



The Spectroscopic Case for a Giant Collision in the β Pictoris Debris Disk

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Evidence for a Giant Collision

- Twenty years ago several different dust populations were detected around β Pictoris using *Spitzer*
- We were excited to reobserve this system with *JWST*, hoping to understand the planetary system in much greater detail
- When *JWST* viewed β Pictoris in January 2023, we discovered that two of the dust components had disappeared!
- This unexpected observation has changed our understanding of the planetary system and leads us to believe that a recent, giant collision has occurred around β Pictoris

The nearby young star, β Pictoris hosts a teenage planetary system, including giant planets, exocomets and dust...

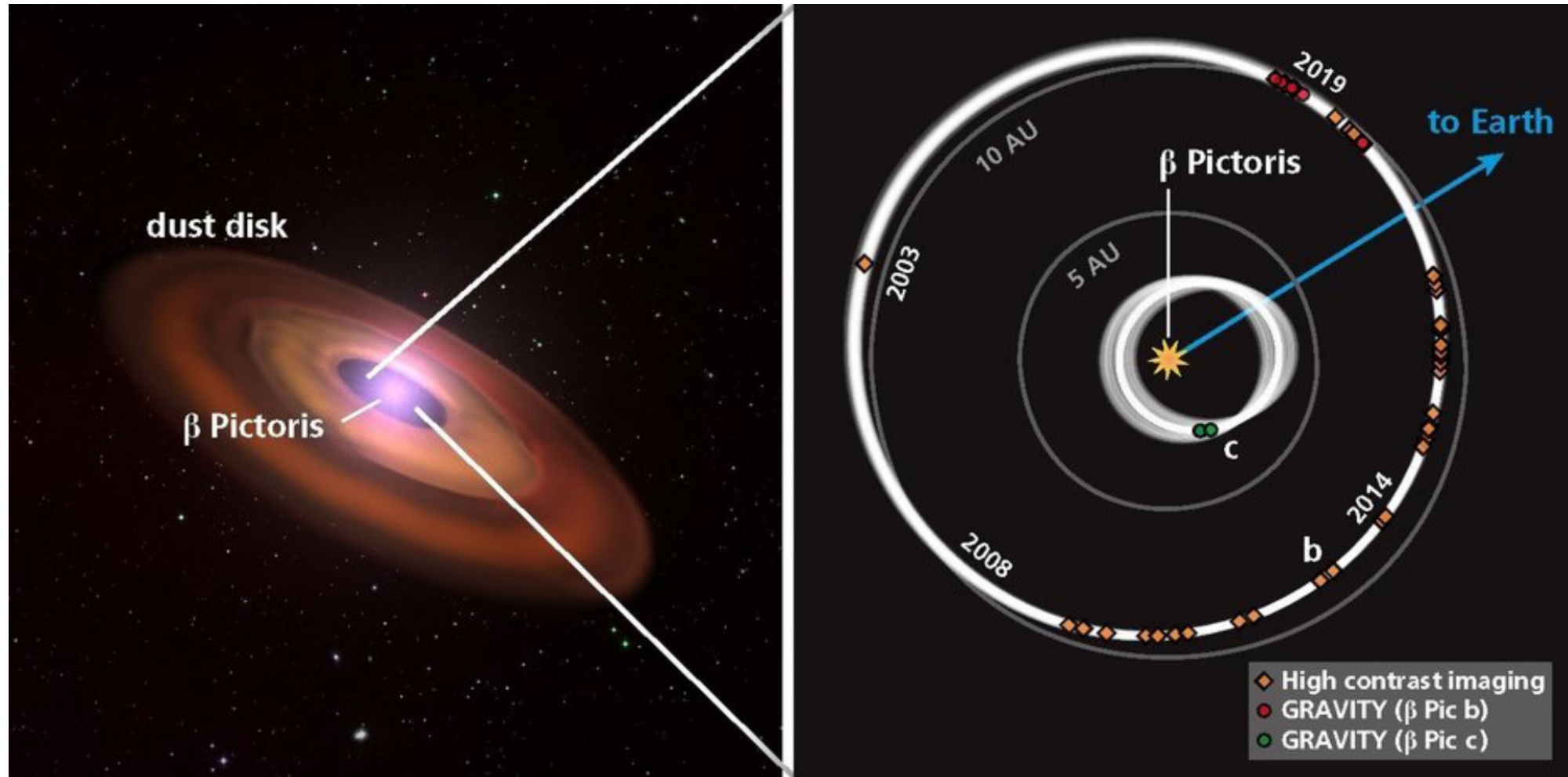
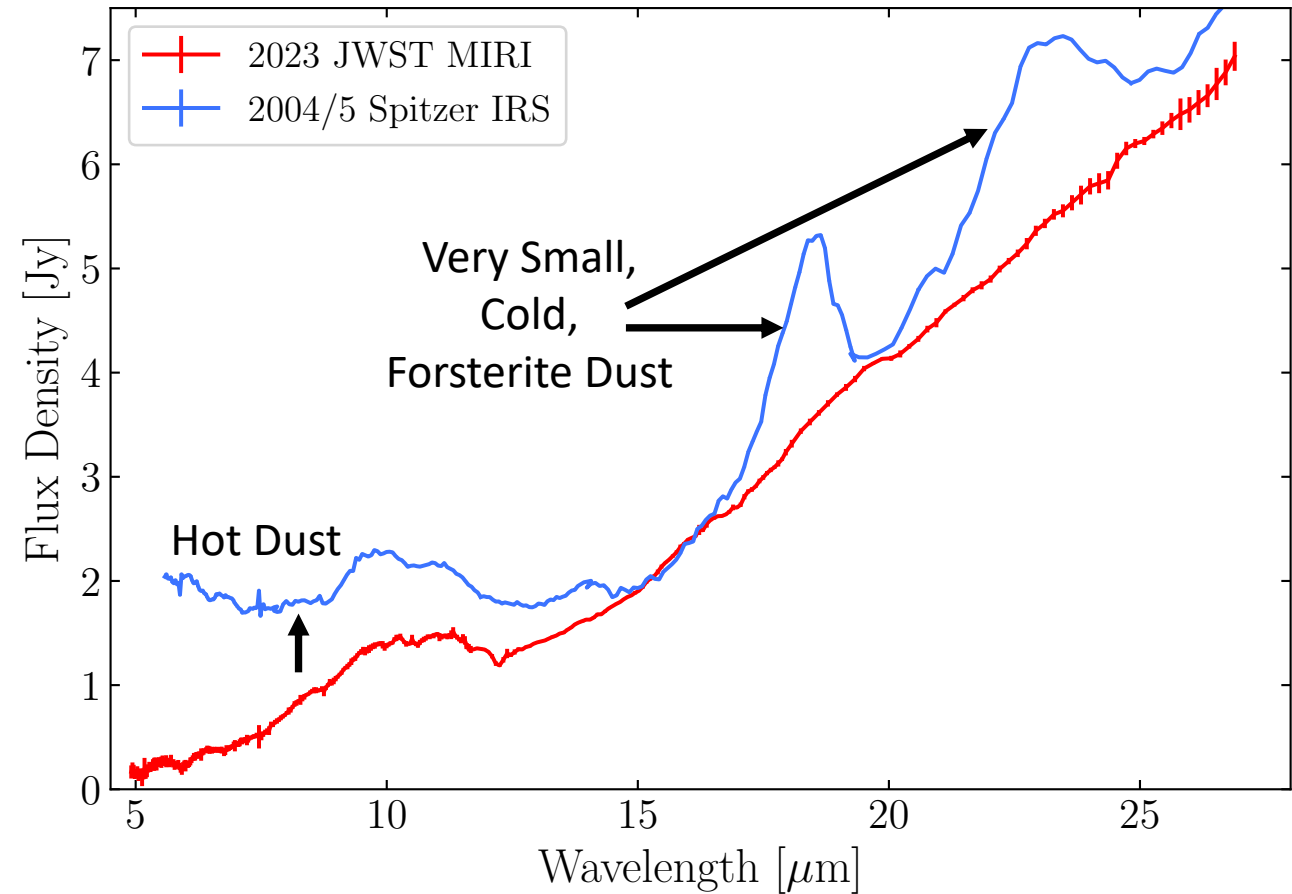
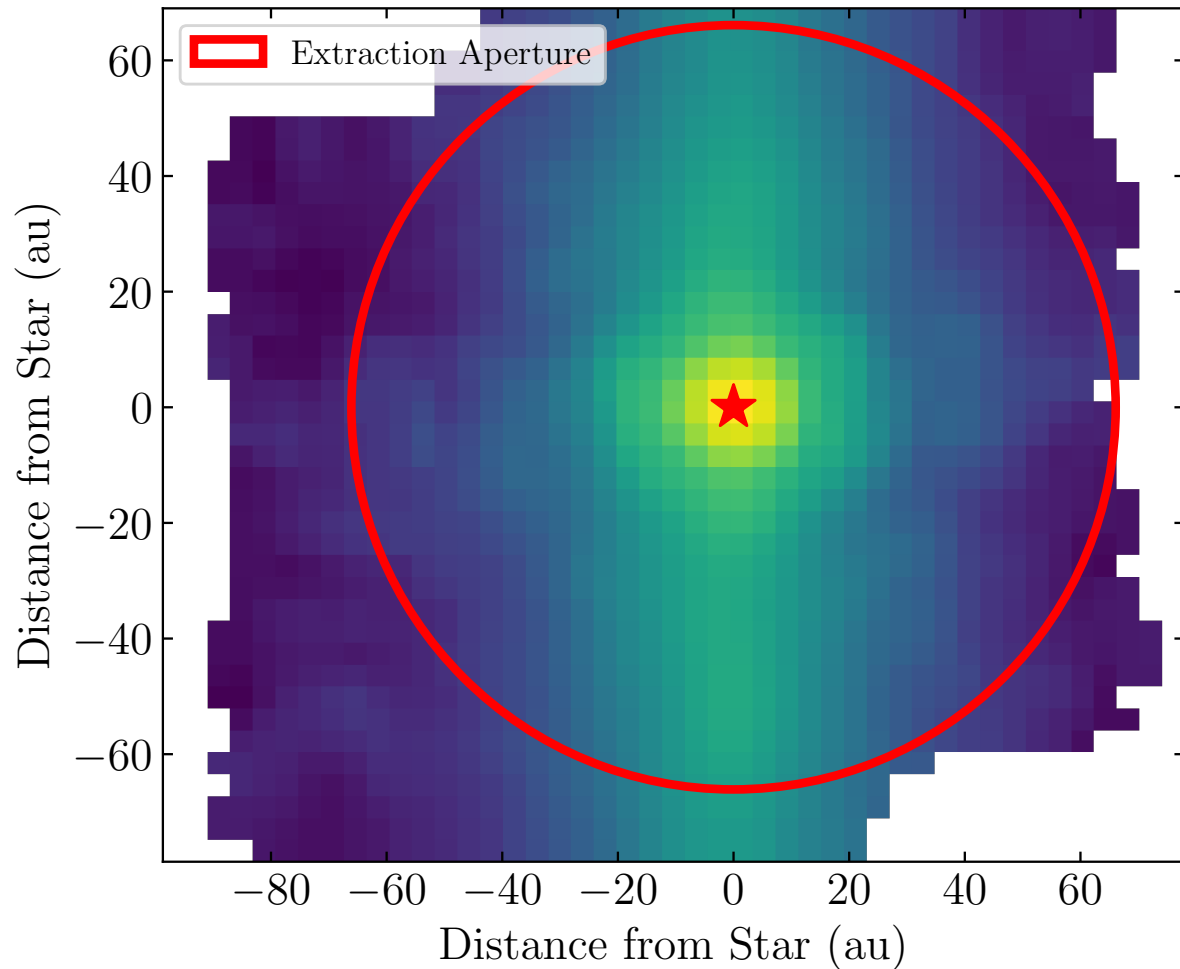


