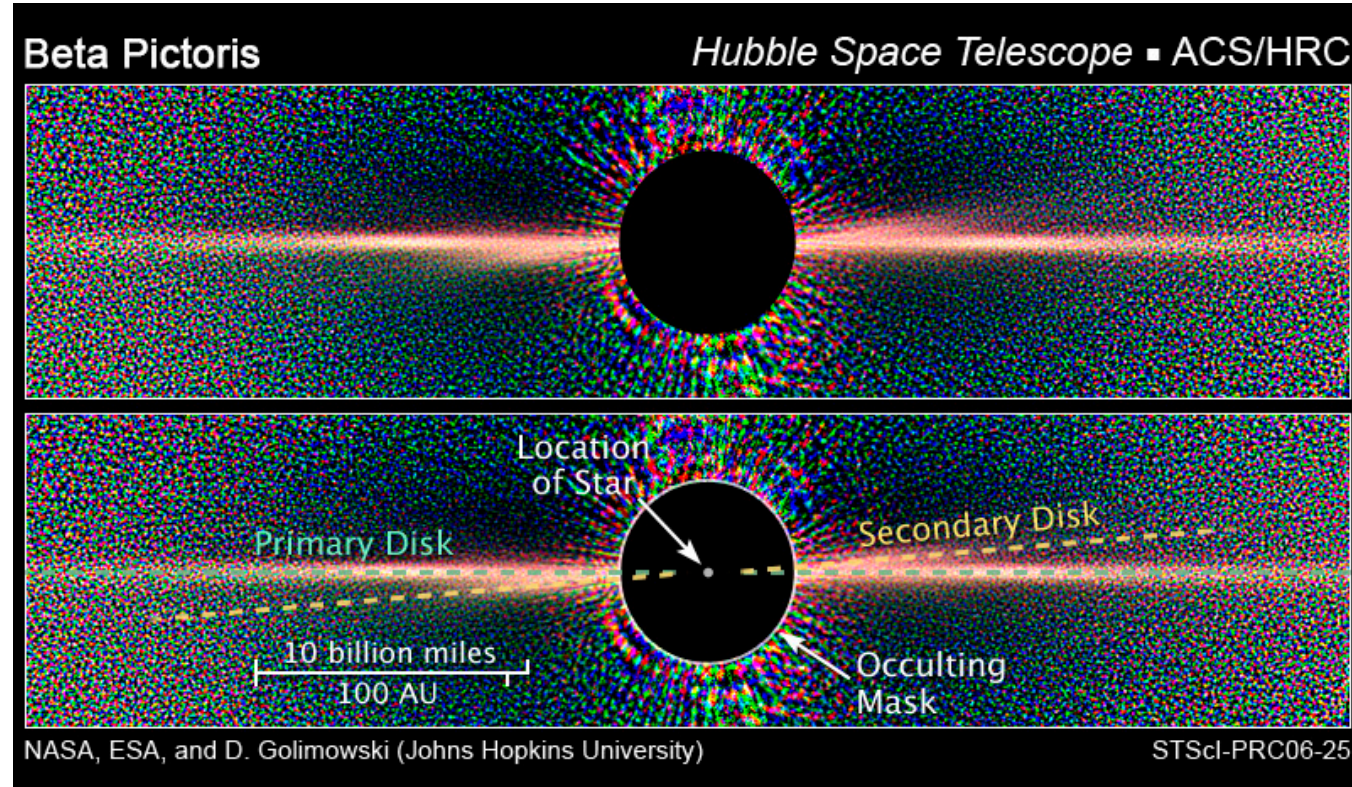
Zieba (2019)

# Beta Pic hosts an edge-on debris disk



HST STIS

Heap (2000)

