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Some Thoughts on the ELT

Thought 1.

- Detecting water etc in planets is hard due to Earth’s own similar bands.
- But, can correct this using the scattered starlight.

Thought 2.

- Pinning down IMF using hot brown dwarfs popular at moment.
- Although number of objects per unit mass interval (dN/dM) is roughly flat….
- Probably interested in objects per logarithmic mass interval (dN/dlogM=MdN/dM)…
- We are running out of objects.
- Should be checked.

The Provocation

- Don’t want to detect planets, need to understand them.
- Is just detecting them stamp collecting?
  - No, but do need decent samples.
- Want to watch discs forming planets.

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The Input Physics

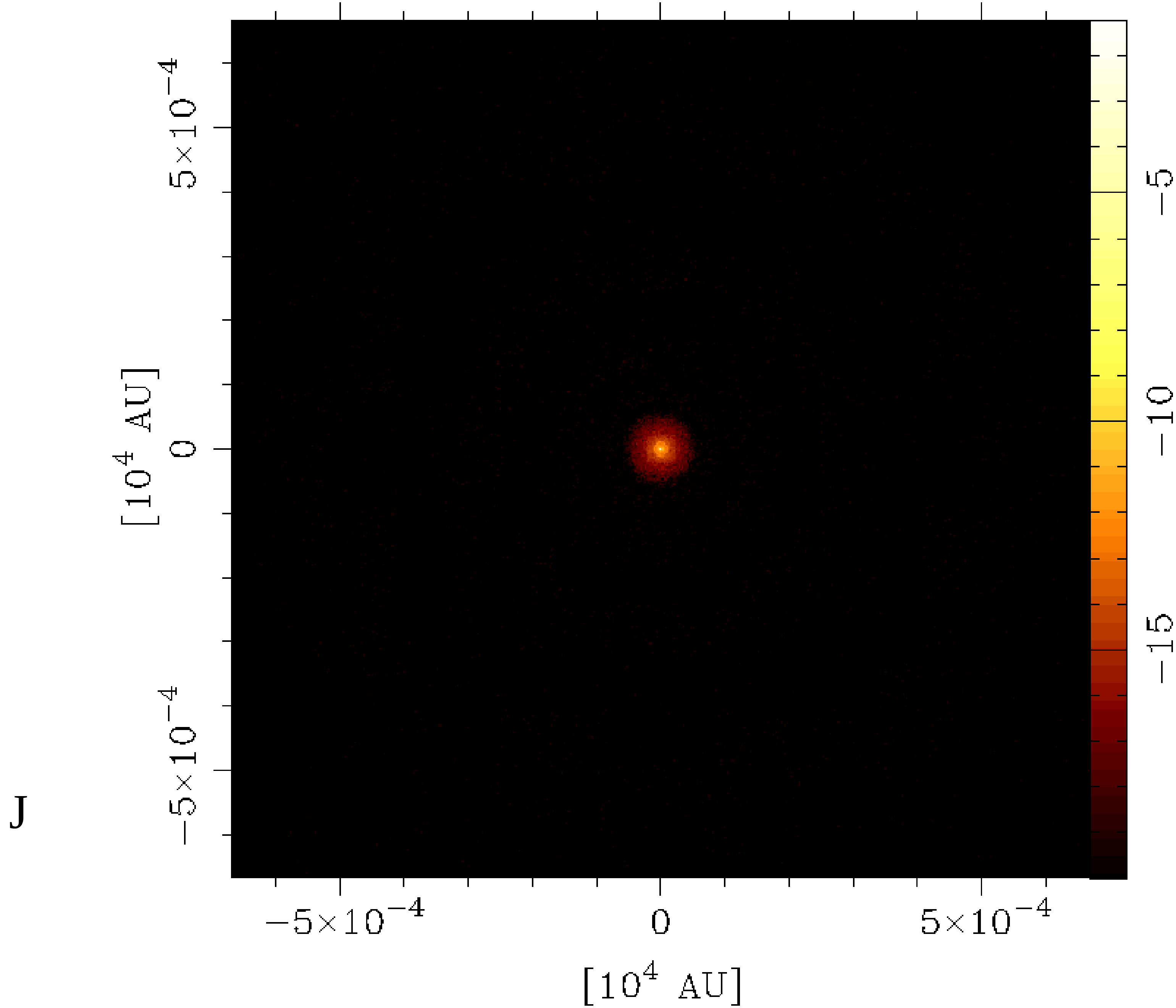
- Standard α-disc model.
- Passive – *i.e.* heated only by star.
- Basically seeing warm dust.
- Calculated by Ryuichi Kurosawa, with Tim Harries and Matthew Bate.

