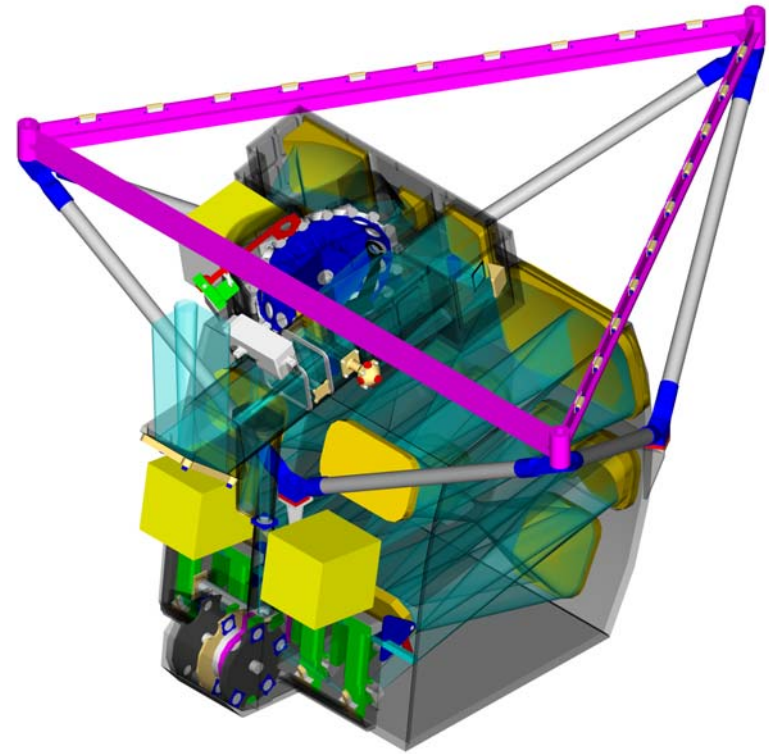


The Mid-Infrared Instrument (MIRI) for JWST



- **MIRI is a NASA/JPL-led partnership with a European Consortium sponsored by ESA**
 - NASA provides focal planes, signal chain
 - Consortium provides optical bench assembly
- **Functional capabilities include**
 - **Imaging**
 - $\lambda=5-27 \mu\text{m}$ wavelength range
 - Diffraction limited imaging with 0.1" pixels
 - ~ 2 square arcmin field of view
 - Low resolution spectrograph ($R \sim 100$; $\lambda=5-10 \mu\text{m}$) for single, compact sources
 - Coronagraph
 - **Spectroscopy**
 - $\lambda=5-27 \mu\text{m}$ wavelength range, goal to reach $\lambda=28.3 \mu\text{m}$
 - Integral field spectroscopy with fields of view of 3" or more
 - $R \sim 3000 - 1000$ from $\lambda=5-27 \mu\text{m}$

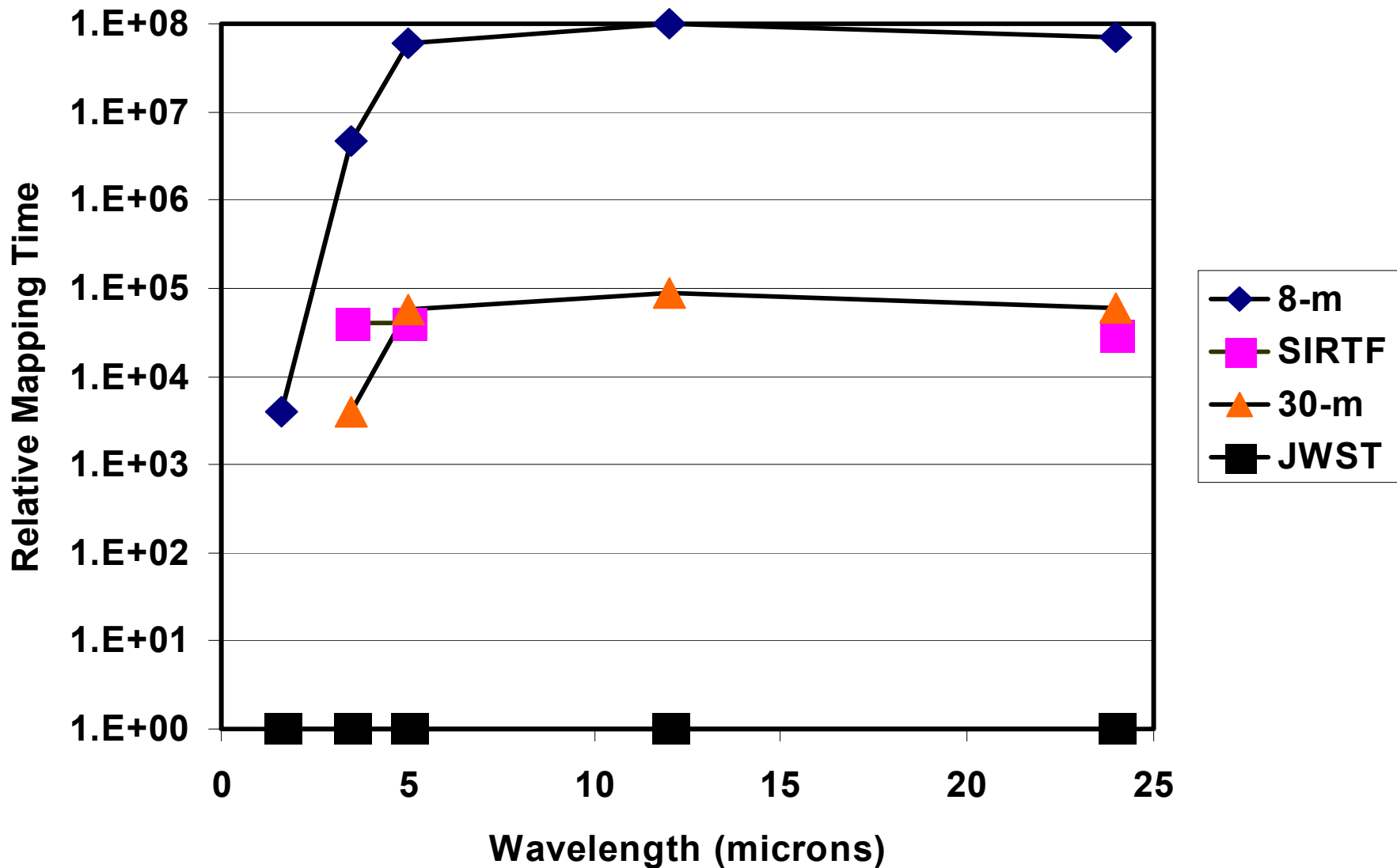


Science team

G. Rieke (lead), G. Wright (co-lead), F. Bortoletto*, T. Greene, T. Henning*, P.-O. Lagage*, M. Meixner, & E. Serabyn (inst.scientist) (+ B. Rauscher & E. van Dishoeck) *acting

