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The circumstellar matter distribution of the proto-typical MYSO GL 2591

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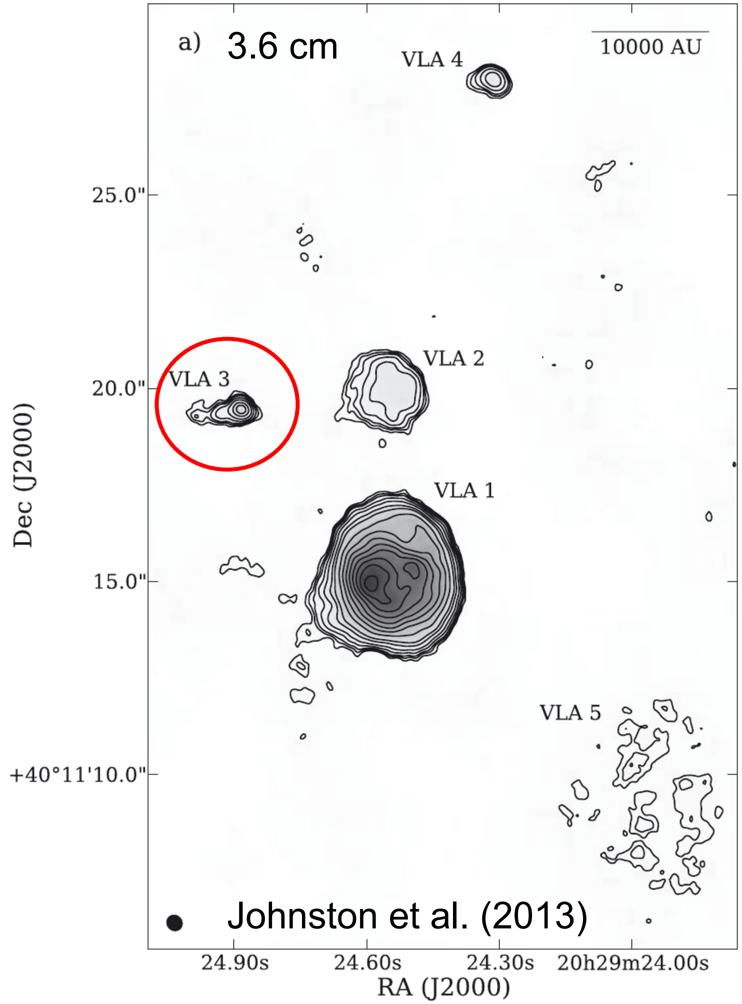
GL 2591

VLA 3: Proto-typical MYSO with jet

Distance[†]: 3.3±0.1 kpc

Luminosity[*]: $2\times10^5\ L_\odot$

Stellar mass[*]: 20-40 $M_\odot$



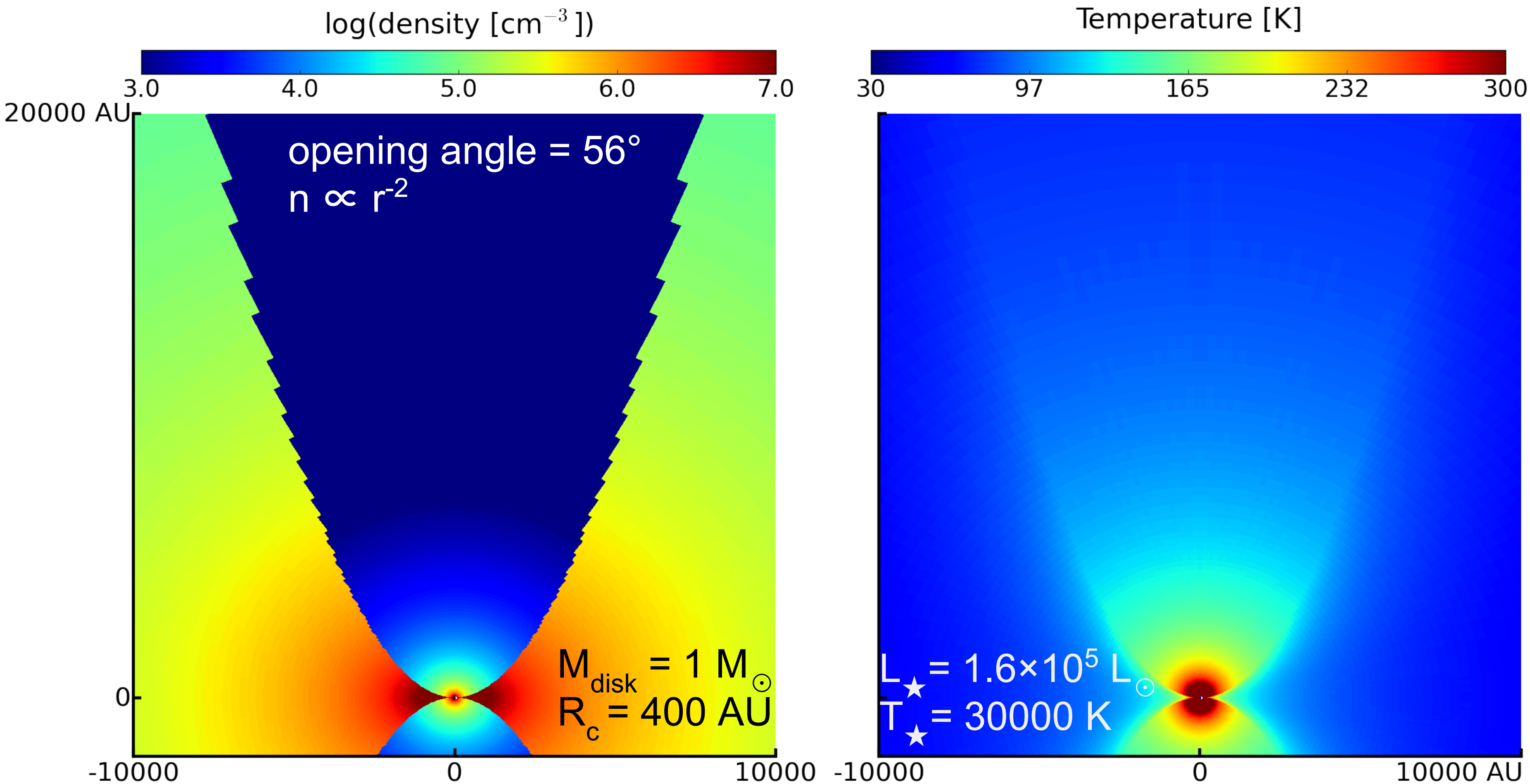
Other sources identified in the region (Trinidad et al. 2003): VLA1 & VLA2: HII regions

