

SUBLIMATION FRONTS IN THE HIGHLY INCLINED DISK OF THE T-TAURI STAR SU AURIGAE



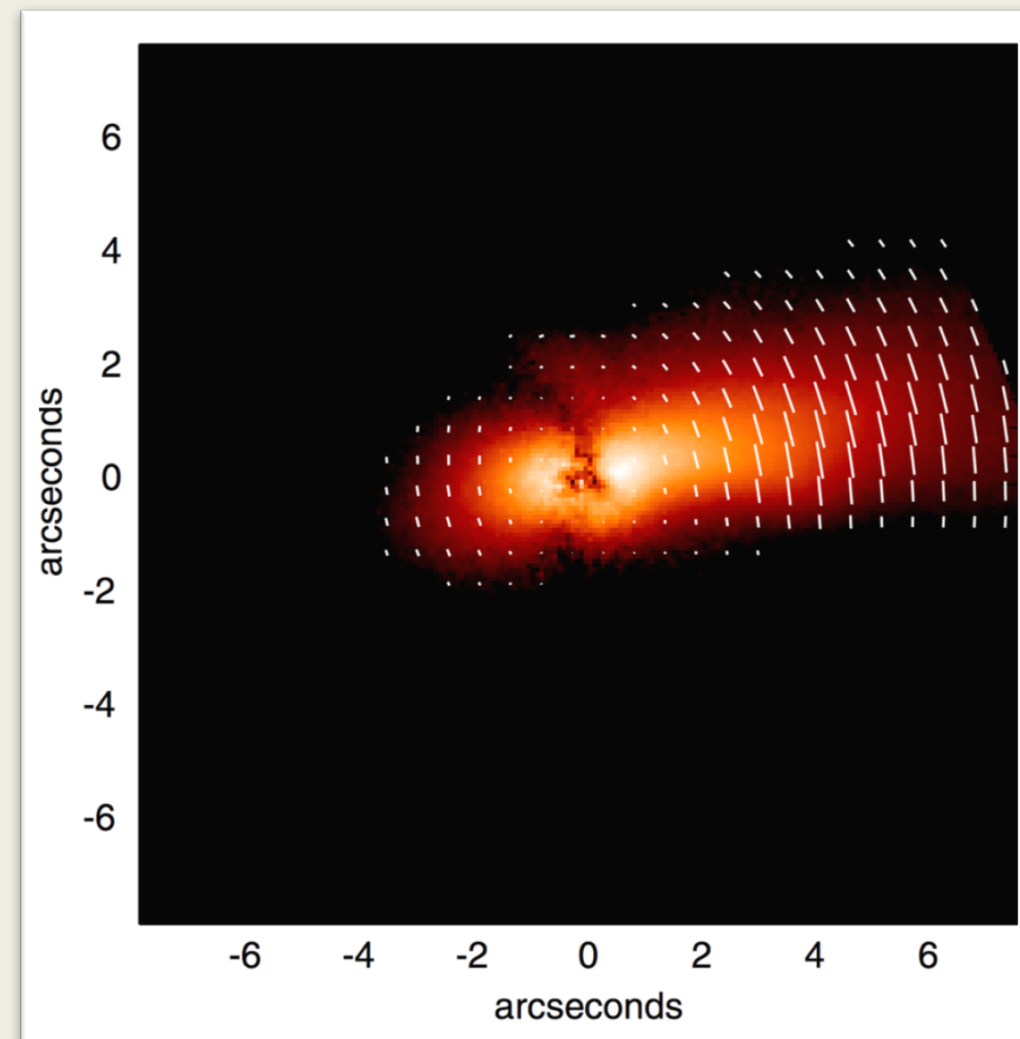
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CHARA MEETING 2018 – PARIS, FRANCE – MARCH 13TH 2018

What is Su Aurigae?