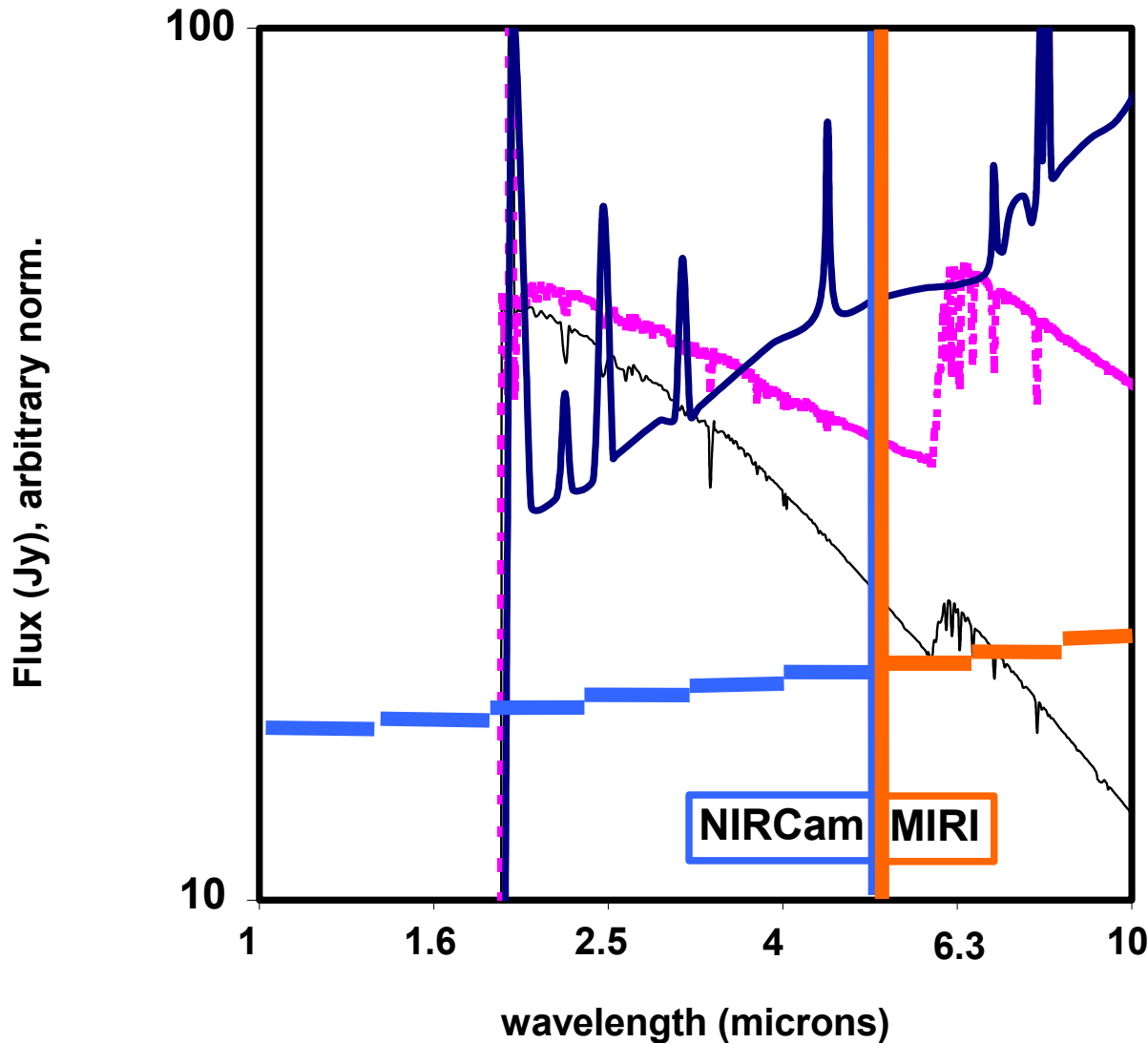


“Having NGST’s sensitivity extend to 27 μ m would add significantly to its scientific return.” .. “NGST would gain its greatest advantage over any ground-based telescope at the longer infrared wavelengths.” – Astronomy and Astrophysics in the New Millenium (McKee-Taylor decadal survey)