Image Credit: Axel Quetz / MPIA Graphics Department

The β Pictoris mid infrared spectrum changed dramatically and unexpectedly!



Crystalline Forsterite



Hawaii's Famous Green Sand Beach

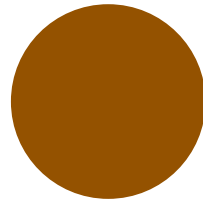
Chemical Formula: Mg_2SiO_4



Radiation Pressure



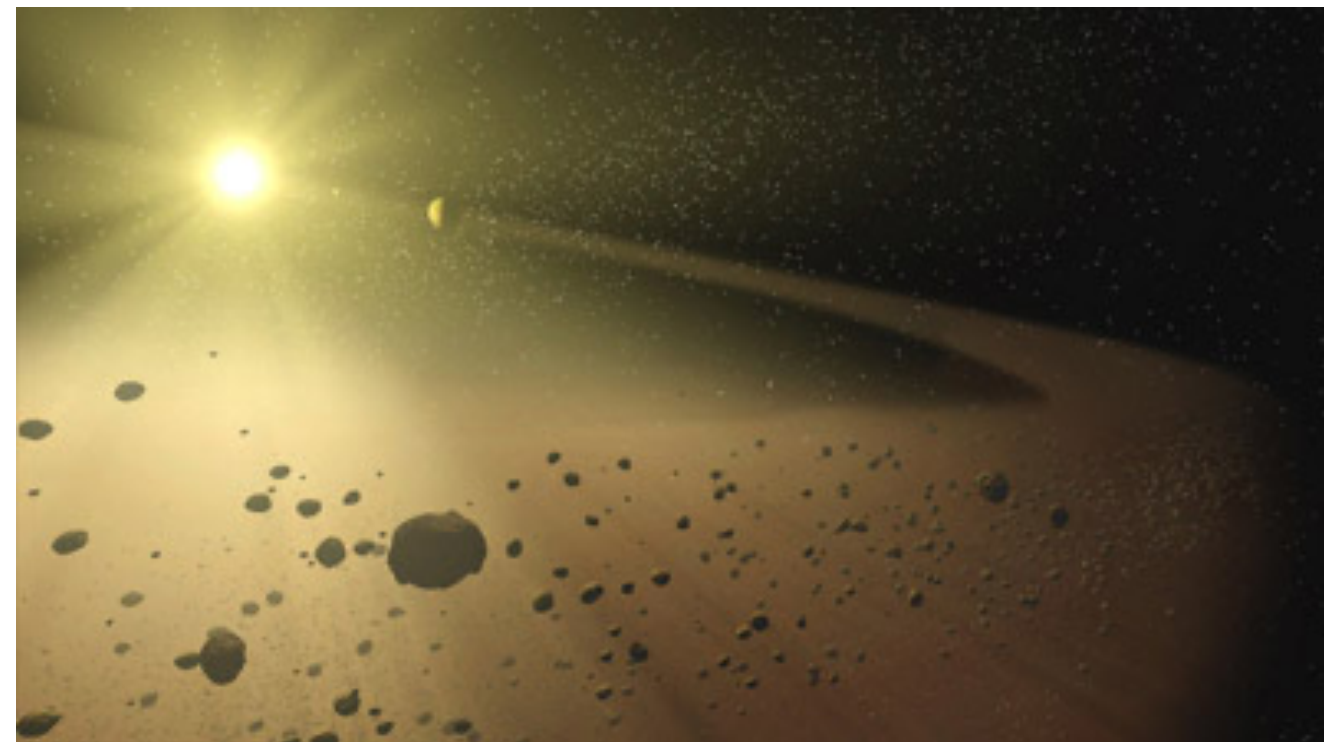
Very small grains are blown out of the planetary system by radiation pressure.



Large grains remain bound and orbit the star.

Changing how we think...

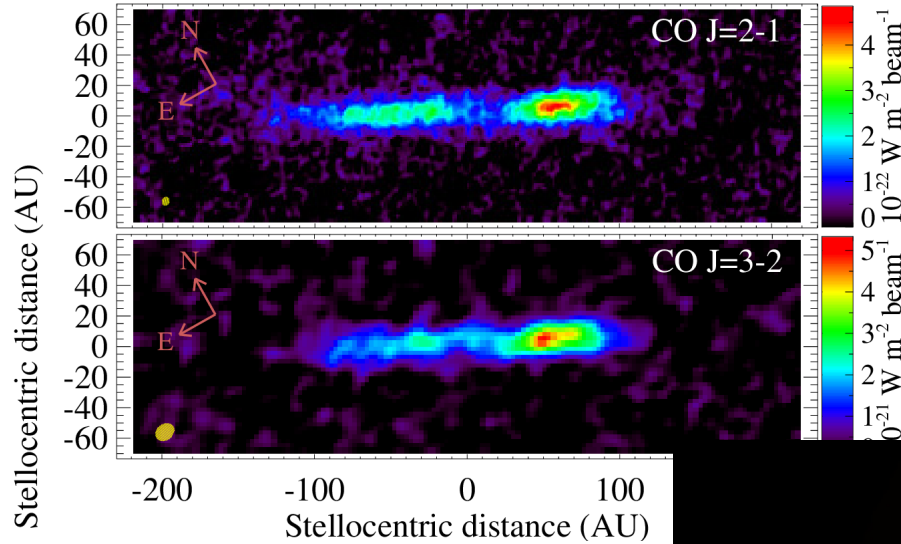
From steady state...