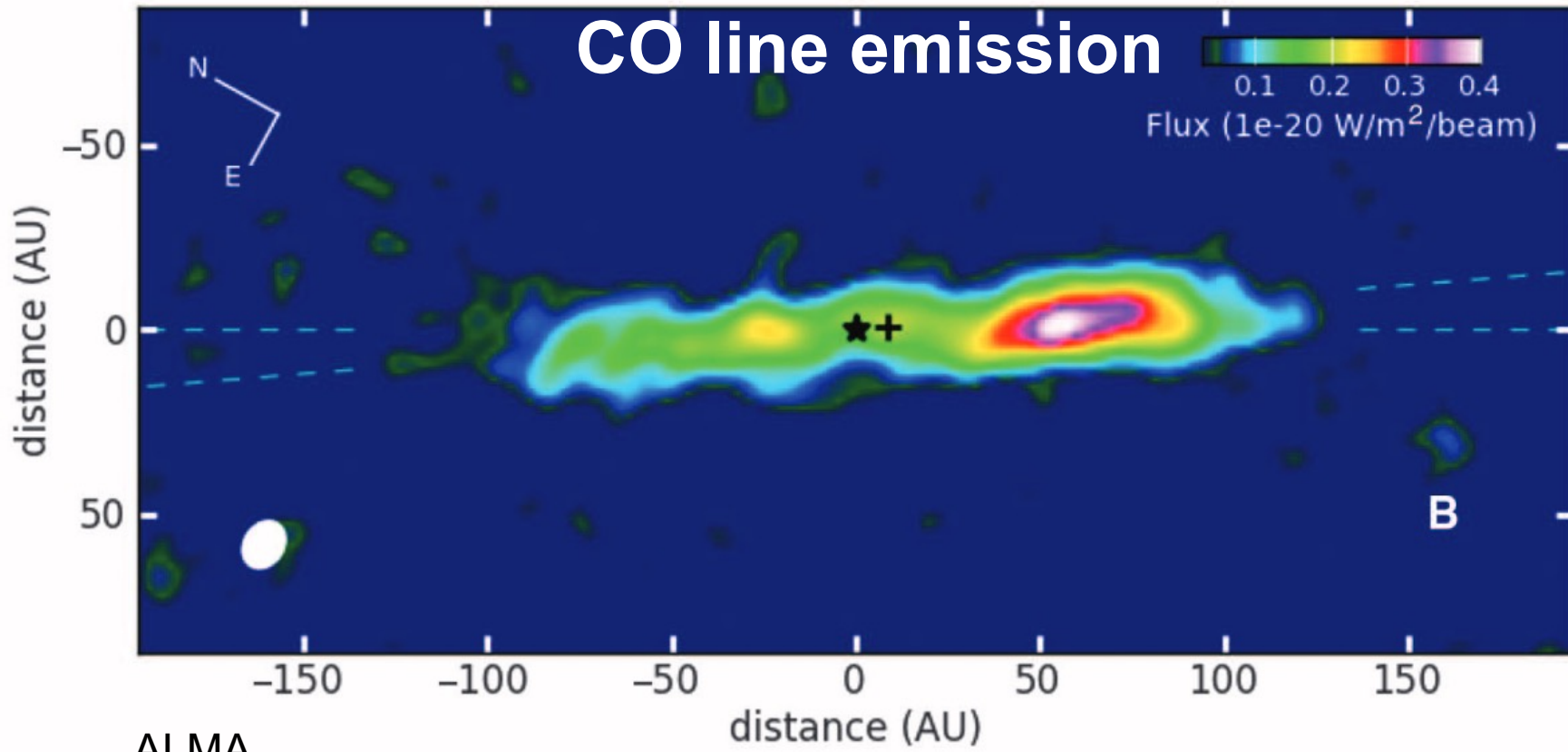


HST ACS

Golimowski (2006)