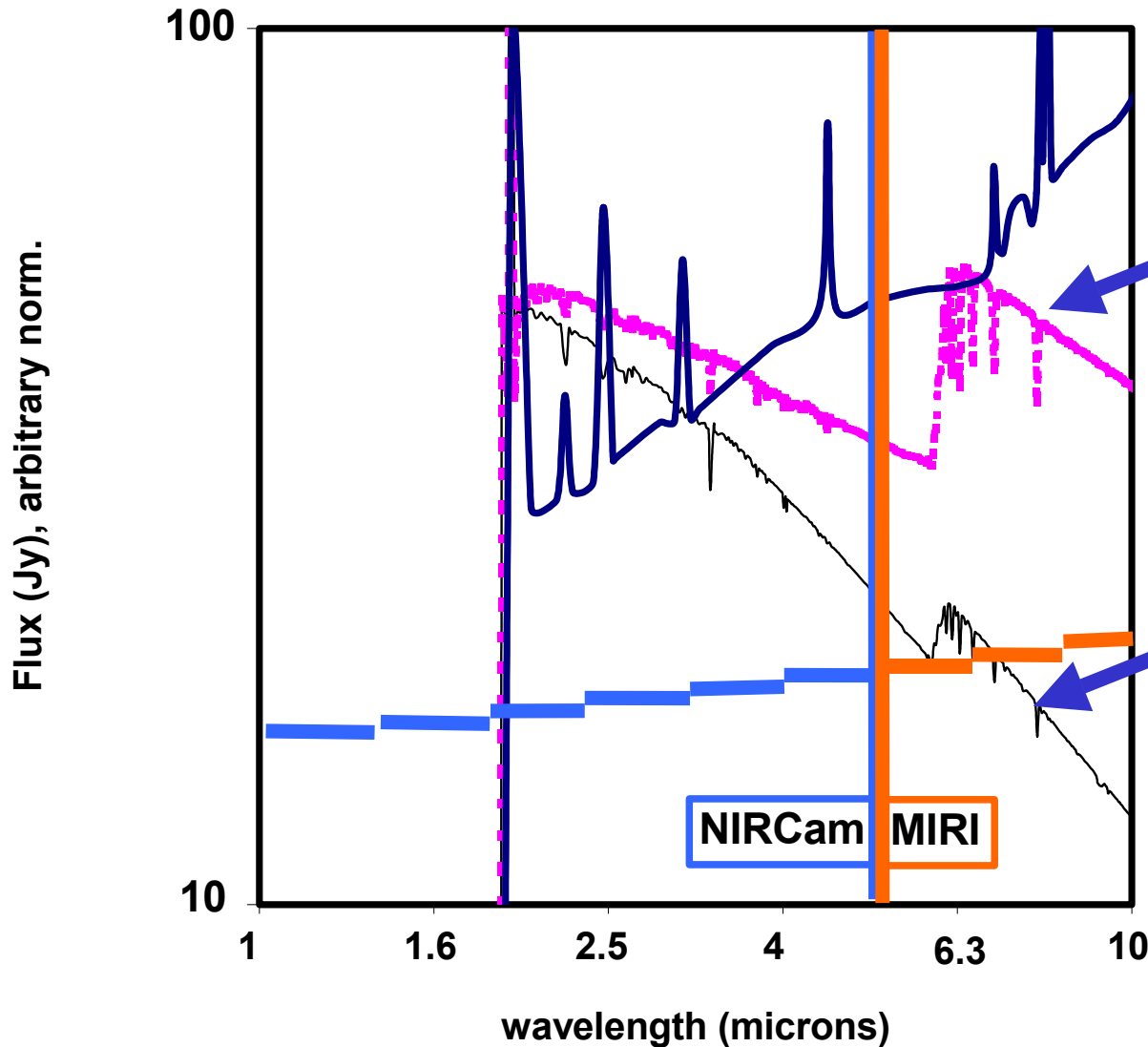
**“NGST will cover the spectrum out to wavelengths of at least 5 μ m
...extending the sensitivity of NGST farther into the thermal infrared
would greatly increase its ability to study galaxies at high redshifts.” –
Astronomy and Astrophysics in the New Millenium**



All three objects
at $z = 15$.



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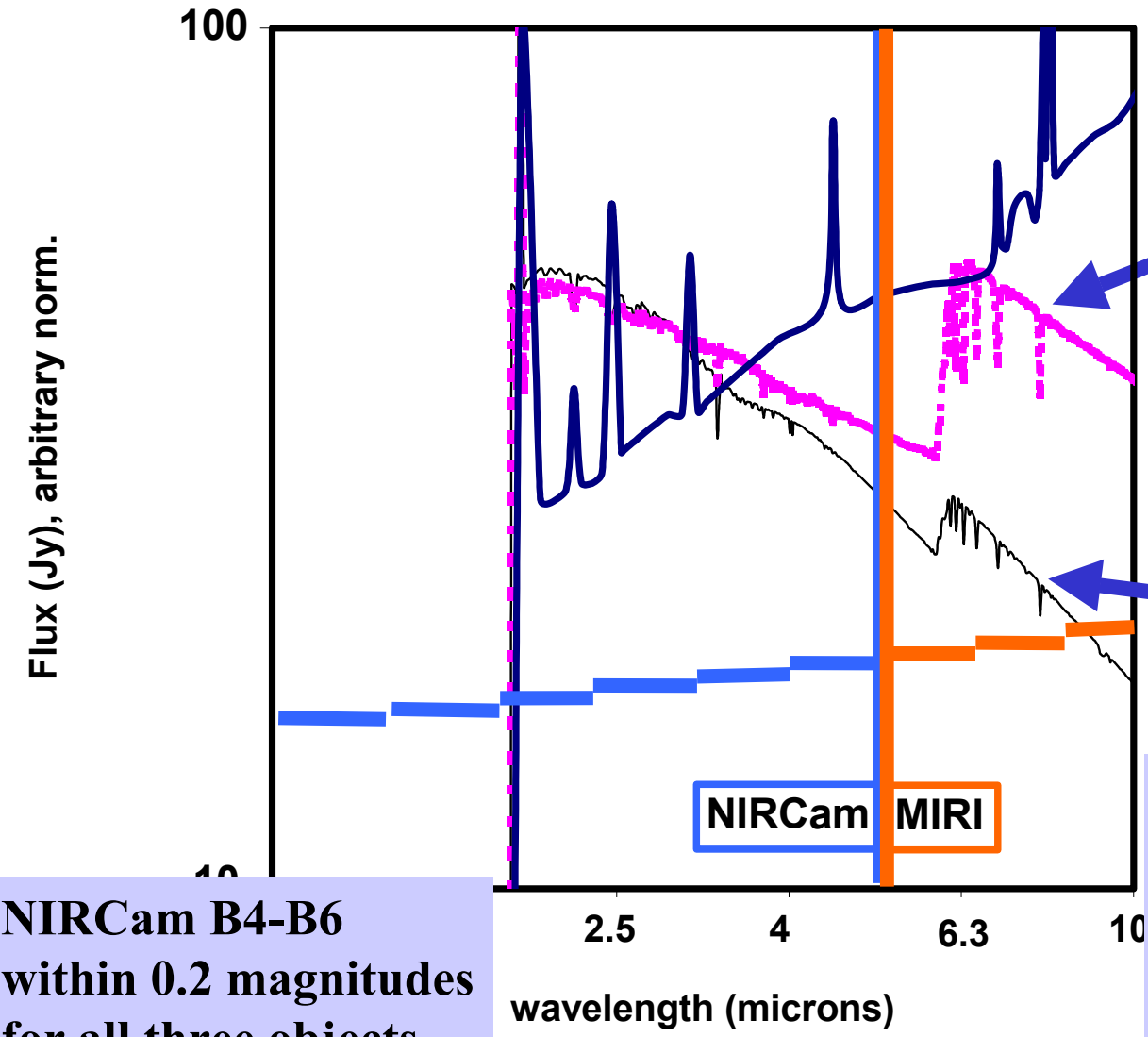
MIRI observations can distinguish a galaxy with an older stellar population

— first light: stars
- - - older galaxy
— quasar

from a true first light object.