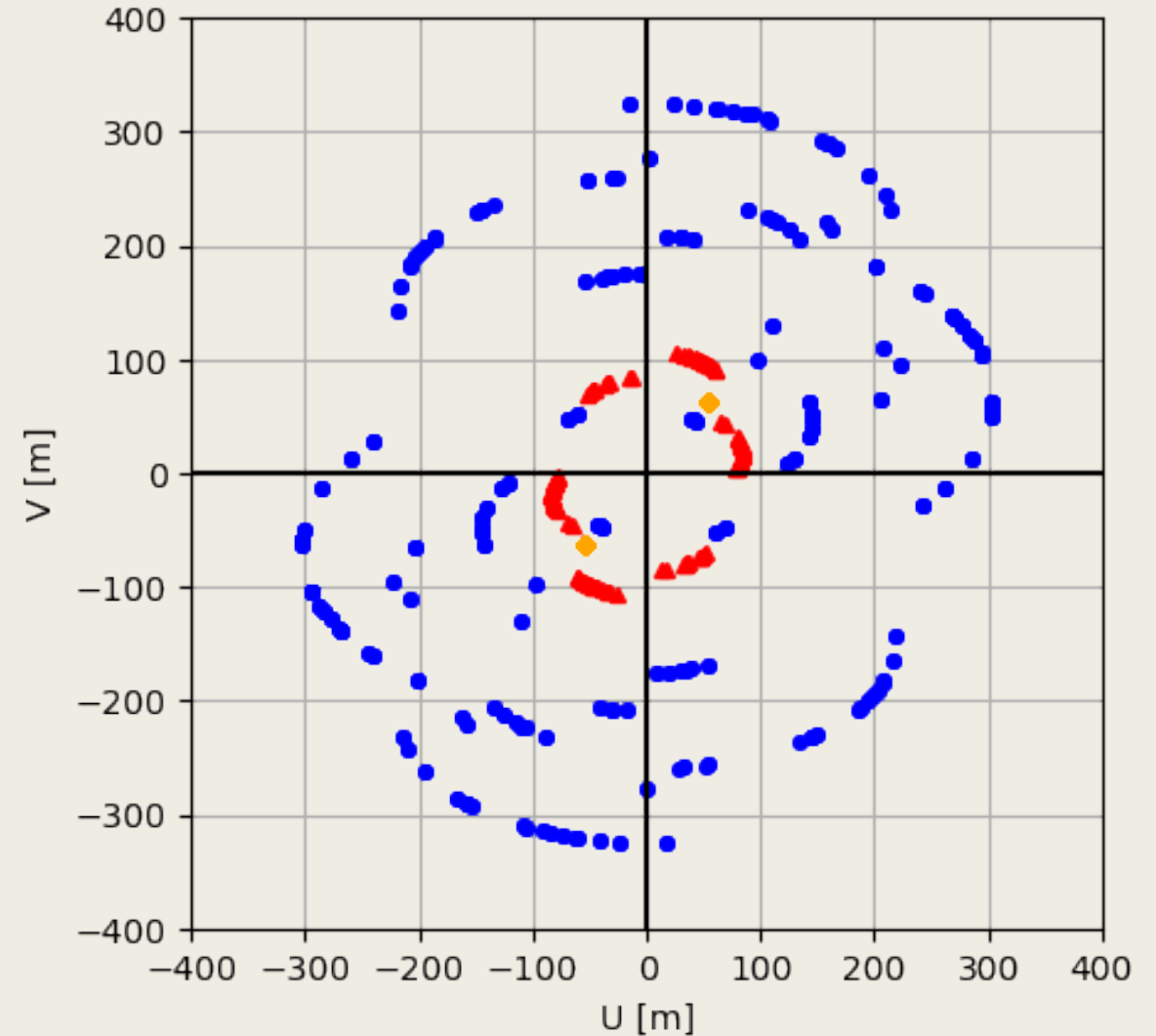
- Young Stellar Object in Auriga
- T-Tauri star surrounded by protoplanetary disk
- Part of CLIMB/CLASSIC YSO survey of 36 objects

Parameter	Value
RA (J2000)	04 55 59.39
Dec (J2000)	+30 34 01.50
Mass	2.0 M_{\odot}
Sp. Type	G2 IIIe
Distance	143 Pc
Radius	3.5 R_{\odot}
K_{mag}	5.99
T_{eff}	5860 K