The Details

- The basic model used are.
  - $R_{disc(inner)} = 0.096$ AU
  - $R_{disc(outer)} = 10$ AU
  - $R_* = 1.71\ R_\odot = 1.7 \times 10^{-3}$ AU
  - $L_* = 0.273\ L_\odot$
  - $T_* = 3200$K
  - $M_* = 0.16\ M_\odot$
  - $M_{disc} = 0.01 M_*$
- $F_{disc}/F_* = 0.2$ for J band
- $F_{disc}/F_* = 0.1$ for K band

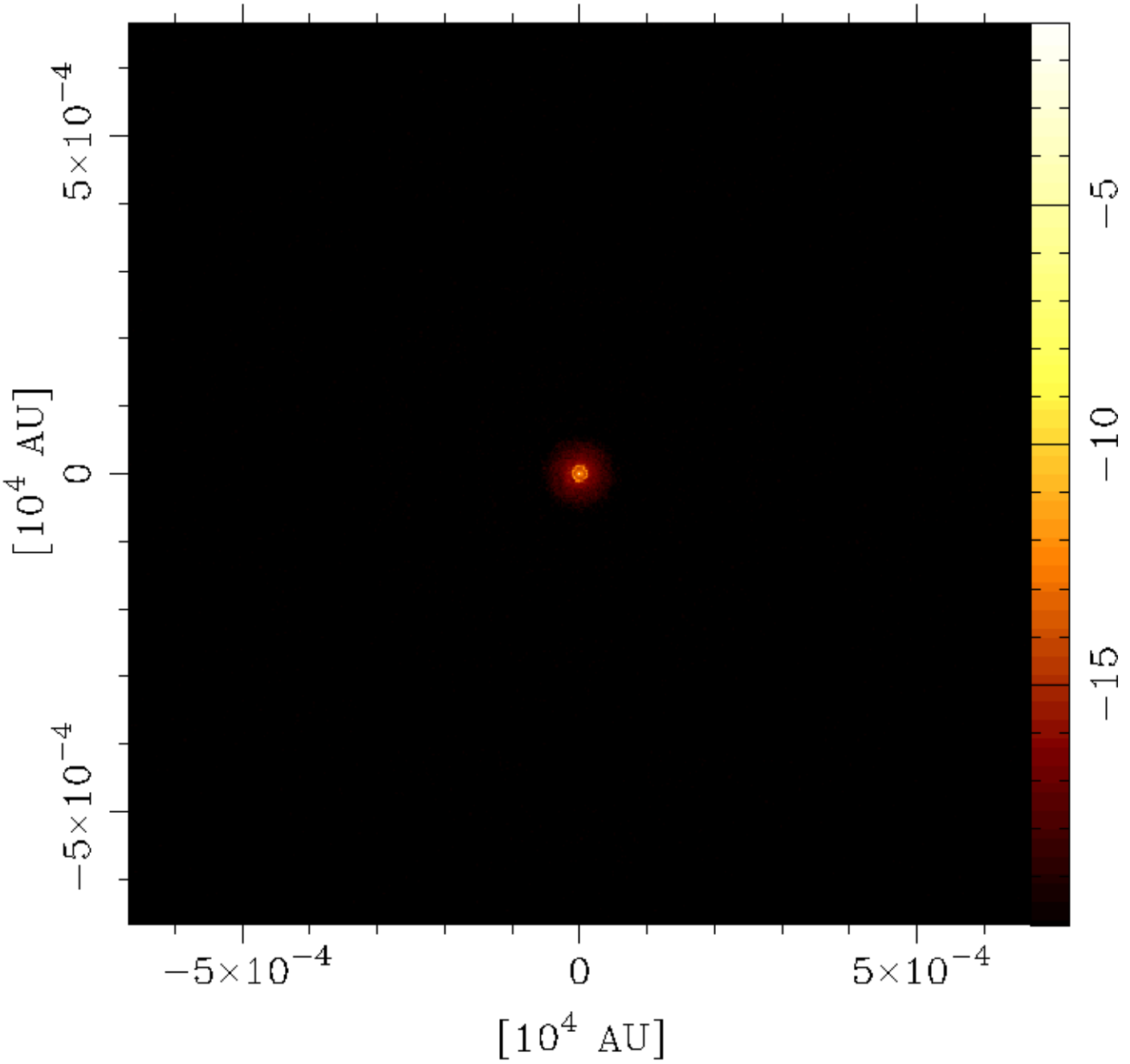
About the Images

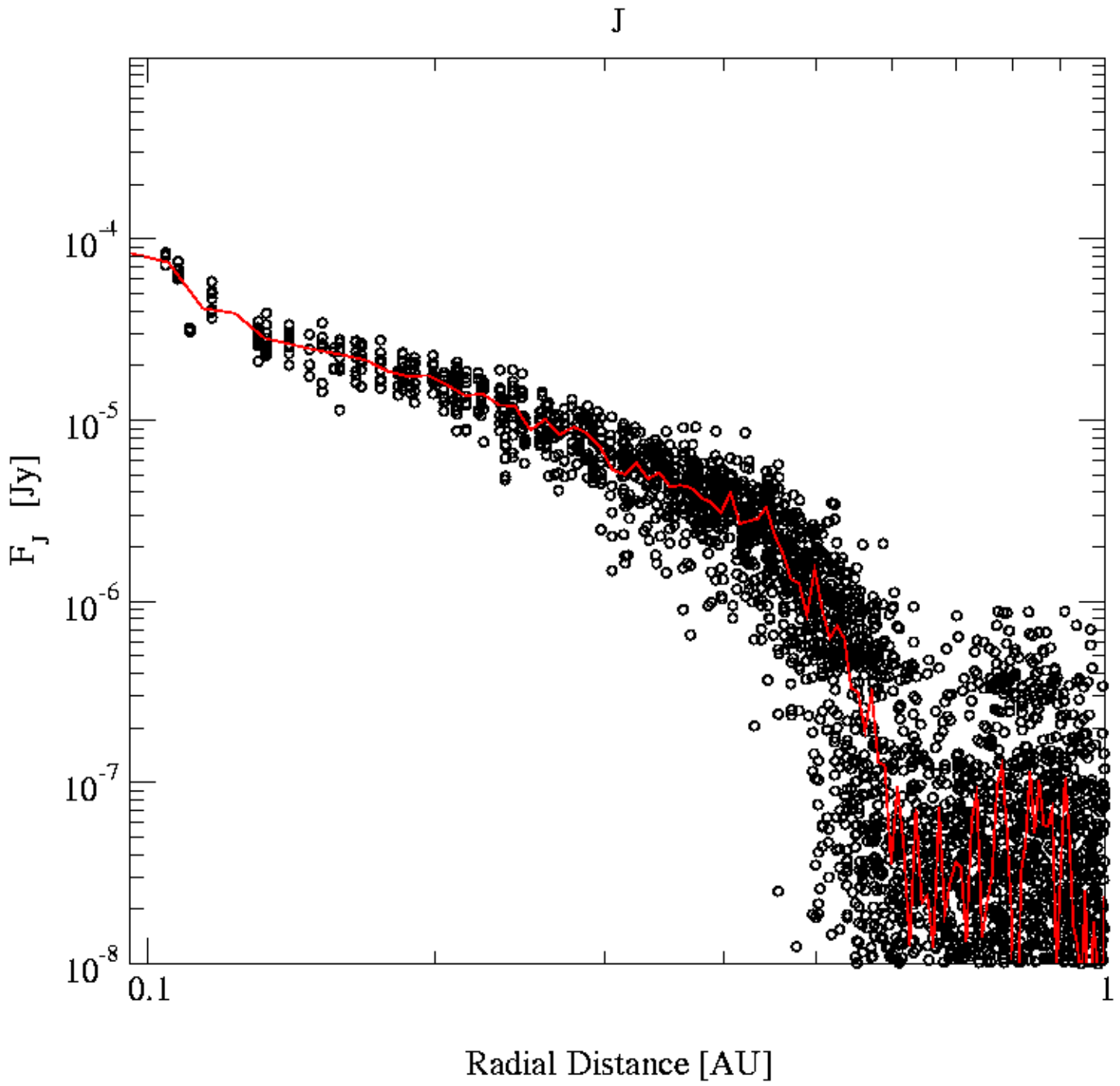
- Distance to the star = 100pc
- Images are 513 by 513 pixels
- 1 pixel = 2.5×10^{-4} arcsec = 2.5×10^{-2} AU
- Diffraction limit of 100m telescope at 2.2 microns is about 5.5×10^{-3} arcsec.
- Images are about 20 resolution elements, or 12AU/side.