**Warped main disk or distinct secondary disk?**

# Beta Pic's secondary disk has a CO "clump"

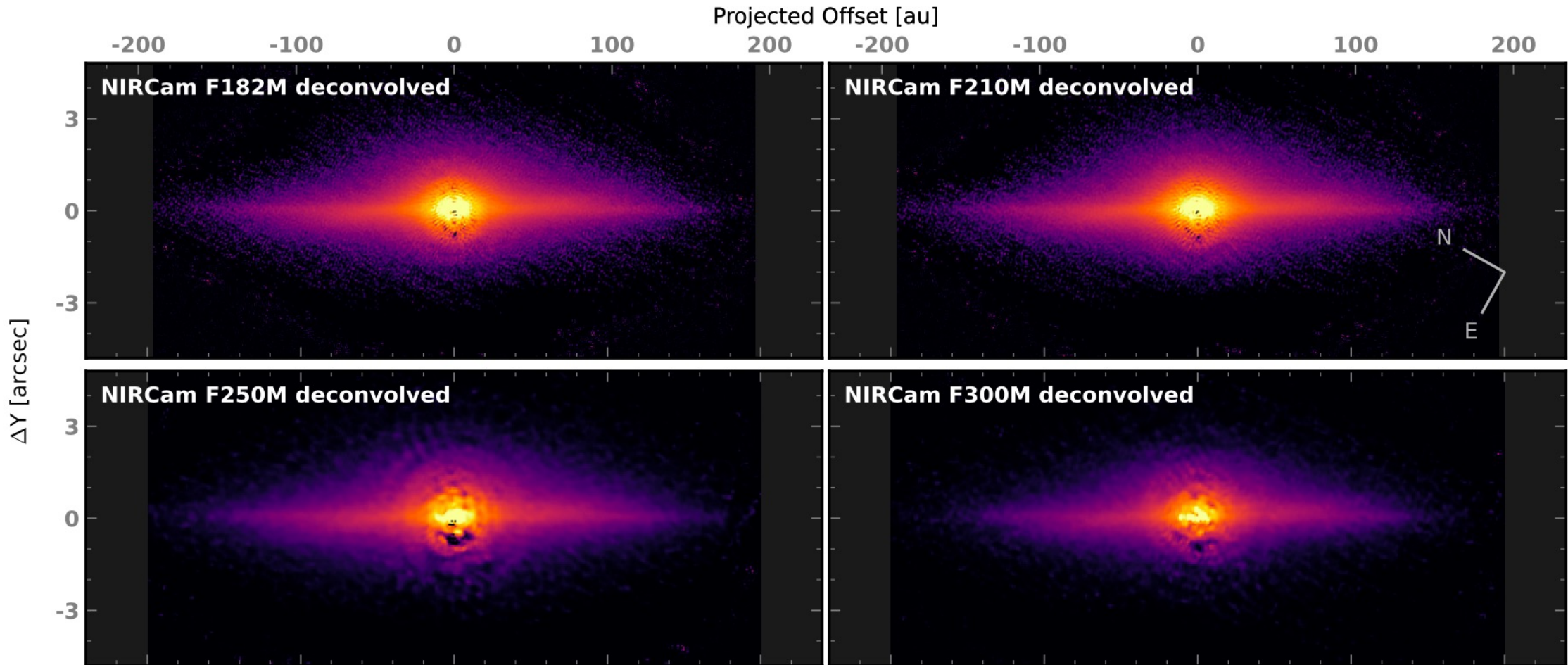


Carbon Monoxide (CO) has a photodissociation time of just ~150 years. Dent (2014) argued CO is due to either:

- a recent massive collision (deemed unlikely), or
- continuous asymmetric production

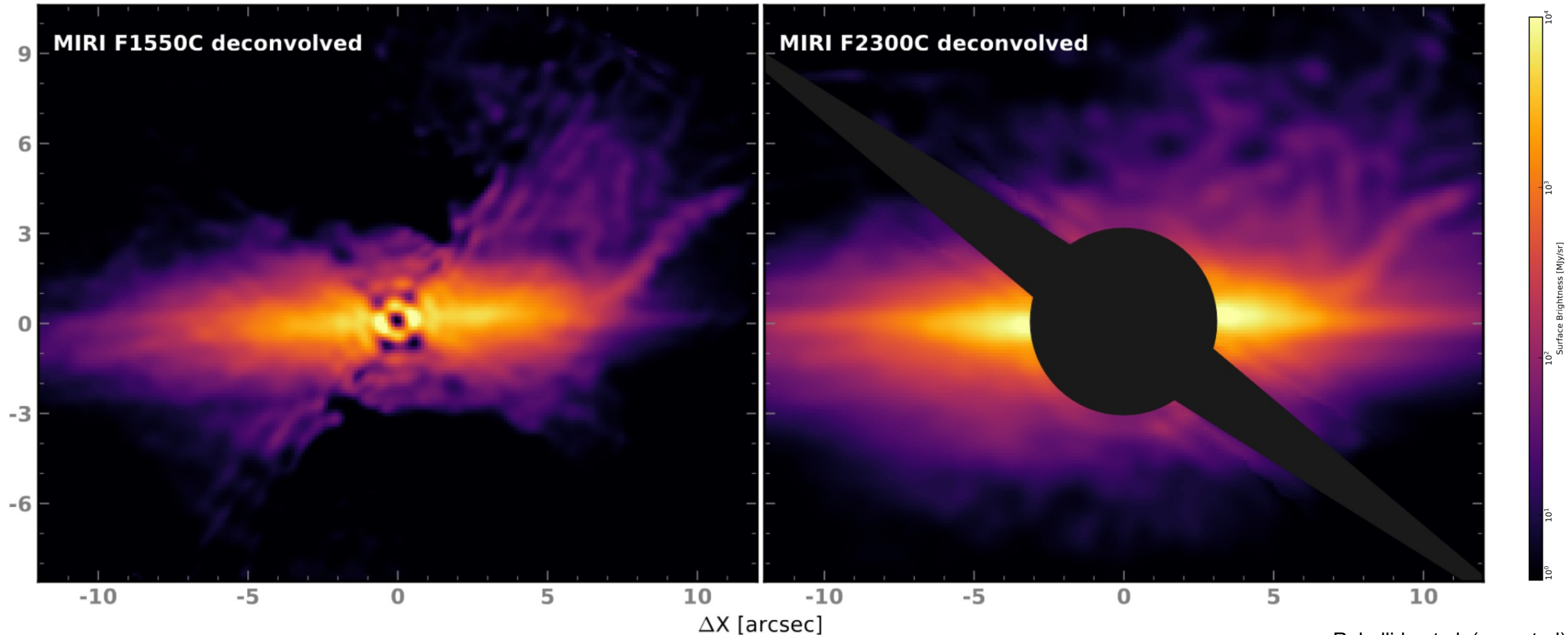
# GTO 1411 (PI Stark): NIRCcam & MIRI coronagraphic observations of Beta Pic