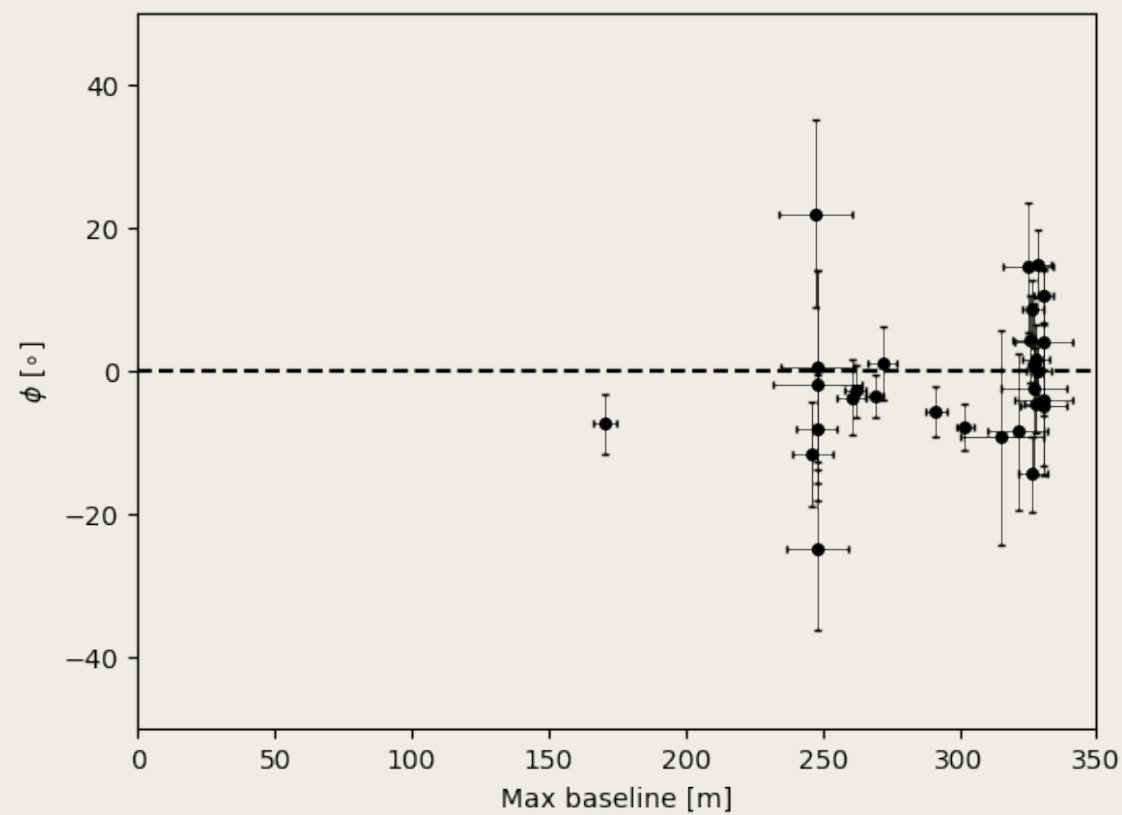
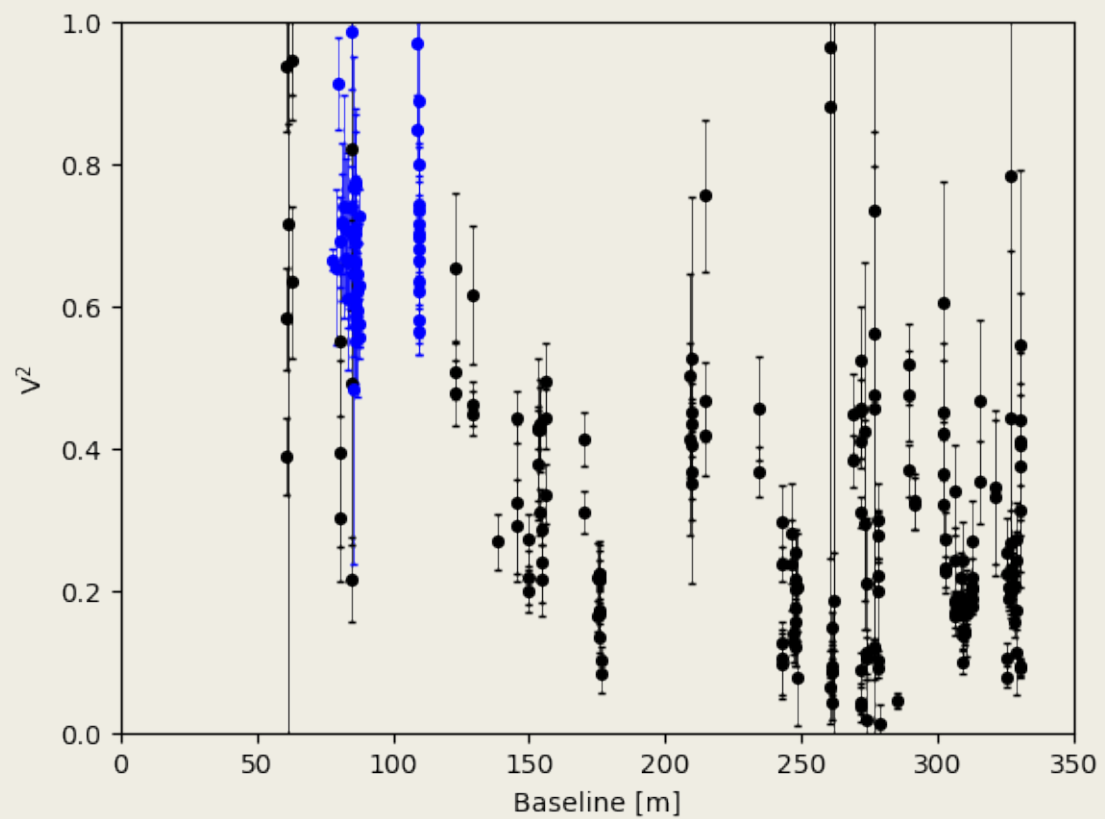