[†]Rygl et al. (2012)

[*]Sanna et al. (2012)

Radiative transfer model

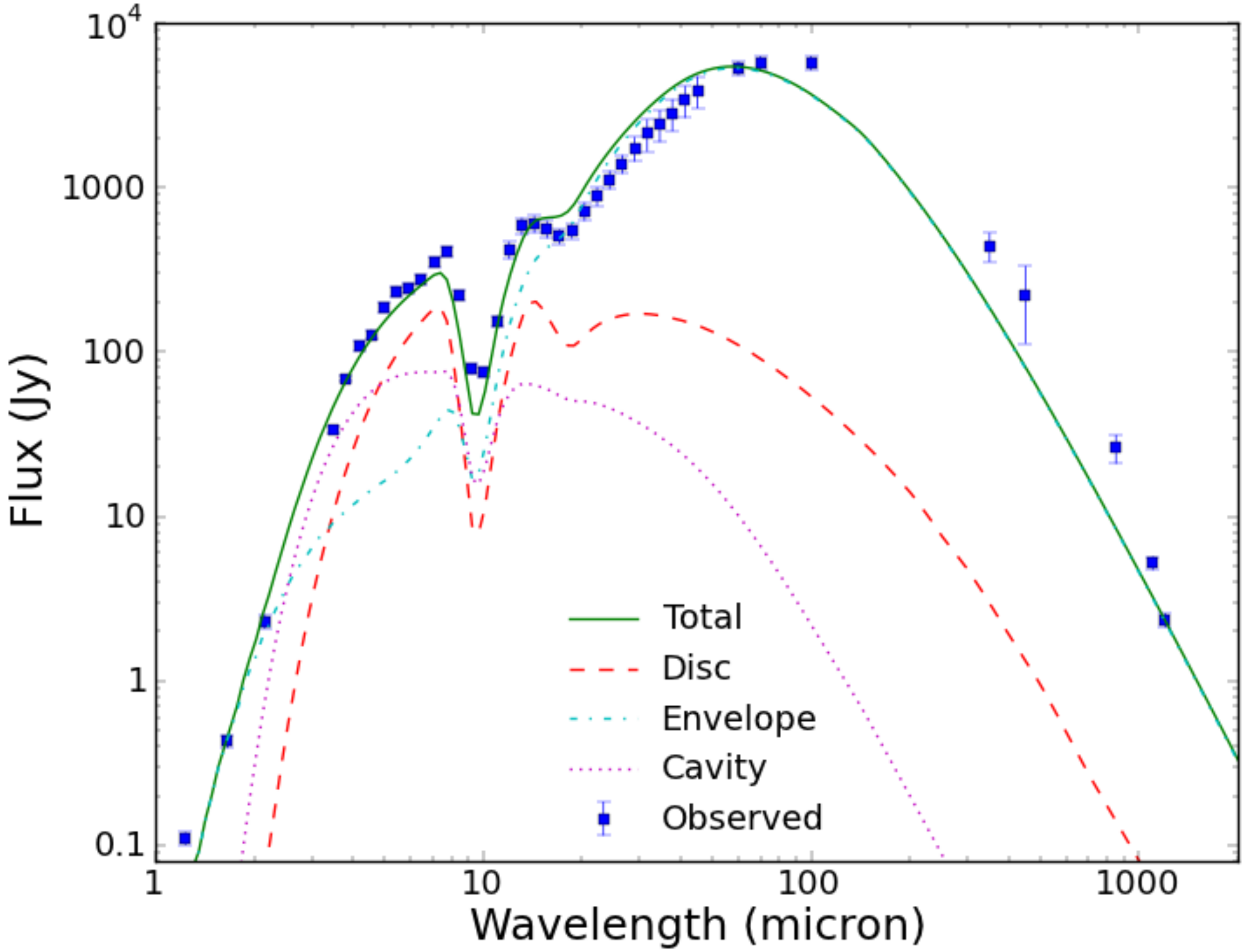
Rotationally flattened envelope (Ulrich 1976) + paraboloidal bipolar cavities + flared disk with the RT code Hyperion (Robitaille 2011)



$\dot{M}_{env} = 1.2\times10^{-3}\ M_\odot\ yr^{-1}$ for $M_\star = 40\ M_\odot$, $R_{out} = 2.1\times10^5$ AU