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MIRI observations can distinguish a galaxy with an older stellar population

+ $A_V \sim 0.4$
@ $z = 3$

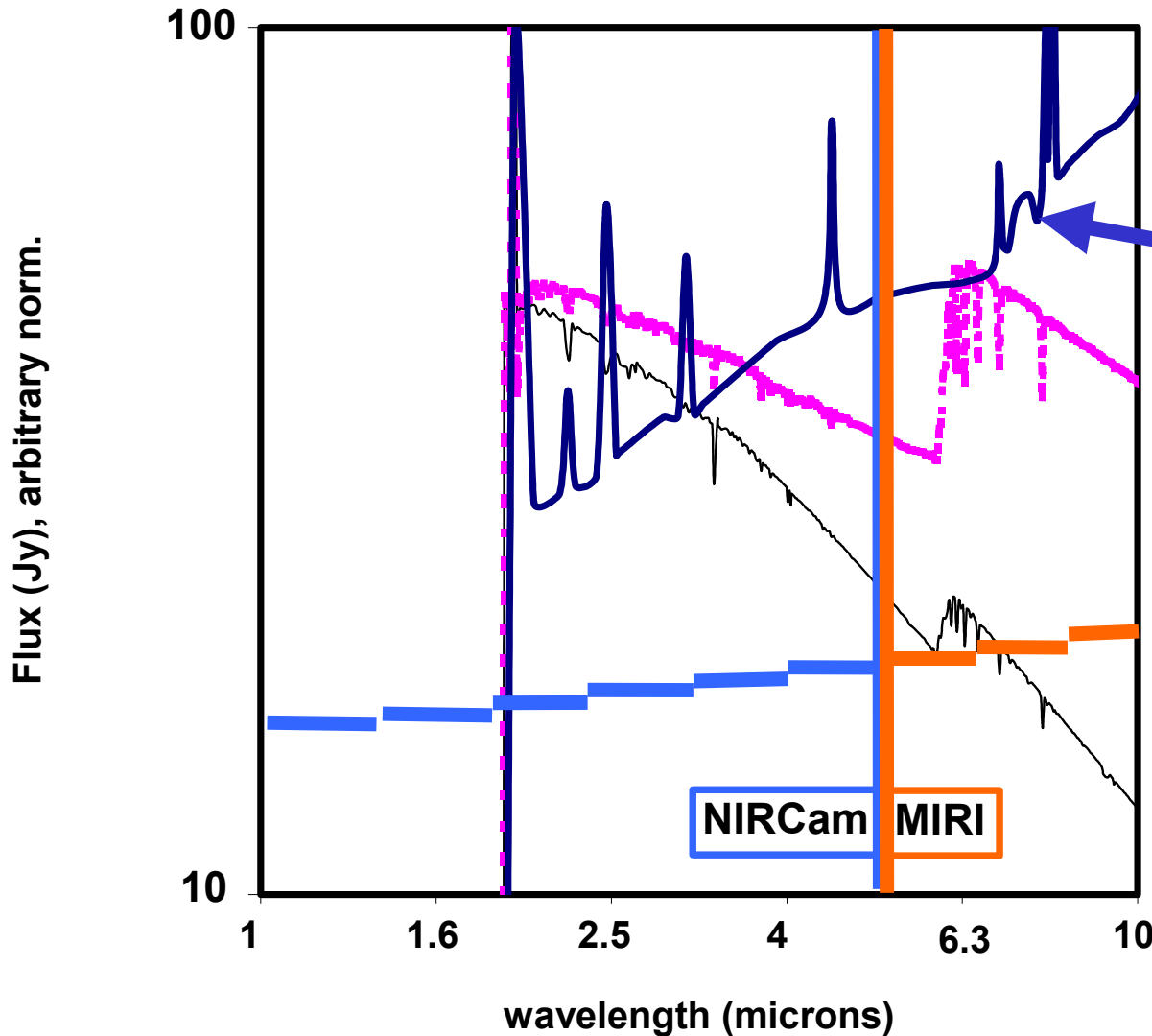
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from a true first light object.

MIRI observations become essential if there is a small amount of reddening due to foreground damped Ly α systems.



“[to trace quasar evolution] to earlier epochs we will require high-sensitivity detections in the near-to-mid-IR. The next generation of surveys will begin with the Space Infrared Telescope Facility (SIRTF) and be carried to unprecedented depths by JWST.”– Origins Roadmap