Observations

- CHARA/CLIMB - 2010 to 2014 ●
- PTI - 1999 to 2004 ▲
- Keck - 2011 ◆

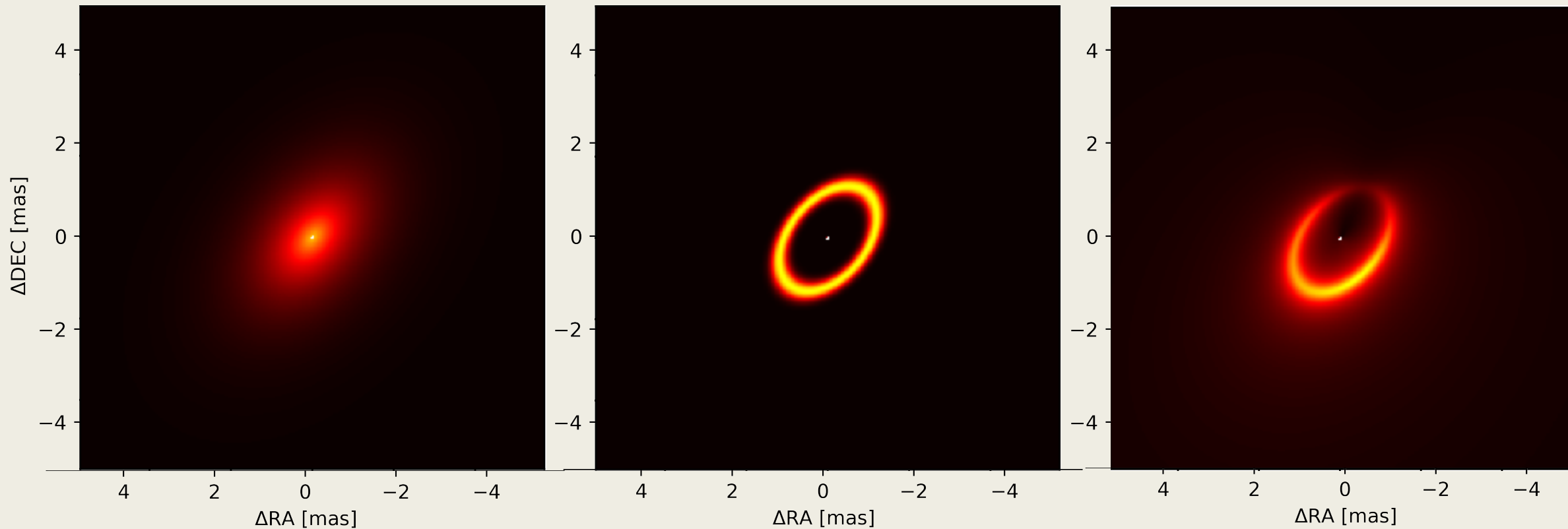


The Data



Geometric Modelling: RAPIDO

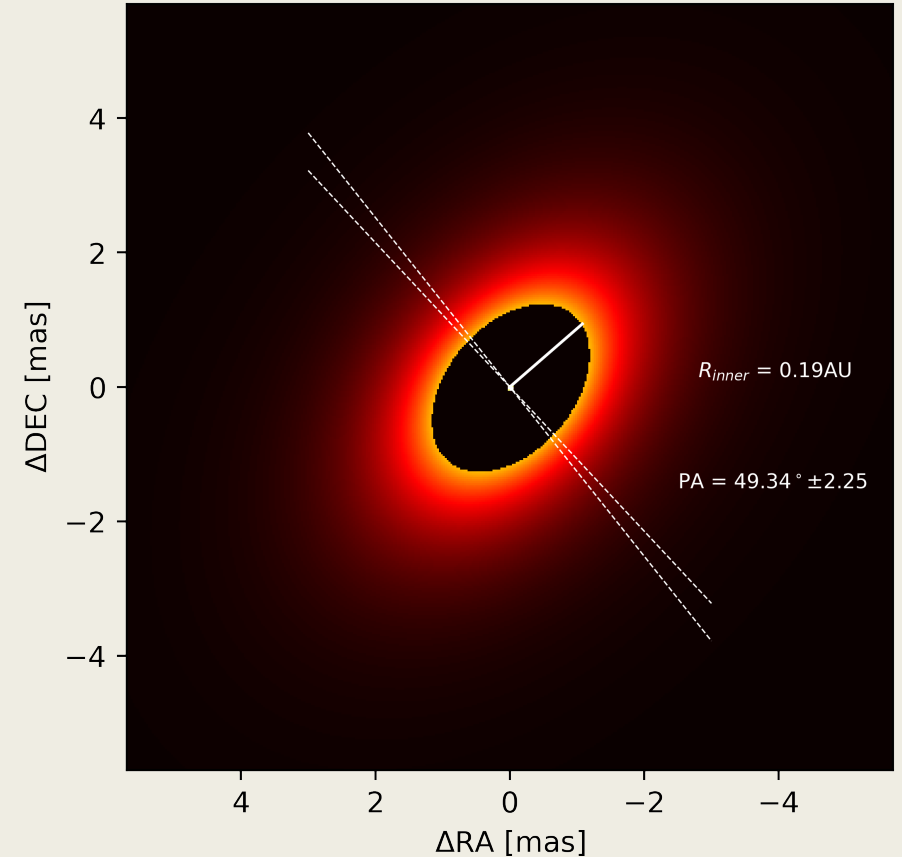
Radiative transfer and geometric model Analysis Pipeline for Interferometric Disk Observations