## Sample of Reduced & Deconvolved NIRCcam Data

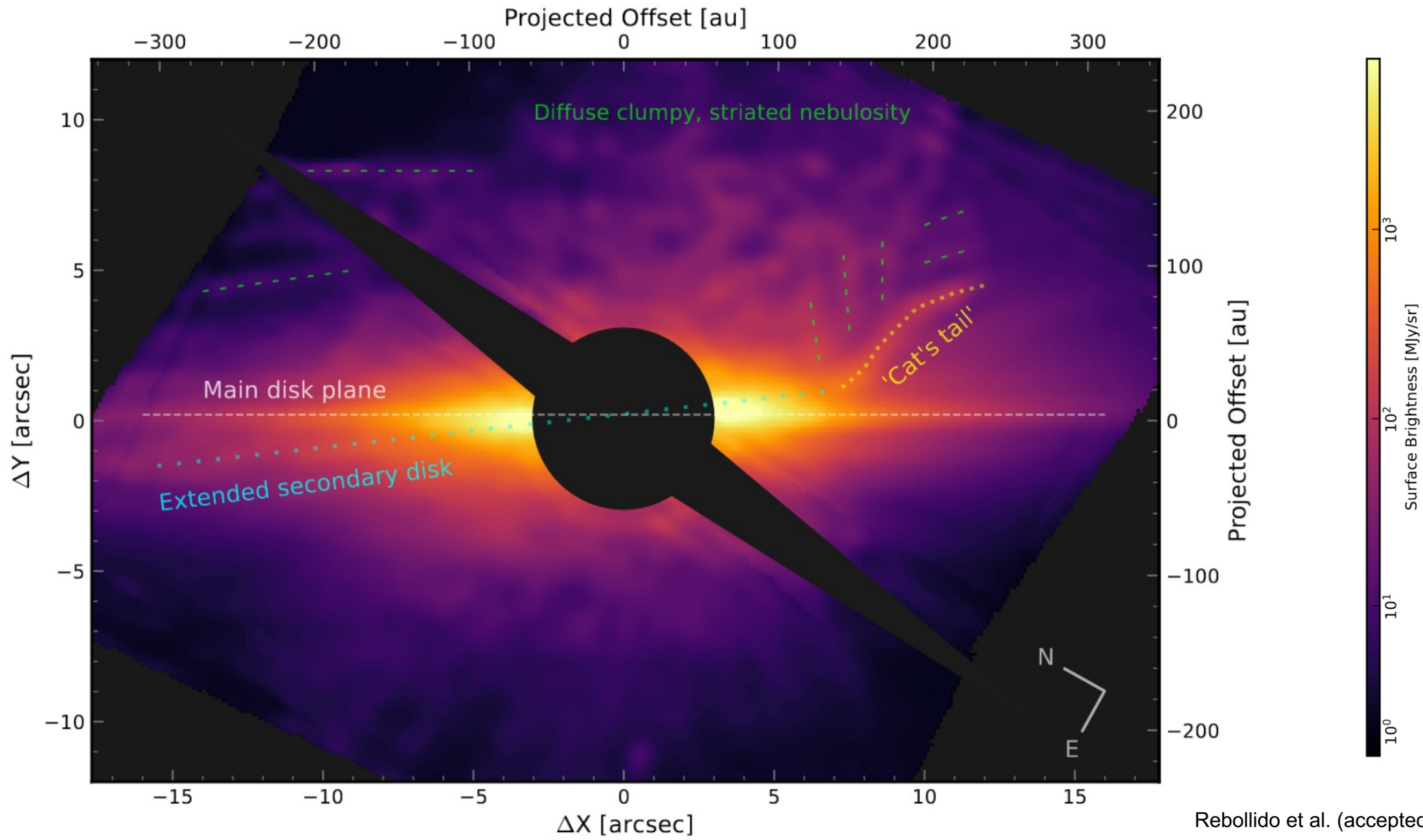


# GTO 1411 (PI Stark): NIRCcam & MIRI coronagraphic