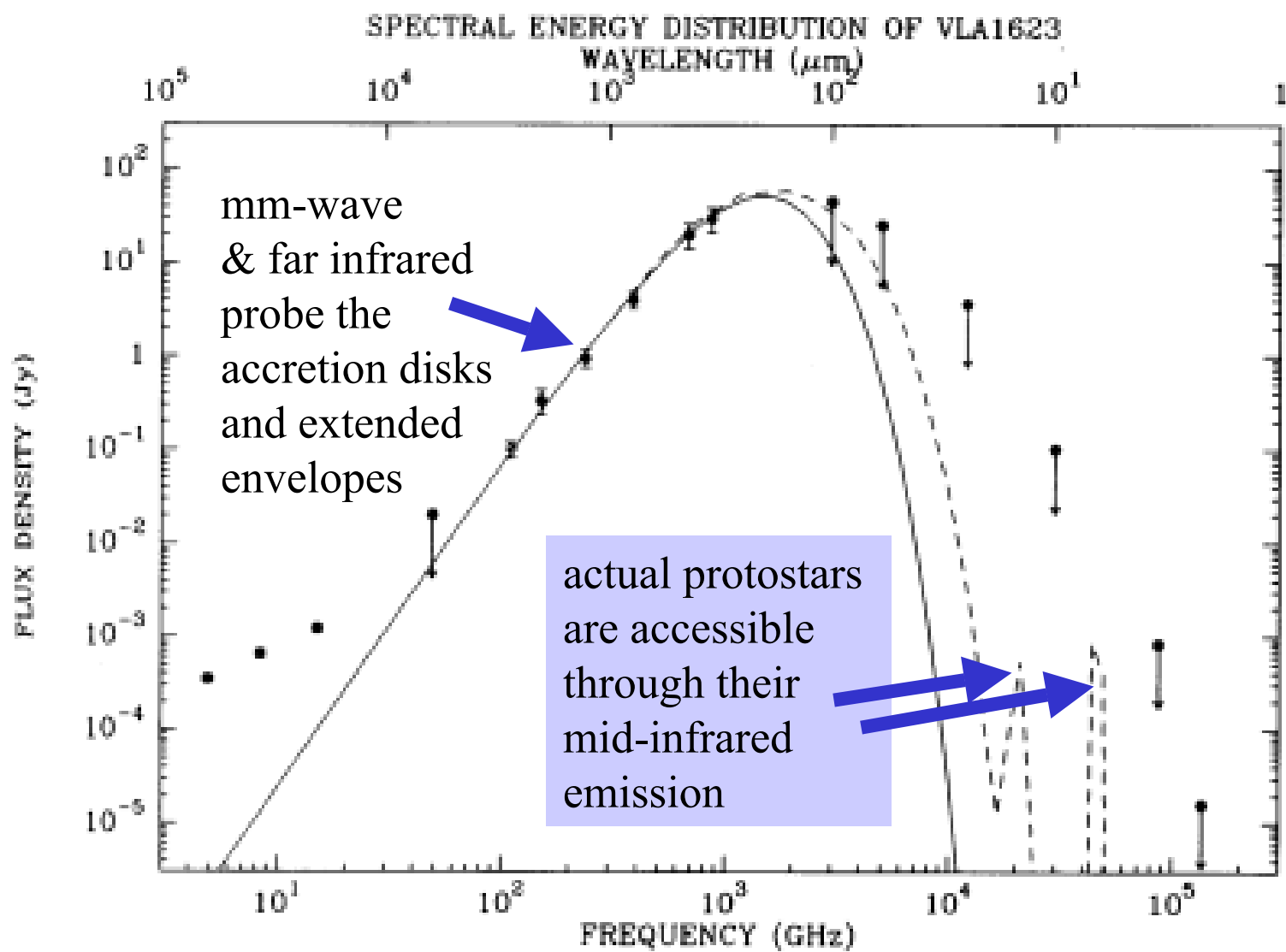


What were the properties of the first quasars, at $z = 10 - 20$?

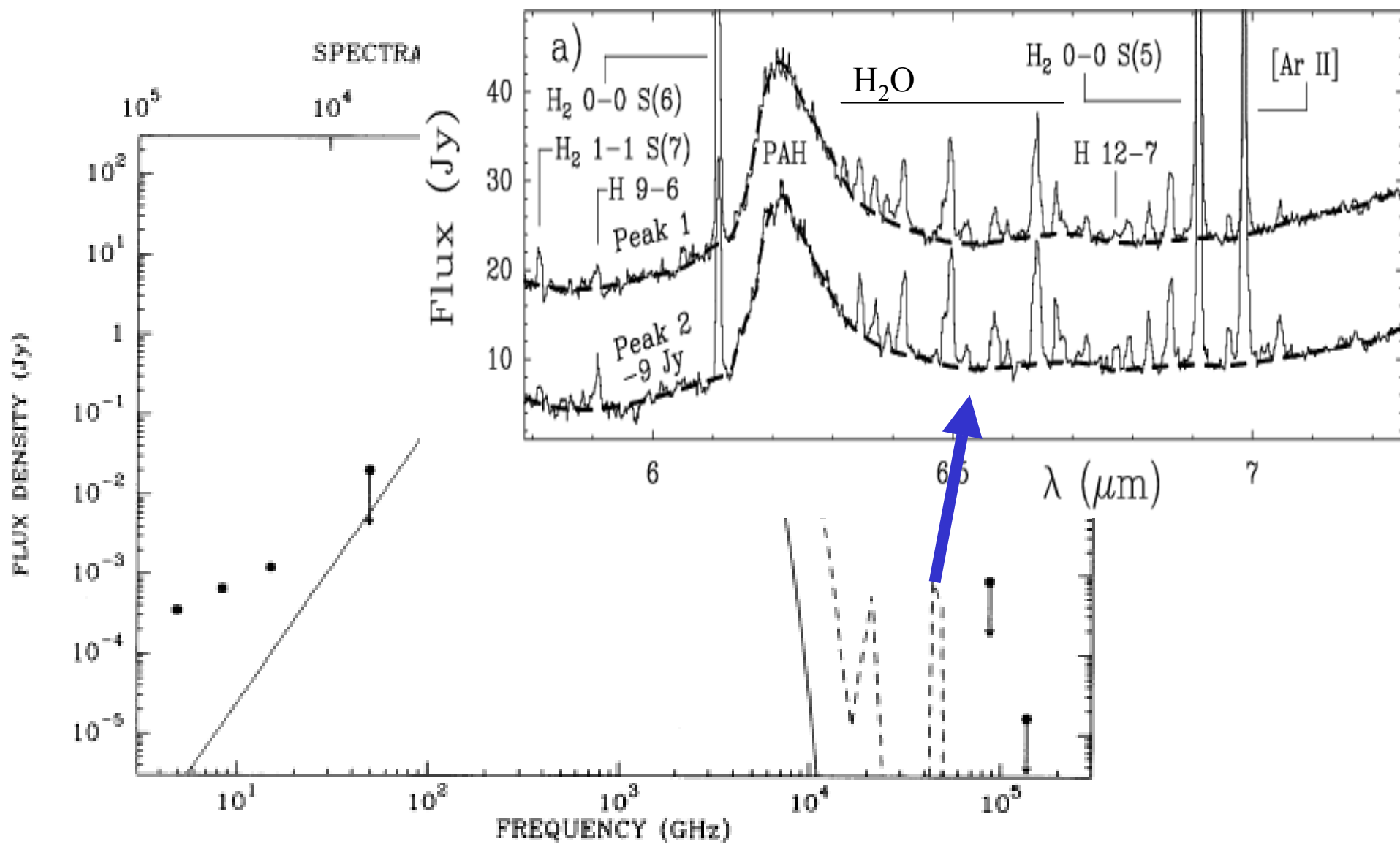
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NIRCam and MIRI will be needed together to compare their properties with those at lower redshift.