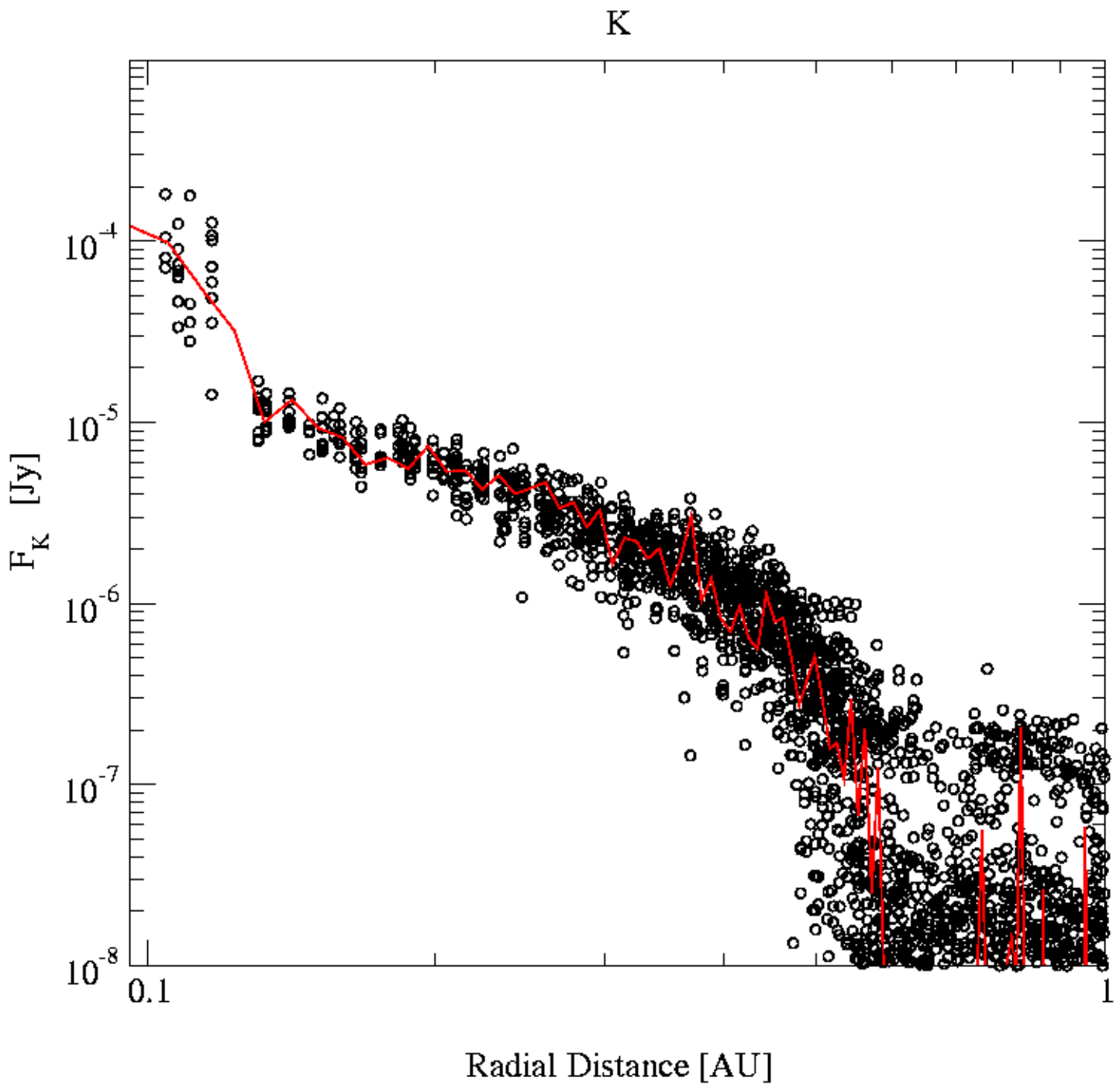


J
5×10−4
0
−5×10−4
[10 4 AU]
−5×10−4
0
5×10−4
[10 4 AU]
−5
−10
−15

K


5×10^{-4}
0
-5×10^{-4}
[10^4 AU]
-5×10^{-4}
0
5×10^{-4}
[10^4 AU]
−5
−10
−15


J
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
F_J [Jy]
0.1
1
Radial Distance [AU]


K
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
F_K [Jy]
0.1
1
Radial Distance [AU]

Conclusions

- Complex images, need filled aperture.
- Resolution is
  - OK at places like ρ Oph (100pc),
  - Excellent at TW Hyi (50pc).
- Strehl
  - looks easy, since ratio of central to scattered light is ~10.
  - But does need detailed calculation.