Results: SED

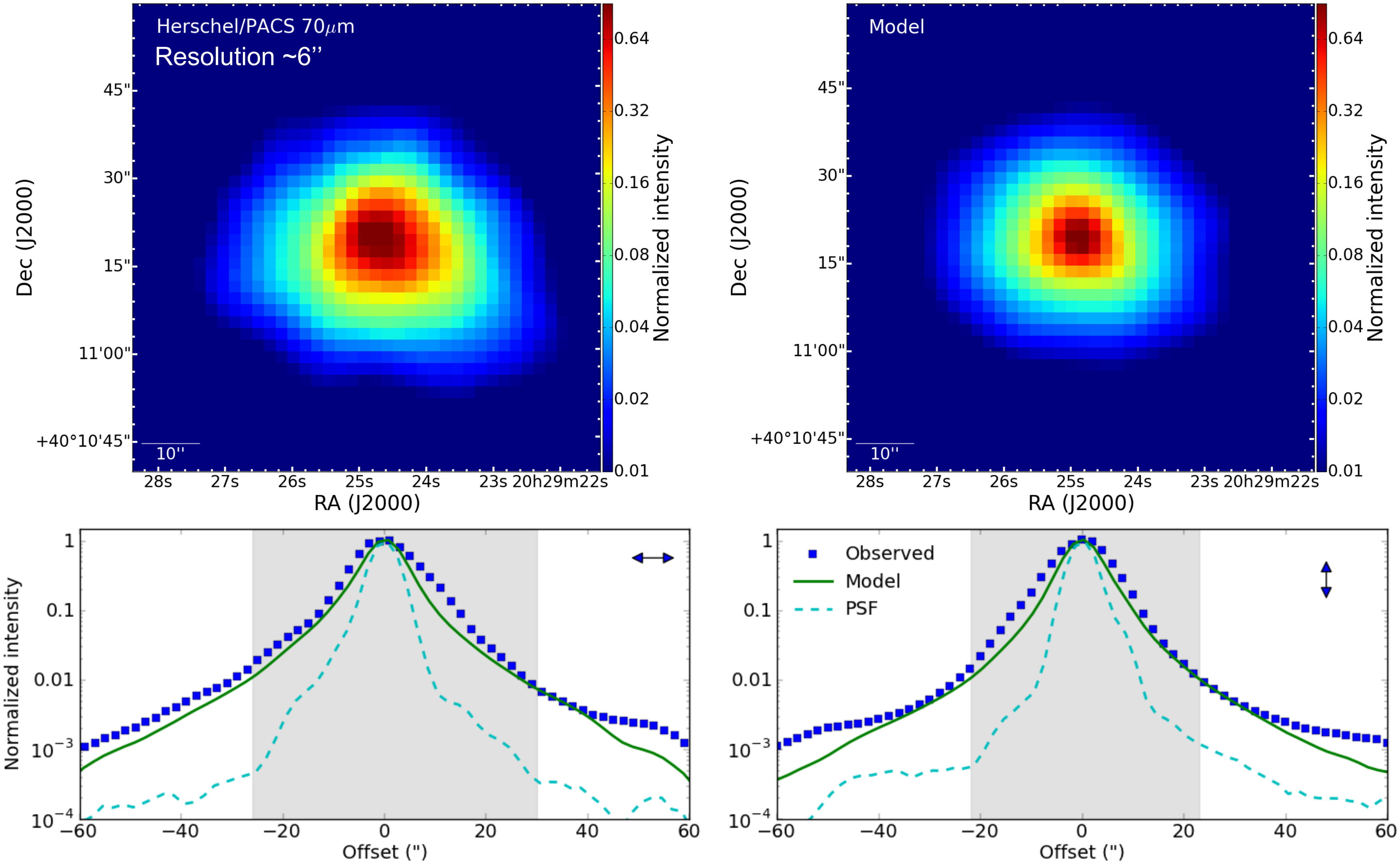
Viewing angle = 30°



Dust:

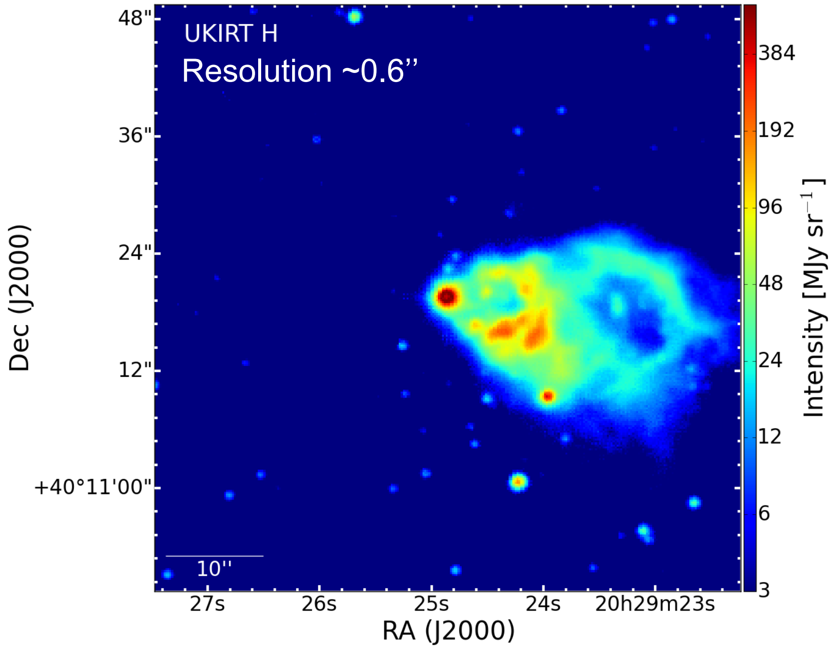
Envelope & cavities:
Kim et al. (1994)

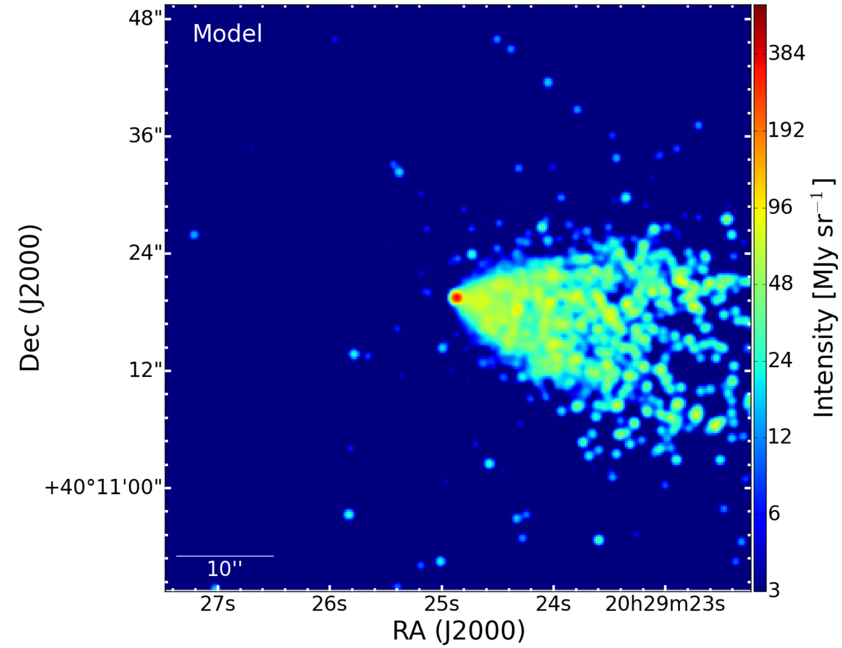
Disk: (de Wit et al. 2010)
warm silicates
(Ossenkopf et al. 1992) +
MRN amorphous carbon