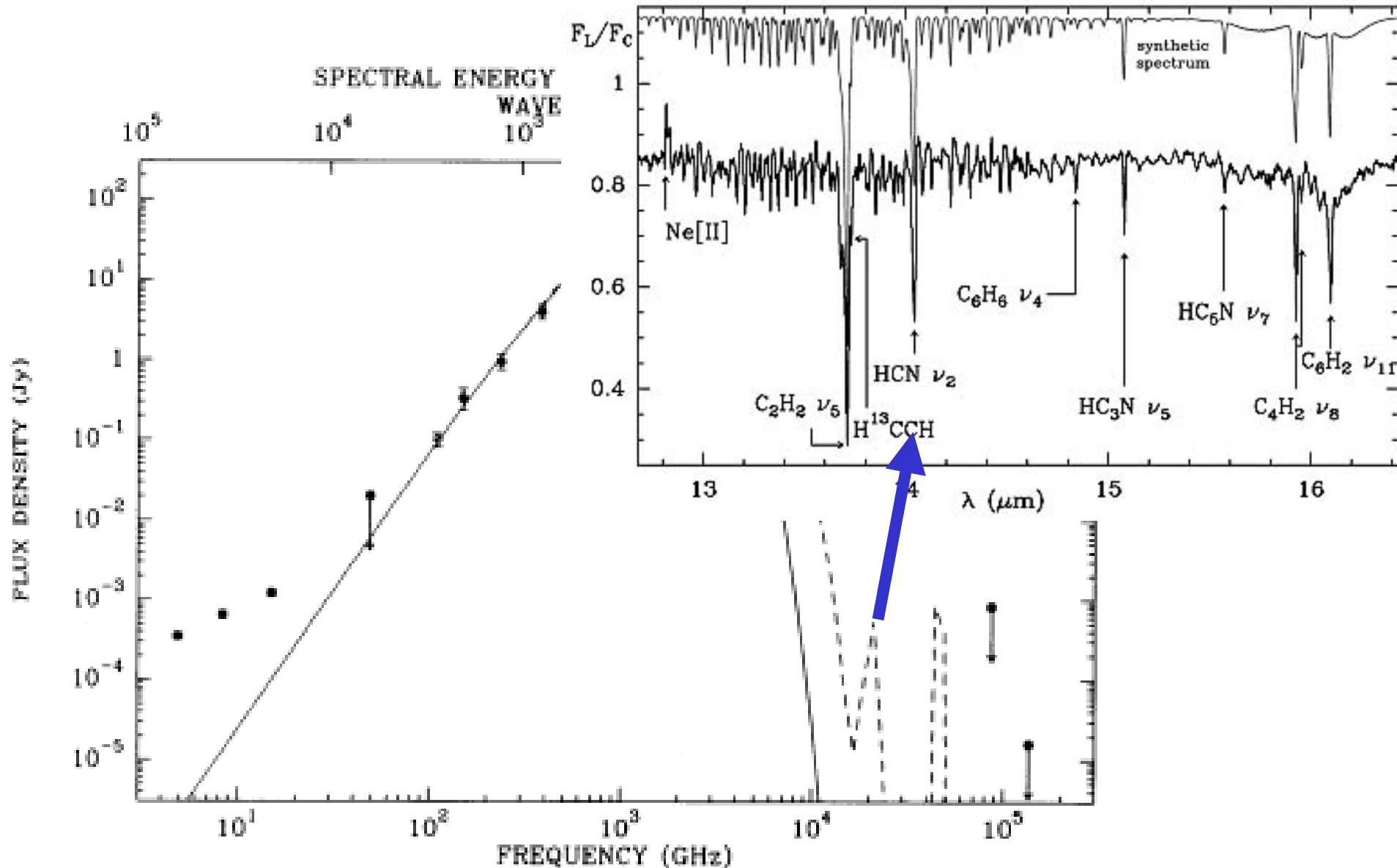
“JWST will be able to probe the most central regions of protostars.” – Origins Roadmap



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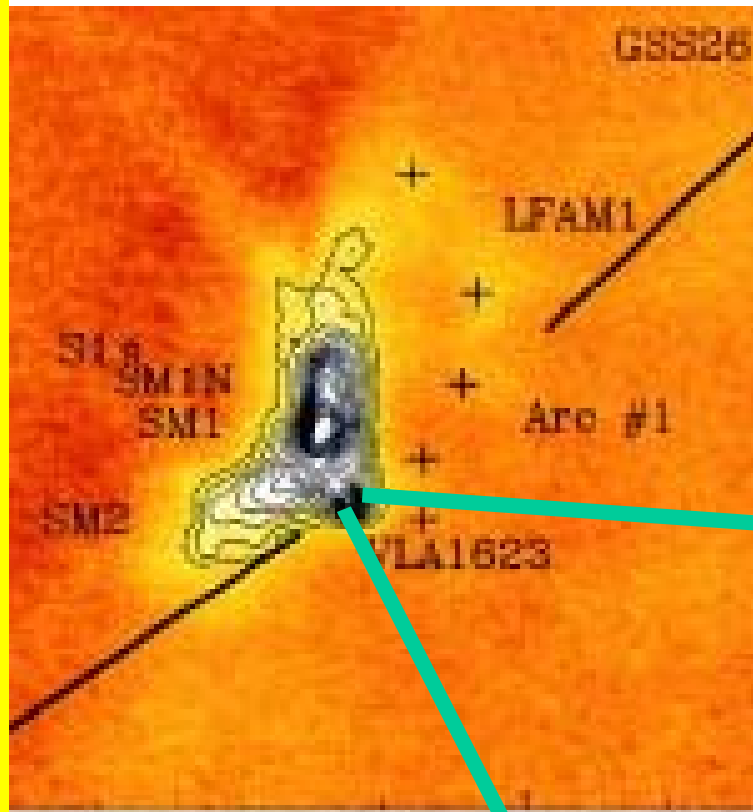


