The Moth: An Unusual Circumstellar Structure Associated with HD 61005

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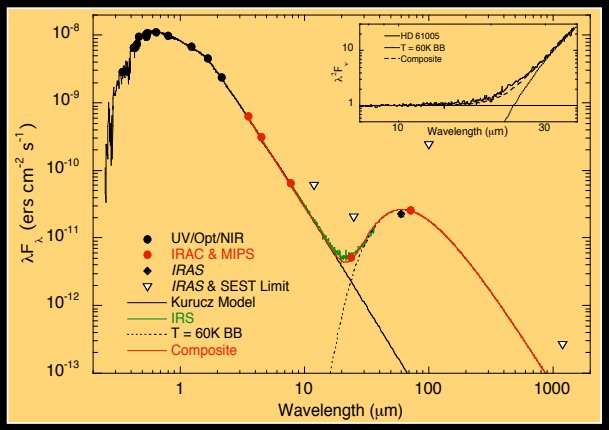
HD 61005

- FEPS *Spitzer* Legacy Science Survey (PI: M. Meyer)
  - 326 ~ 0.7-2.2 M_{sun} (F8-K0) stars
  - 3 Myrs ≤ t_{age} < 3Gyrs
  - IRAC: 3.6, 4.5 & 8μm
  - IRS: 7.2 - 35μm
  - MIPS: 24 & 70μm
- Evolutionary Status of HD 61005
  - Sp. Type = G8
  - D = 34.6 pc
  - L ≈ 0.55 L_{sun}
  - Chromospherically active; not actively accreting
  - t_{age} = 100 ± 50 Myrs
  - M ≈ 0.98 M_{sun}

Thermal Emission

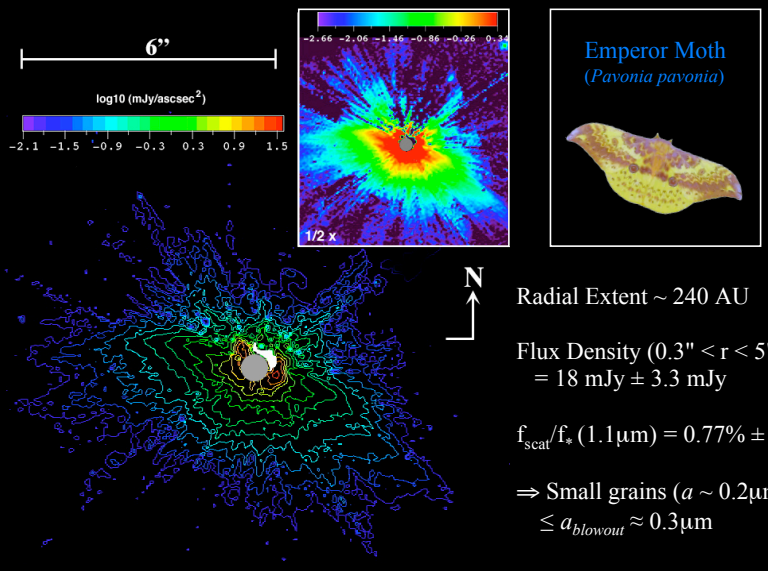


T_{BB}= 60 ± 10 K $r_{dust} \geq$ 13 AU $L_{IR}/L_* = 2x10^{-3}$

No obvious solid state dust features in spectrum

Most IR luminous detection for age in FEPS sample!

NICMOS Coronagraphic Image



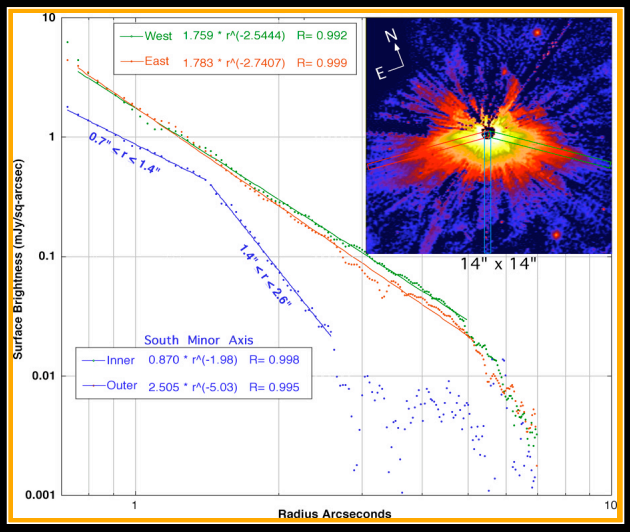
Radial Extent ~ 240 AU

Flux Density (0.3" < r < 5")
= 18 mJy ± 3.3 mJy

f_{scat}/f_* (1.1μm) = 0.77% ± 0.17%

⇒ Small grains (a ~ 0.2μm)
≤ $a_{blowout}$ ≈ 0.3μm

Radial Profiles



Why is the "disk" warped?

Why is the "disk" so bright?

Interaction with ISM?

- *UVW* motion ≈12 km/s in "head" direction
- Ram Pressure

$$\frac{z}{r} = f \sim 10^{-4} \left(\frac{n}{cm^3}\right) \left(\frac{r}{100AU}\right)^2 \left(\frac{1um}{a}\right) \left(\frac{v}{10km/s}\right)^2$$

  - $f \sim 0.3$ observed at r ~ 200 AU
  - If $n = 100$ cm^{-3}, $a \sim 0.1\mu$m, smaller than $a_{blowout}$ and consistent with NIR scattering constraints

- Bondi-Hoyle (BH) Accretion?
  - $r_{BH} \sim 15$ AU
  - Balancing the BH accretion rate with blowout rate at r_{BH} yields $L_{IR}/L_* \sim 10^{-3}$, consistent with the observed value
  - ***Bright "Debris" Signature Caused by Interaction with Local ISM?***