observations of Beta Pic

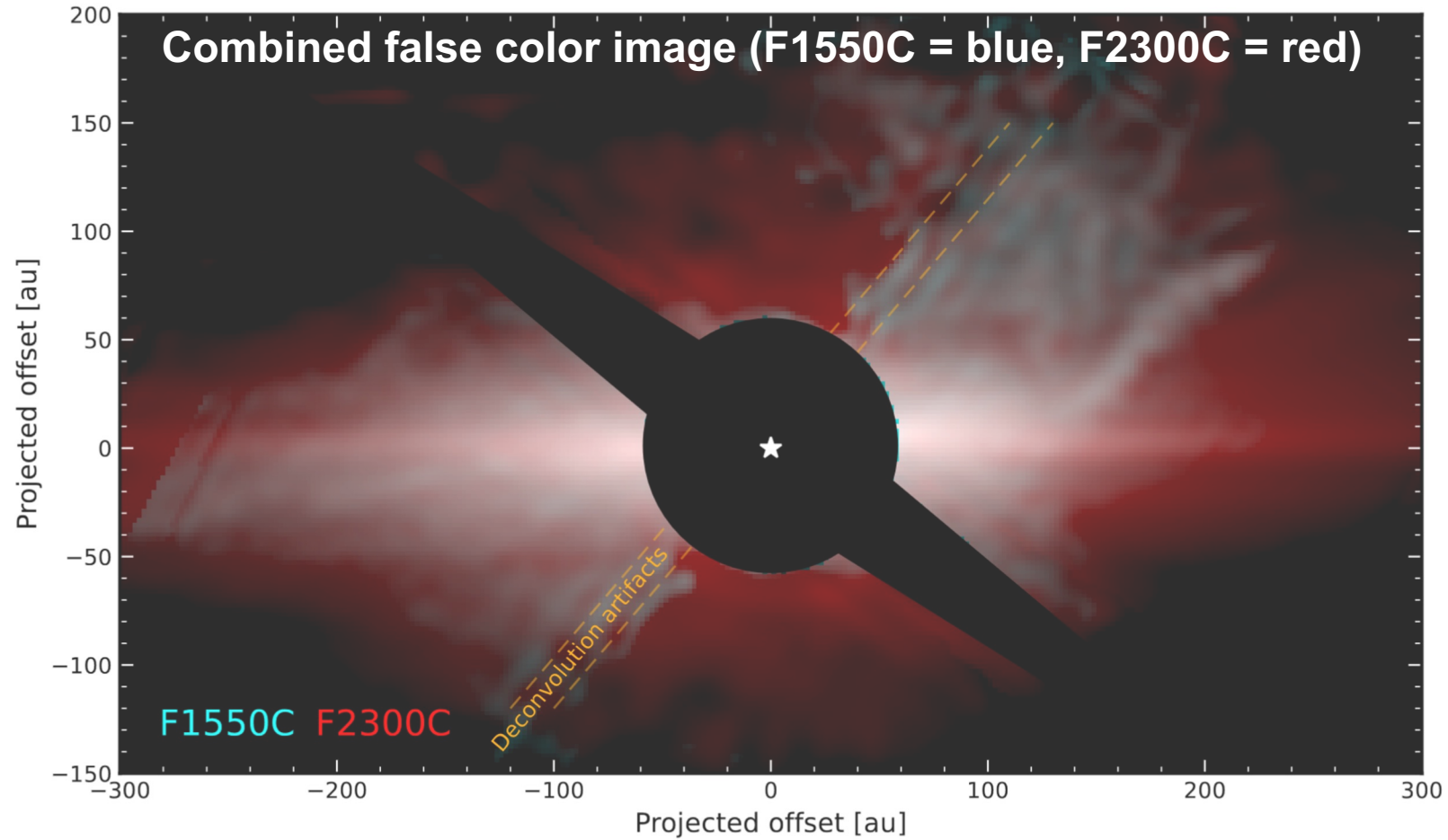
## Reduced & Deconvolved MIRI Data



# MIRI reveals puzzling new