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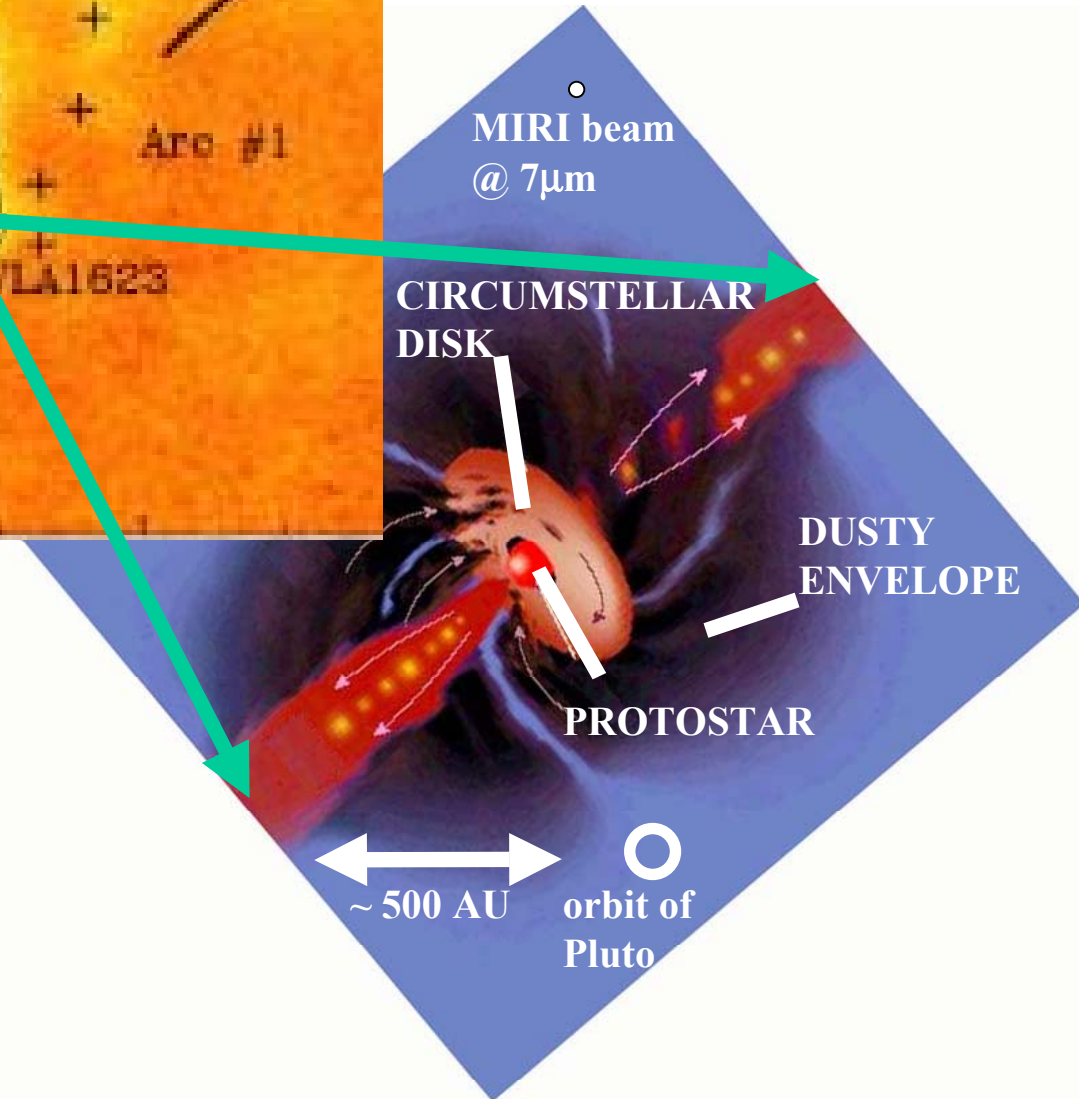




"The initial steps toward planet formation occur in the surrounding disk of material that avoids either falling into a forming star or being ejected in outflows.... JWST will penetrate the obscuration to image these disks.

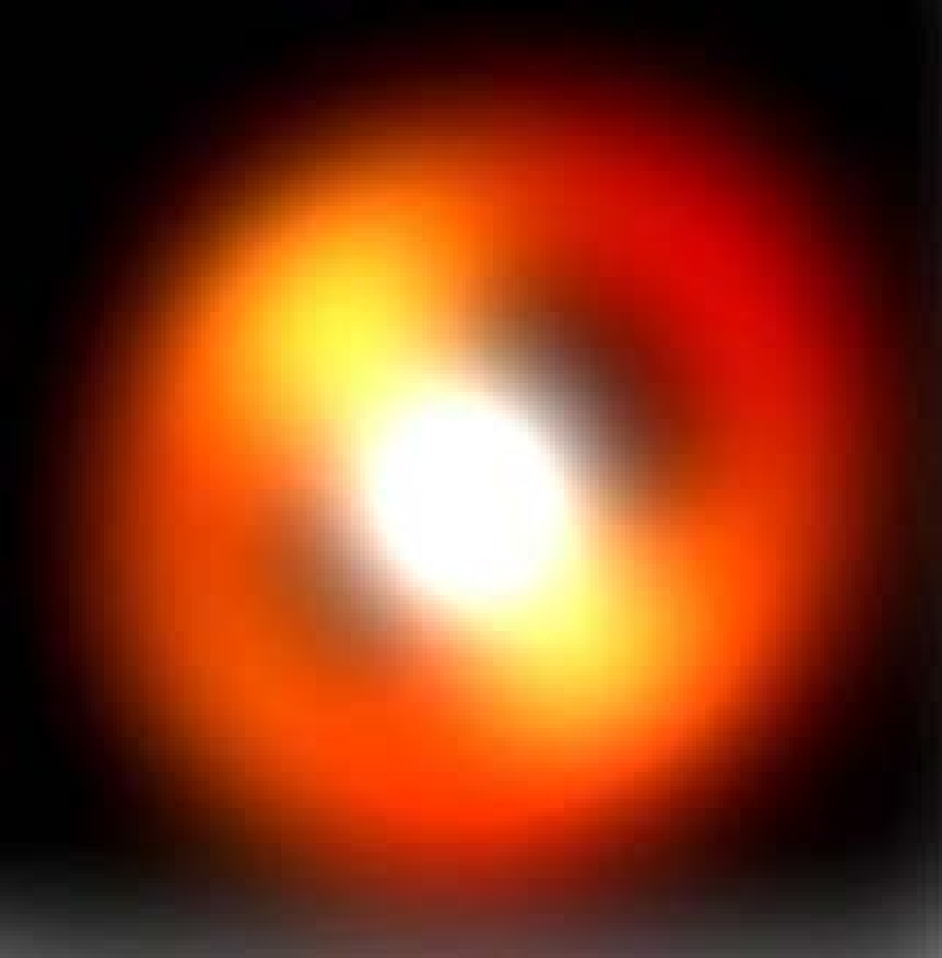


".. continuum and spectral line observations must be conducted at angular resolutions of 0.1 – 1.0 arcsec (10 – 100 astronomical units in the nearest star-forming regions)." --Origins Roadmap