Extended emission along the cavity is well reproduced

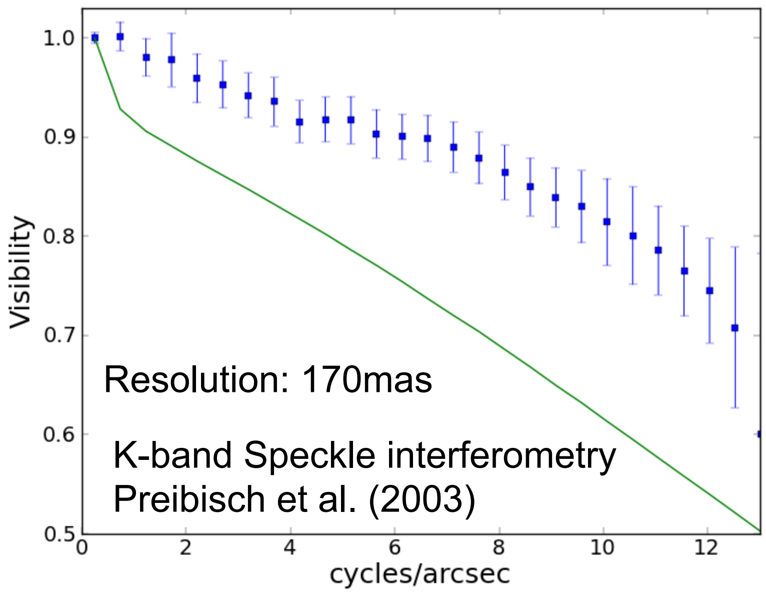
70 microns HOBYS (Motte et al. 2010)