disk features



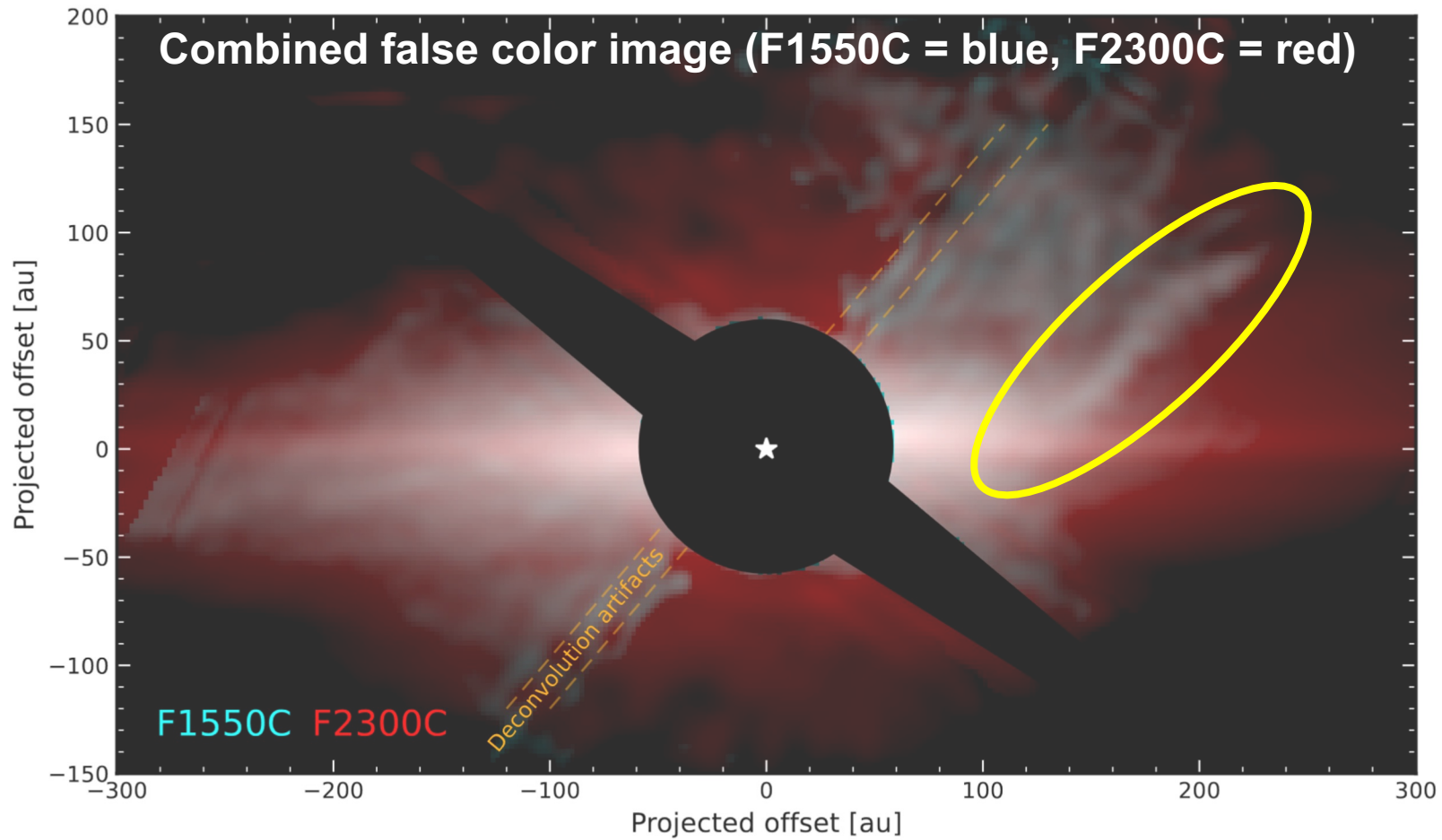
# The secondary disk and new features are distinct and hotter than the main disk