**“SIRTF will give us our first hints
concerning gas and dust dispersal,**

Debris Disks



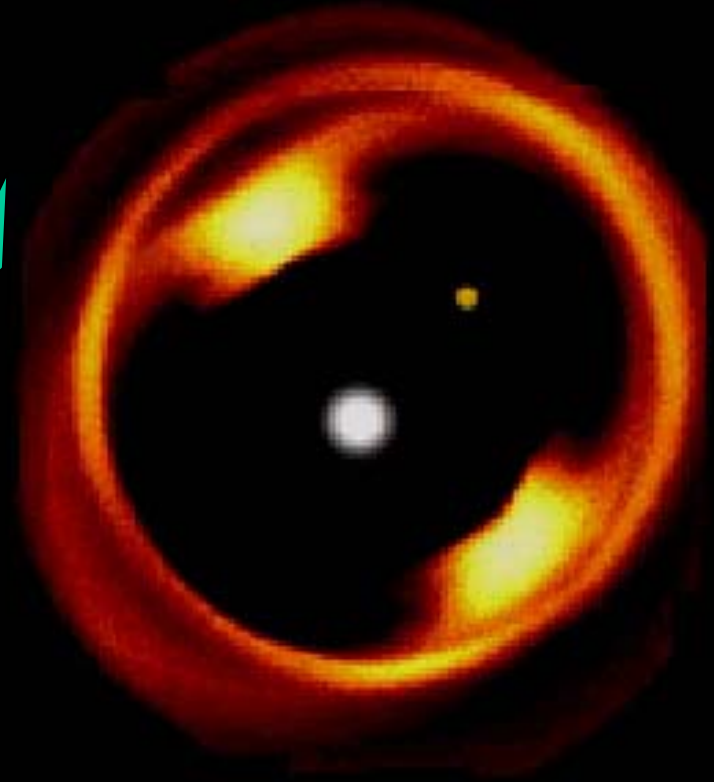
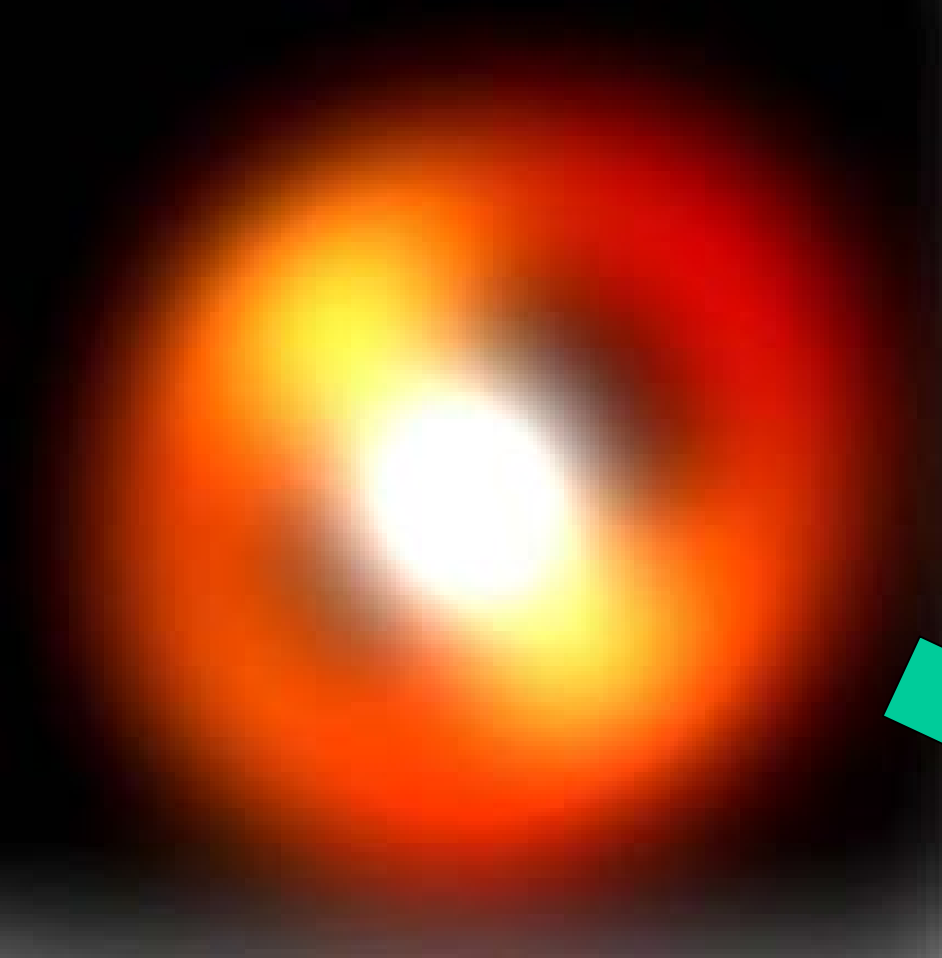
**(model of Vega system
by Wilner et al. for submm)**

“SIRTF will give us our first hints concerning gas and dust dispersal,

Debris Disks



but follow-on large space-based telescopes such as JWST and SAFIR are ideally suited to track the evolution and map the structure of vestigial debris disks around nearby main-sequence stars.” – Origins Roadmap



**(model of Vega system
by Wilner et al. for submm)**

“Our recommended large-aperture, IR-optimized space telescope will be essential for the detailed studies of the early universe at $\lambda \sim 1 - 5\mu\text{m}$. However, we also recommend that it be operated as a powerful general-purpose observatory, serving a broad range of scientific programs over the wavelength range $\lambda \sim 0.5 - 20\mu\text{m}$, the exact coverage to be determined on the basis of future technical evaluation.” – HST and Beyond

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