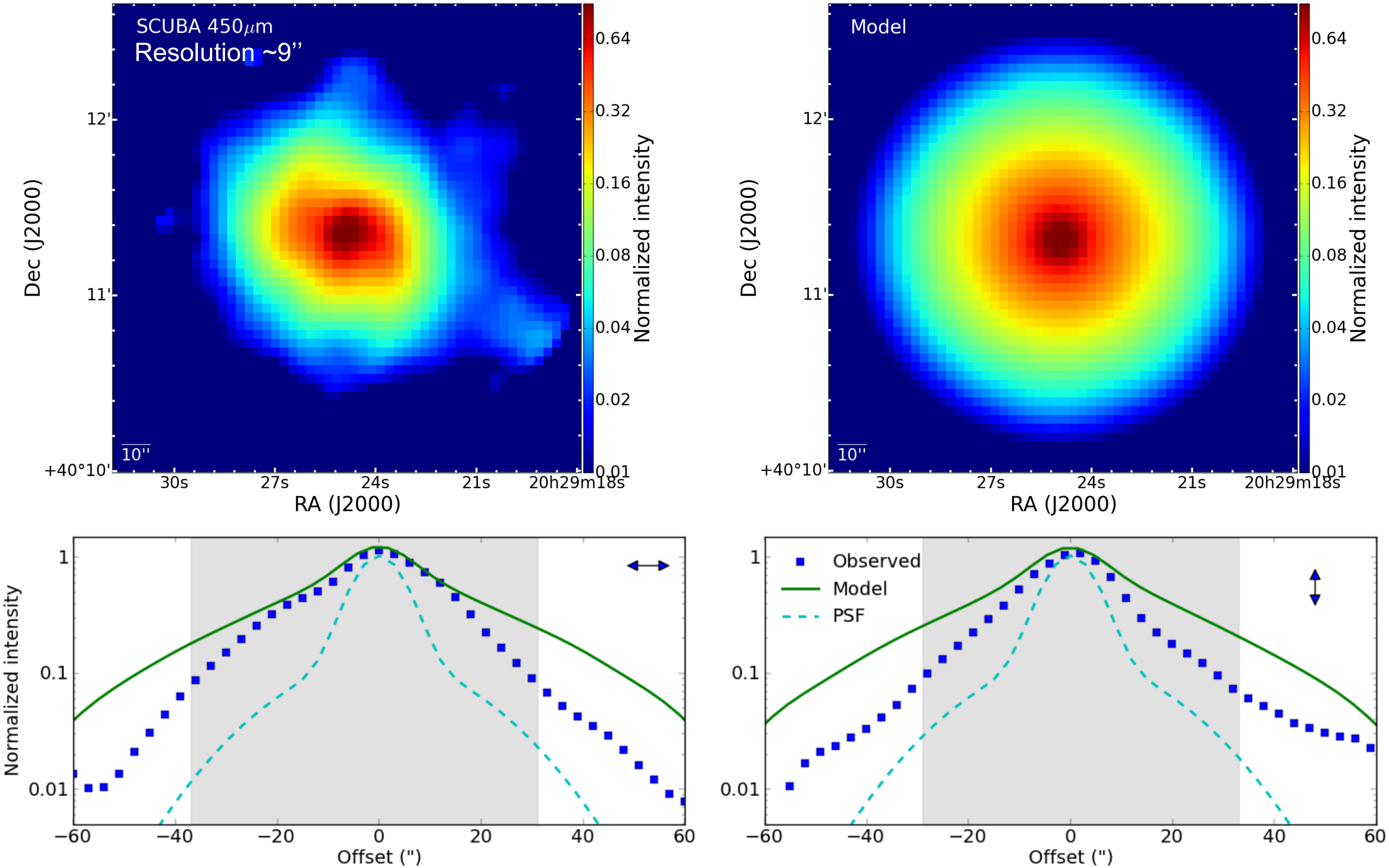


Opening and inclination angles are well constrained

Partially resolved inner region not well fit

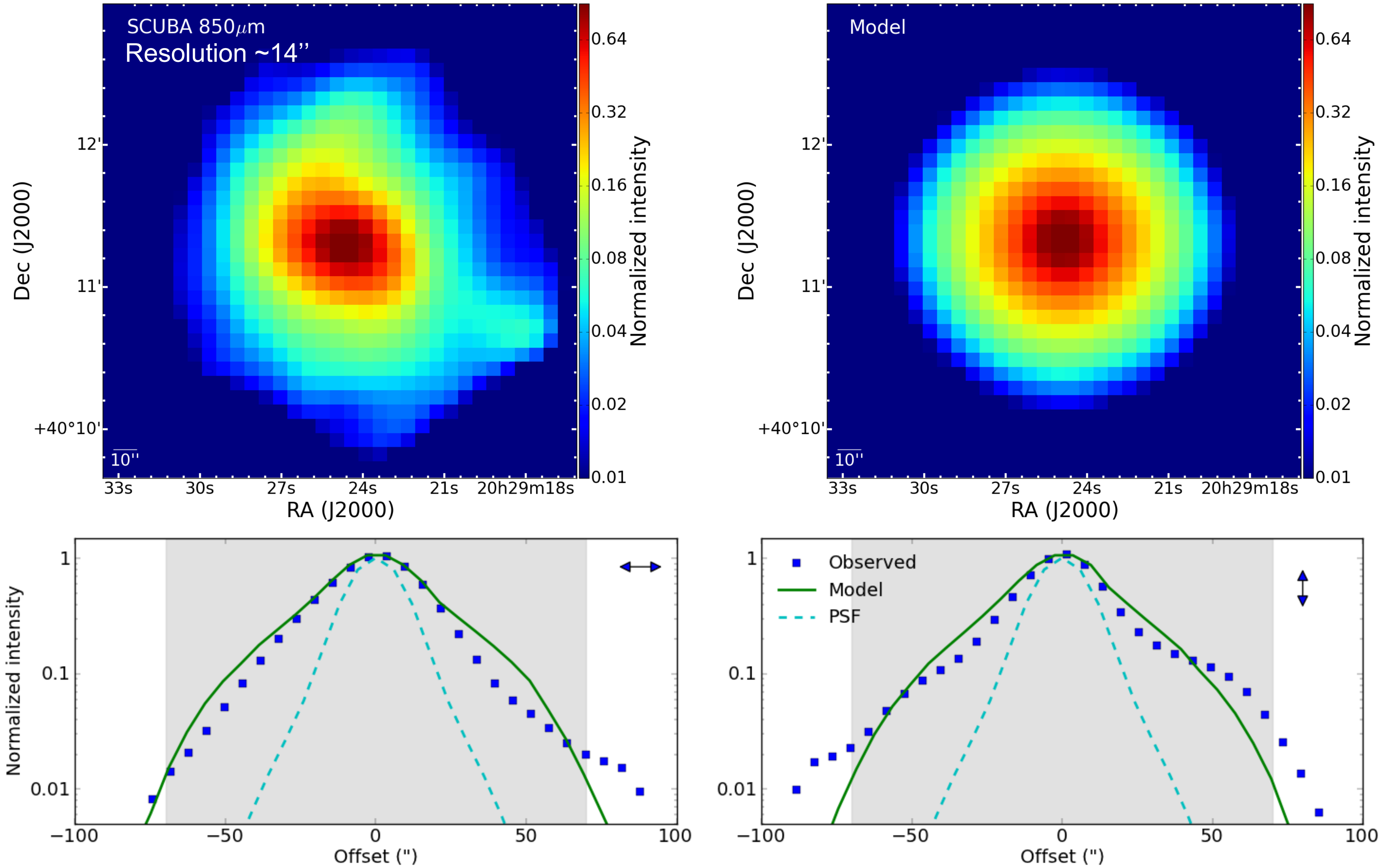


Near-IR



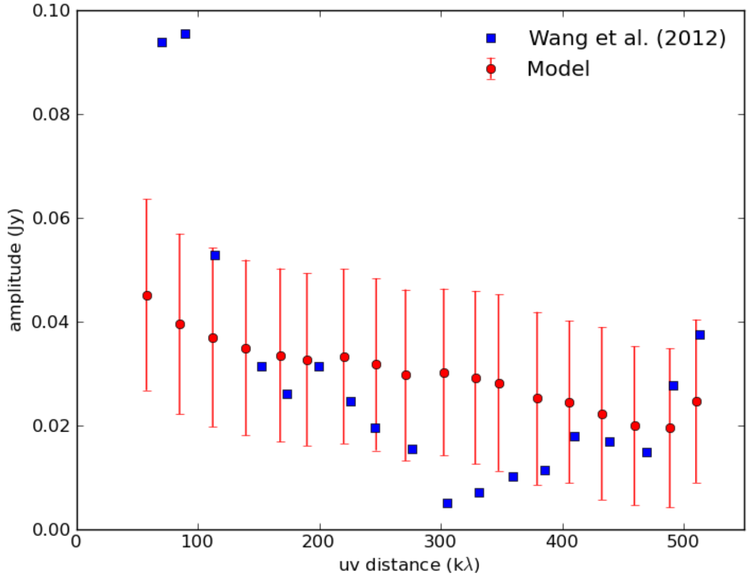
Elongation is not reproduced at 450 microns.