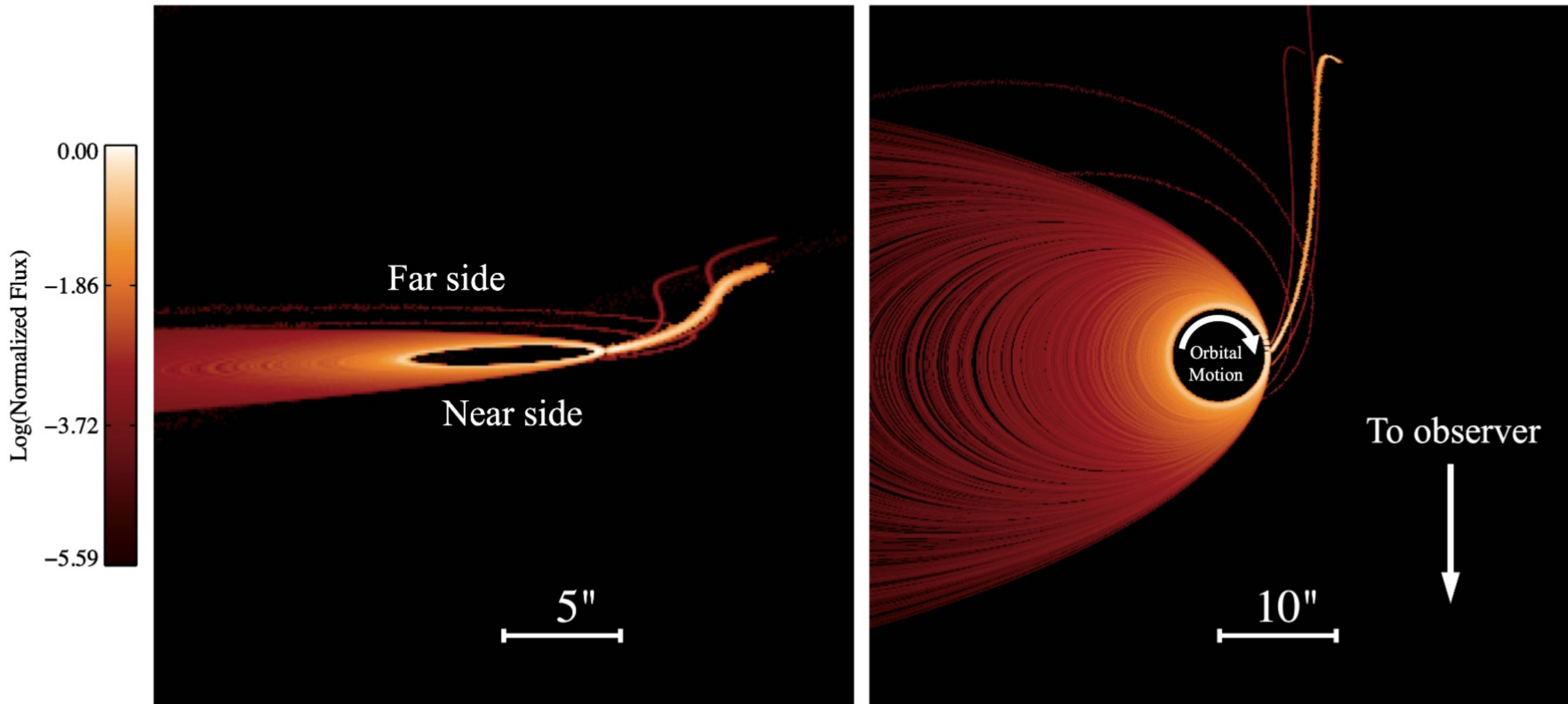
**Composition may be porous/“fluffy” refractory organics.**