to dynamic

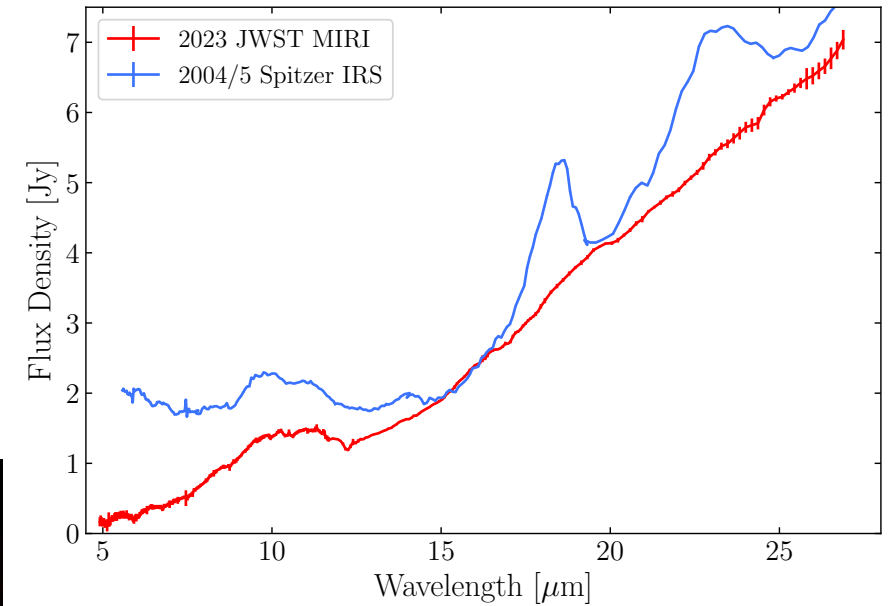
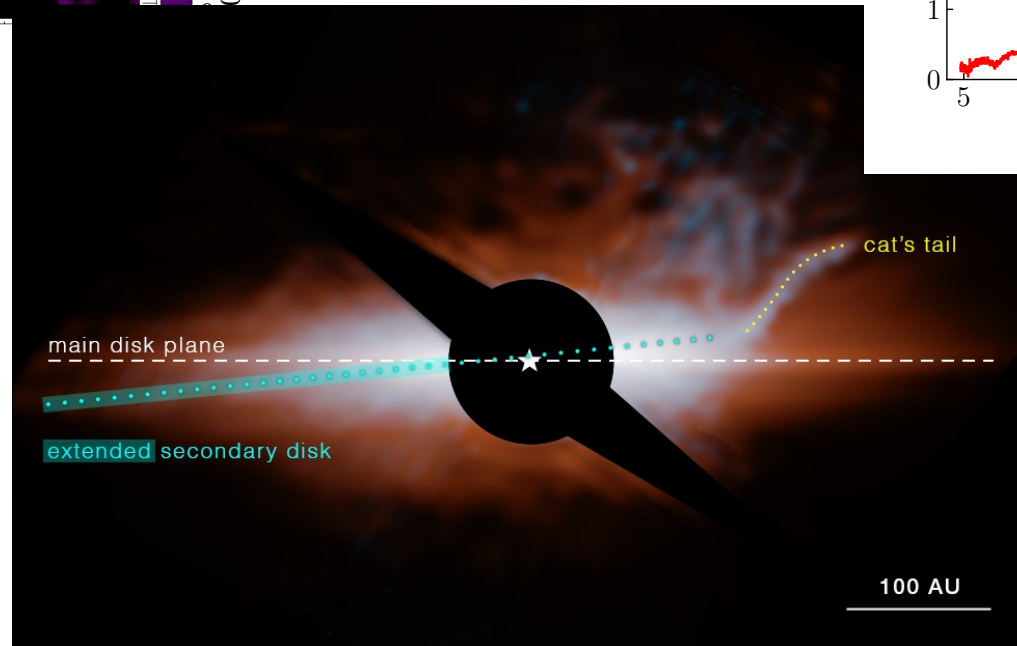


Building Evidence for a Collisionally Active System



2014 ALMA
Discovery of
Carbon
Monoxide Gas

December 2022
JWST Discovery
of the Cat's Tail



January 2023
JWST Discovery
of the changing
mid-infrared
spectrum

Summary

- The β Pictoris planetary system has experienced a recent, giant collision
 - The collision likely occurred 20 – 30 years ago, deep within the terrestrial planet zone
 - The collision released a large dust cloud, the equivalent of pulverizing a large solar system asteroid
 - Stellar radiation pressure blew the dust out of the planetary system
 - As the dust cloud swept through the planetary system, it might have impacted the giant planets within it
- By providing continued access to infrared wavelengths, *JWST* is enabling us to witness terrestrial planet formation