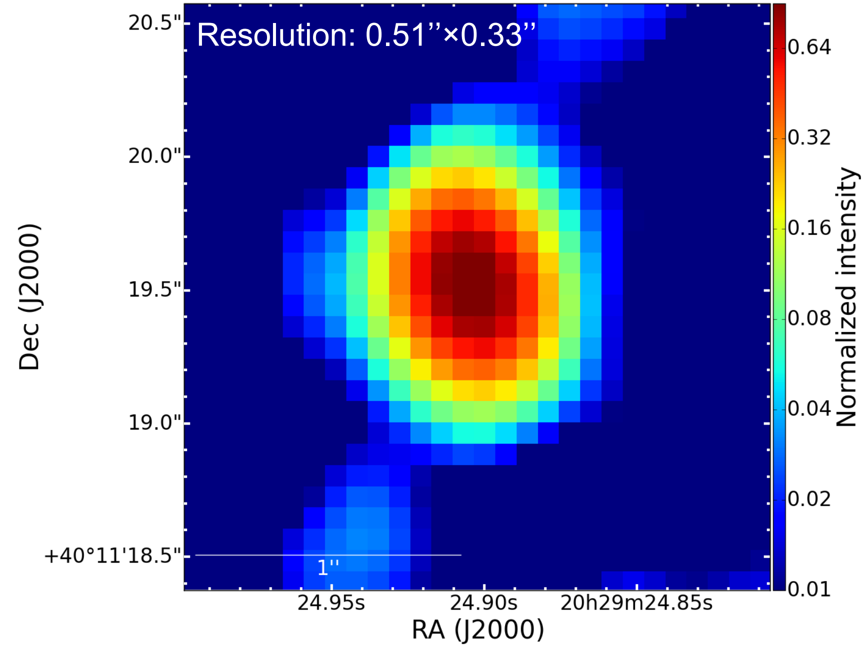
Sub-mm



SCUBA 850μm
Resolution ~14''
Model
Dec (J2000)
RA (J2000)
Normalized intensity
Observed
Model
PSF
Offset (")