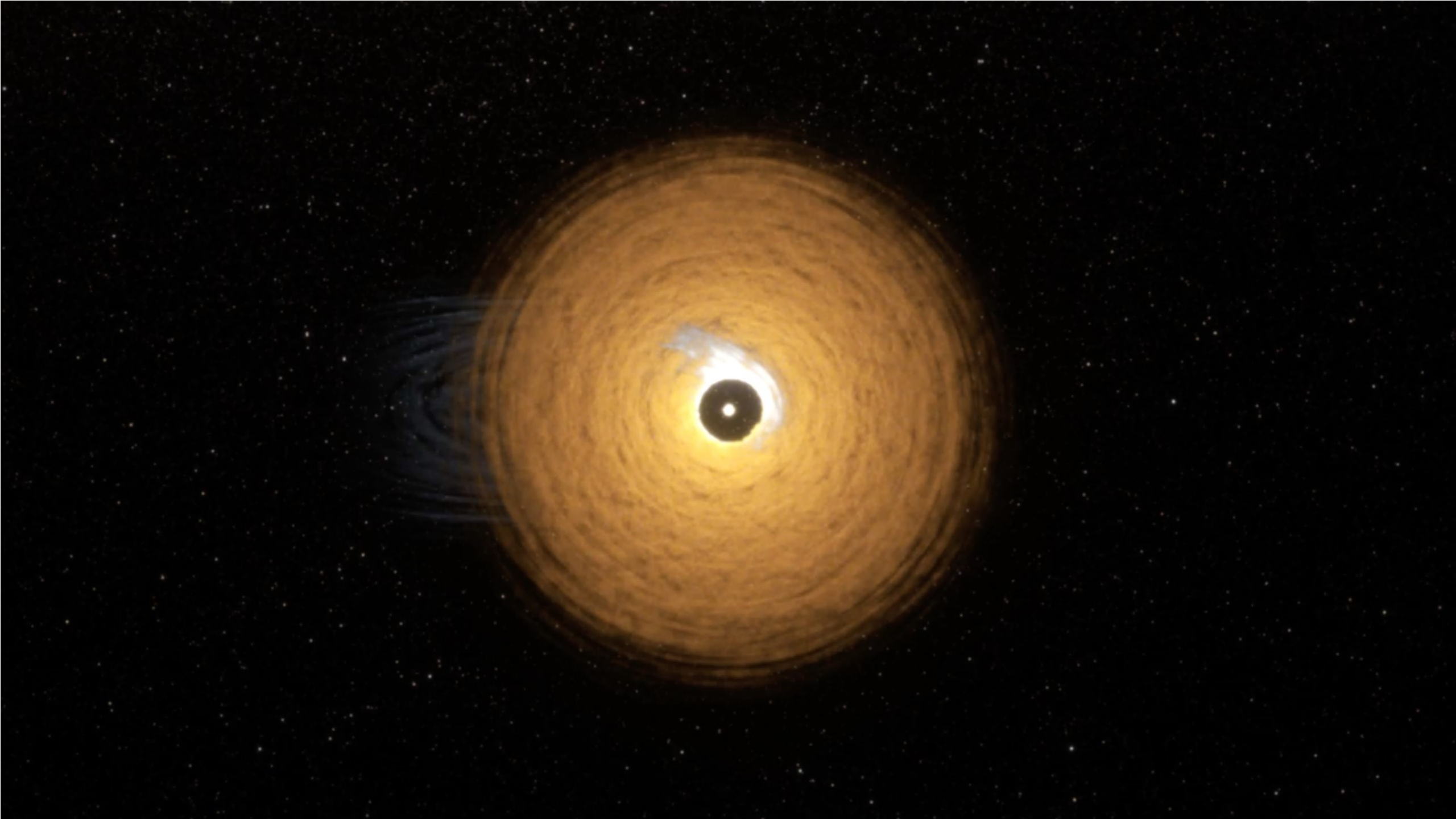


# What is the cat's tail?



# Cat's tail may be a curved tail of debris from a recent collision, ~150 years old





# What This Means

## **Beta Pic may be more active than previously thought**

- Signs of a very recent collision of a body at least the size of a large solar system asteroid
- May explain prior detections of abundant C and CO gas

## **JWST is providing an unexpected new window into debris disk dynamics & composition**

- JWST MIRI is very sensitive to porous organic refractory material and can search other disks for similar features
- This material may be similar to what the OSIRIS-REx Mission returned