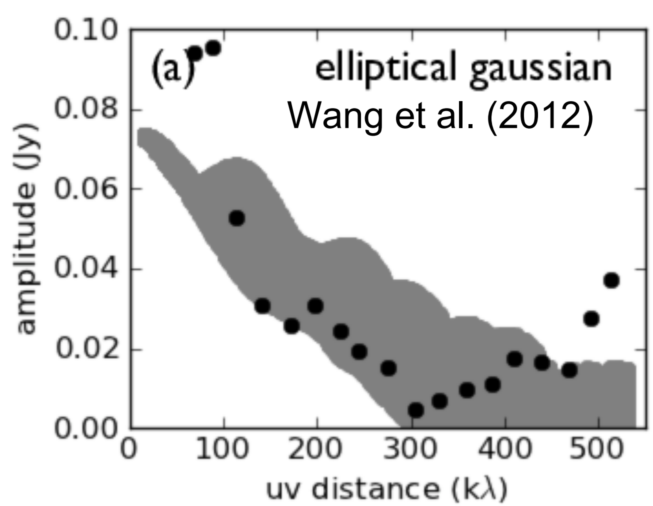
Sub-mm

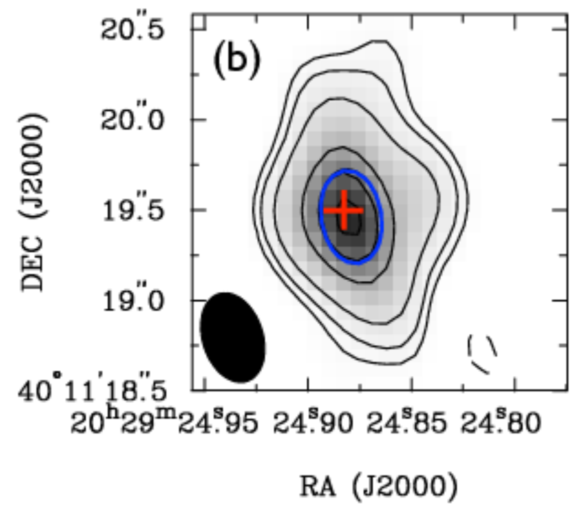




Consistent with emission from a disk

$M_{disk} = 1\ M_{\odot}$
$R_c = 400$ AU

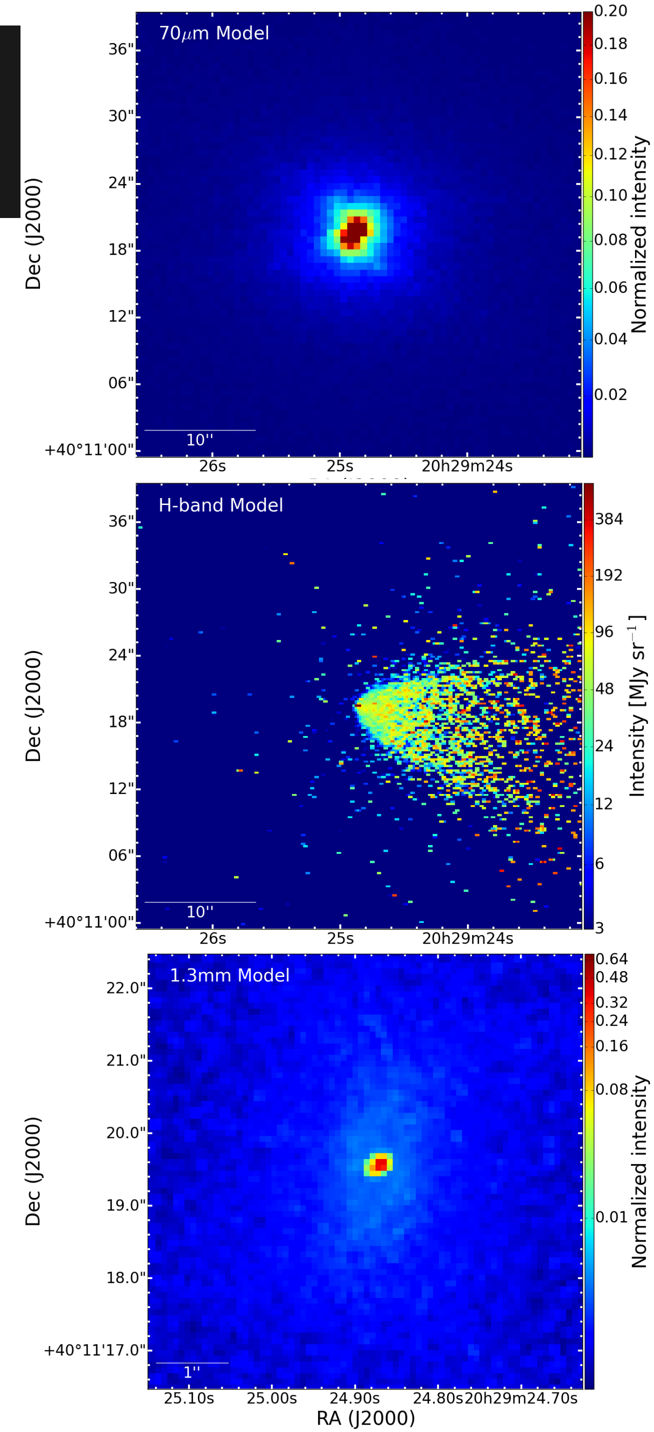




PdBI 1.3 mm continuum

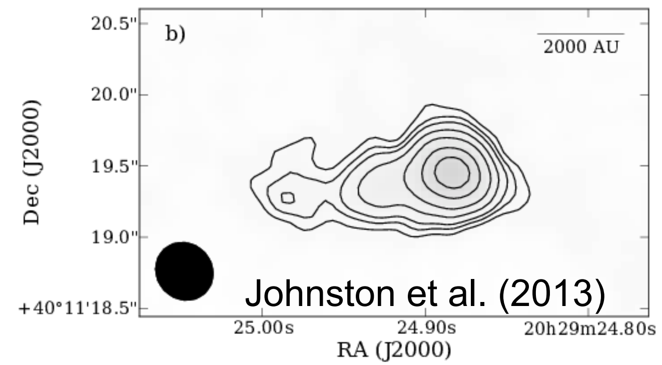
Conclusions

- Resolved 70 microns observations show extended emission along the cavity of GL 2591
- The geometry of the source is well constrained by models with an extended envelope + bipolar cavity
- An inner disk may explain the small scale emission observed at 1.3mm and K band emission



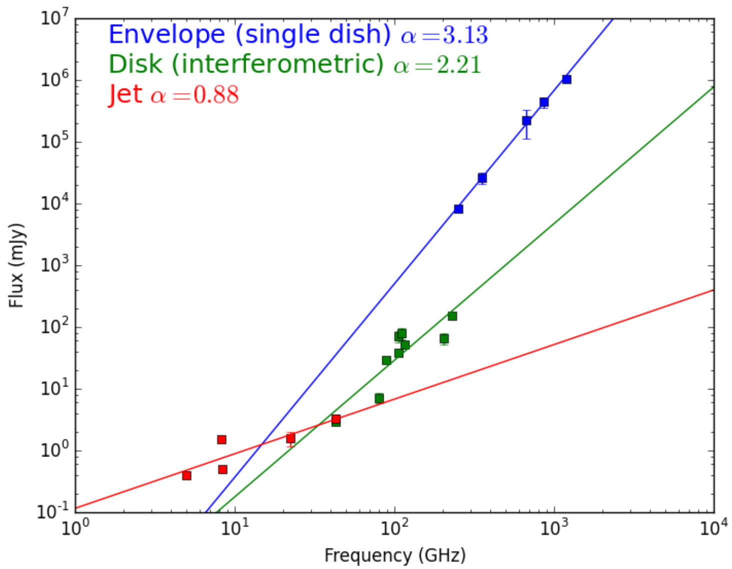
Future work

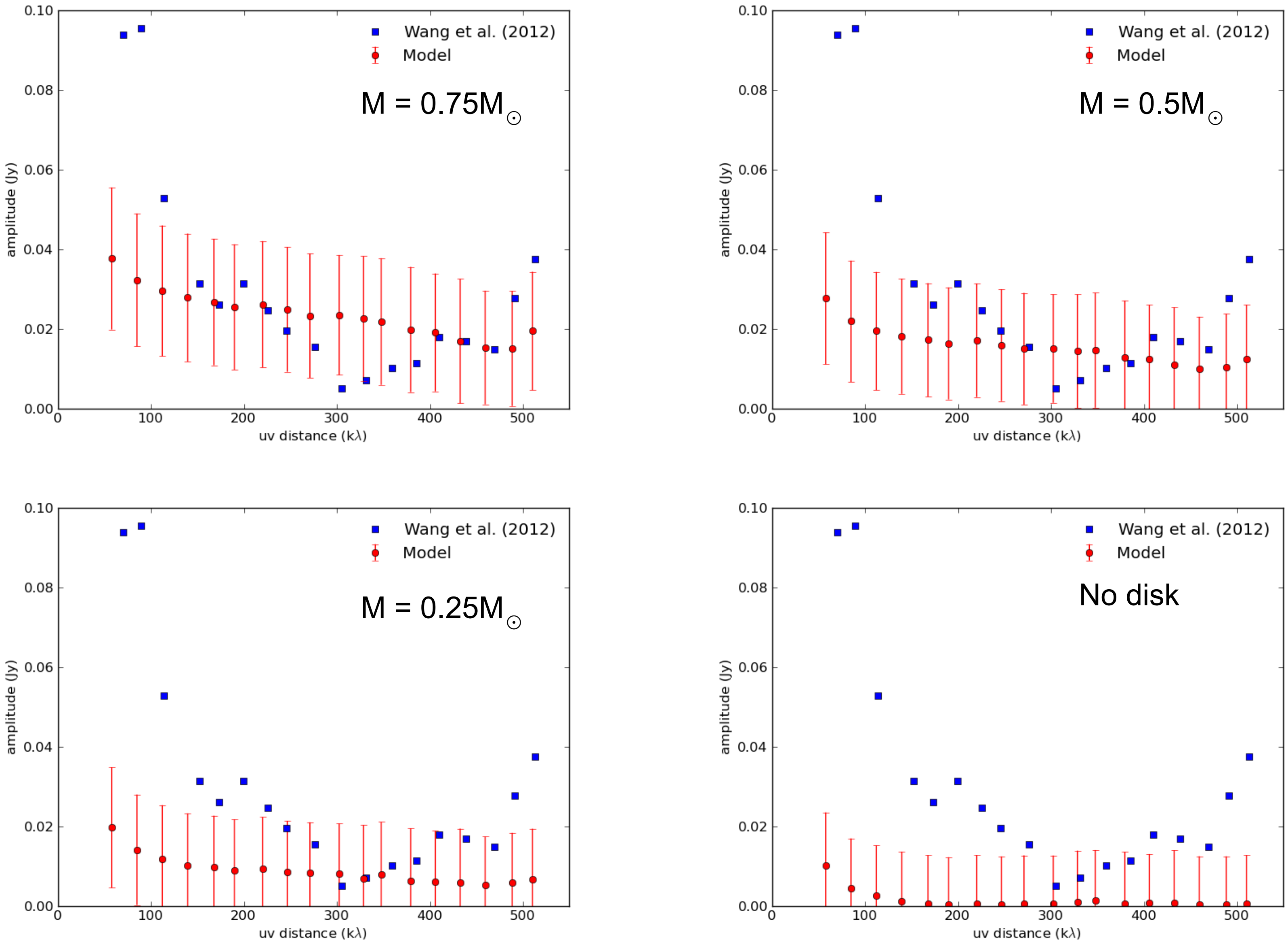
Kinematics: line radiative transfer with LIME (Brinch & Hogerheijde 2010)



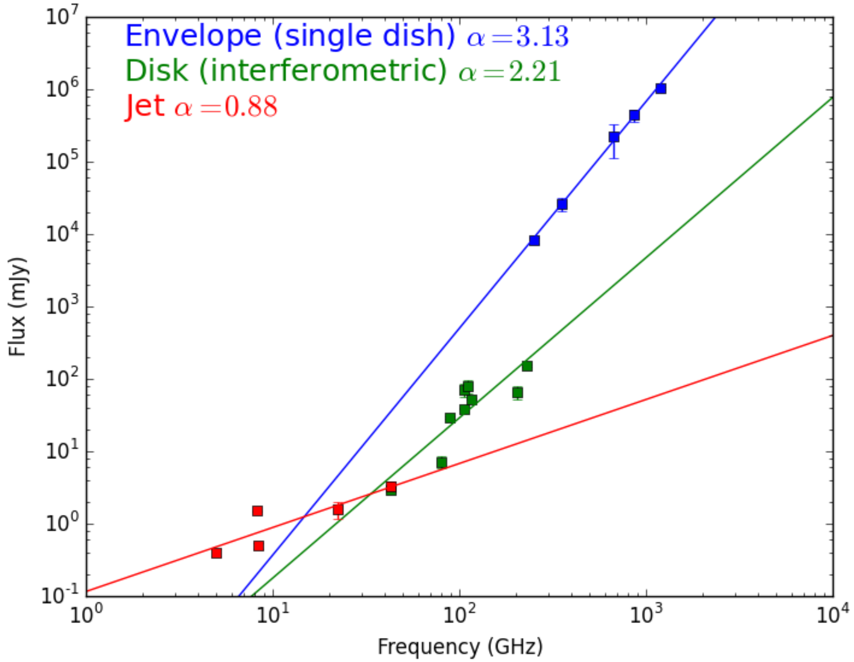
High resolution images of the jet with e-Merlin (~40mas resolution)

Hint of dust grain growth (e.g. Maud et al. 2013)

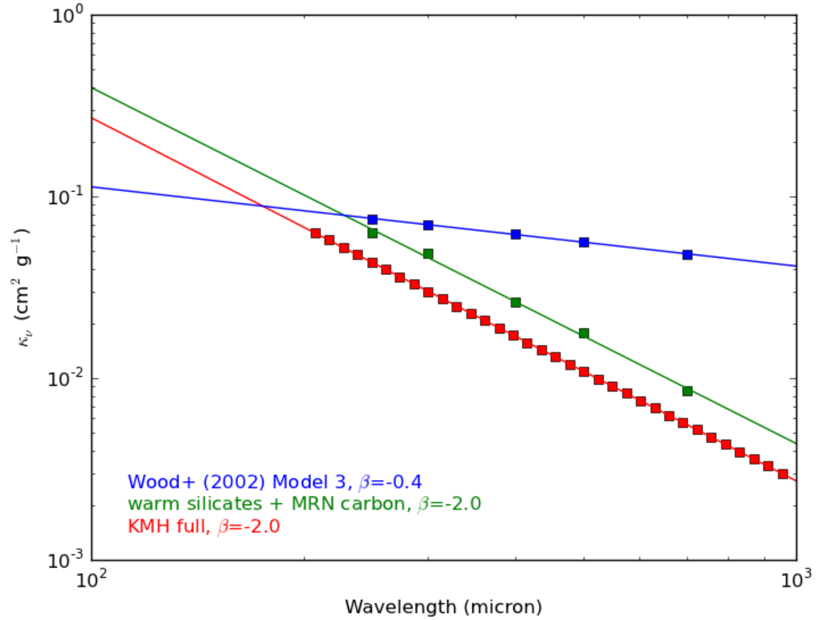



Wang et al. (2012)
Model
M = 0.75M$_\odot$
M = 0.5M$_\odot$
M = 0.25M$_\odot$
No disk
amplitude (Jy)
uv distance (kλ)
0.00
0.02
0.04
0.06
0.08
0.10
0
100
200
300
400
500

1.3 mm



Envelope (single dish) $\alpha = 3.13$
Disk (interferometric) $\alpha = 2.21$
Jet $\alpha = 0.88$
Flux (mJy)
Frequency (GHz)



Wood+ (2002) Model 3, β=-0.4
warm silicates + MRN carbon, β=-2.0
KMH full, β=-2.0
κ_ν (cm^2 g^{-1})
Wavelength (micron)

Dust