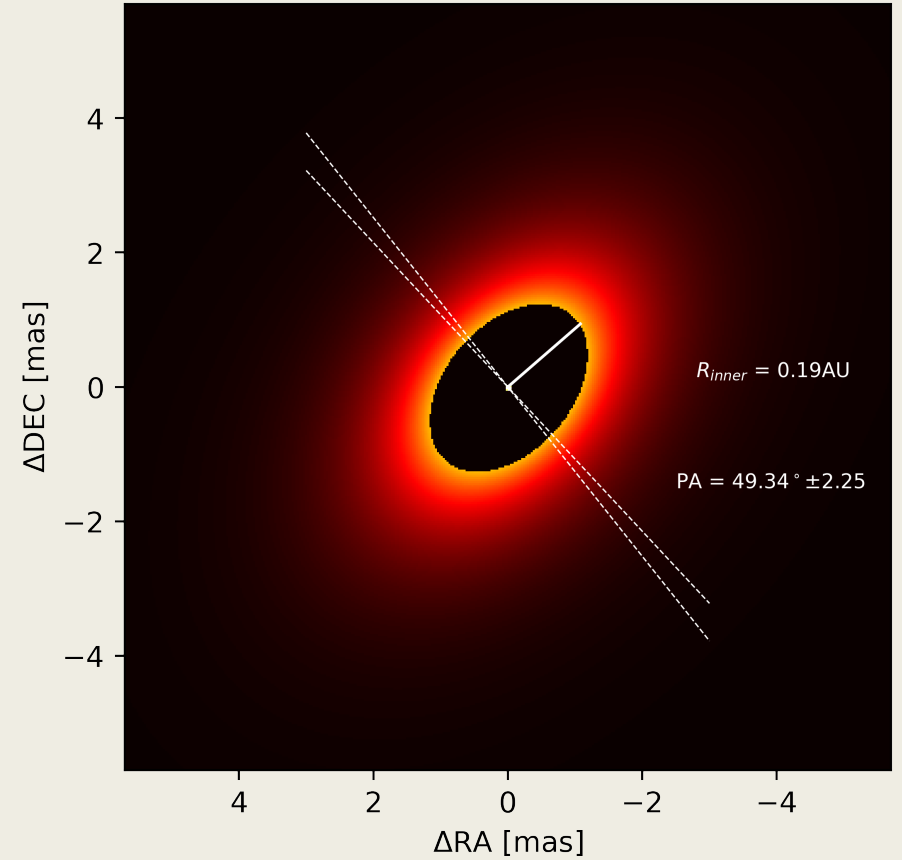
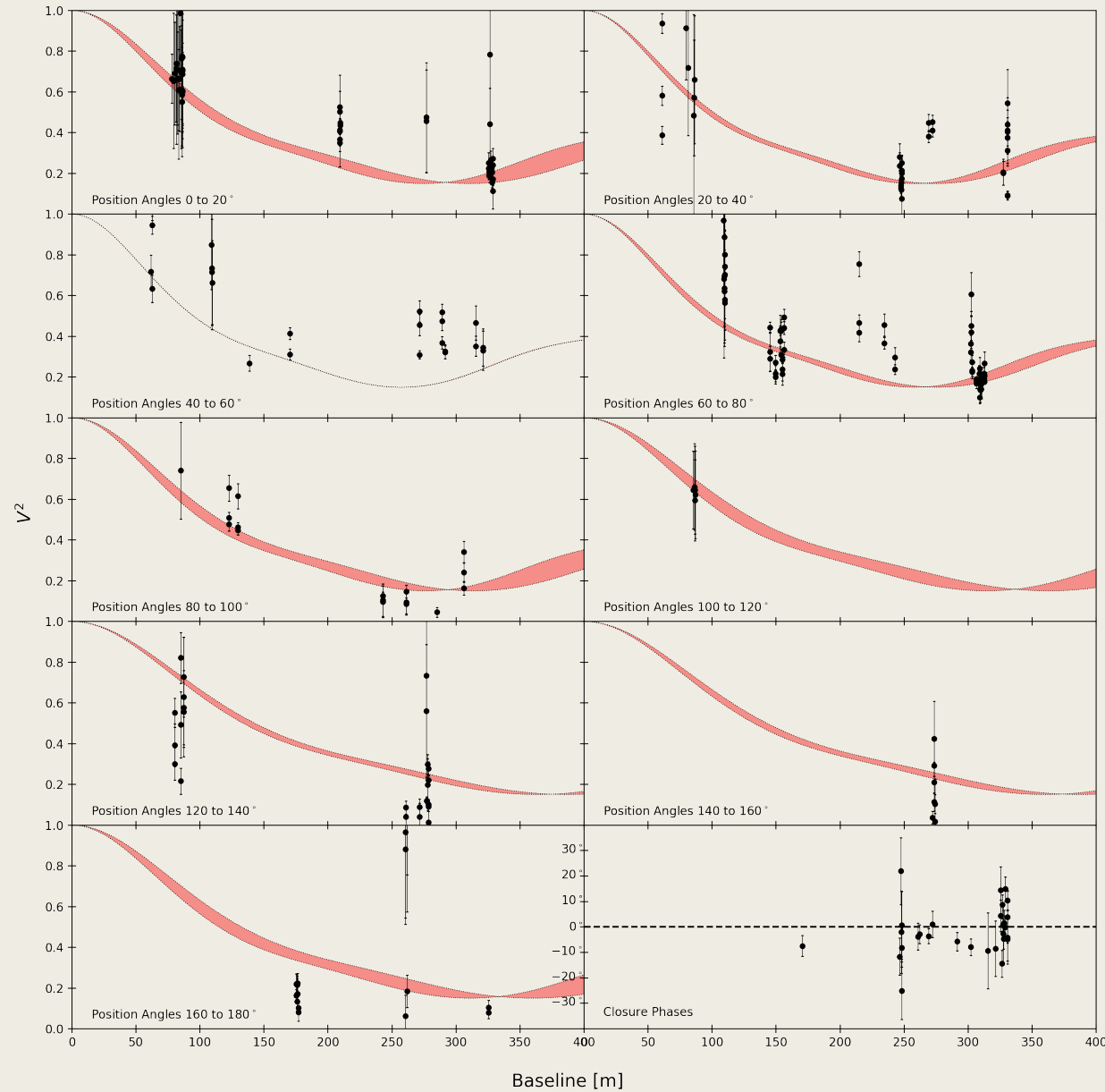
Geometric modelling

- Temperature Gradient Model (TGM)
proved best fit
- Hard inner-rim with extended emission component.

Parameter	Value
Inner R	1.43 mas
Outer R	59.94 mas
Temp	1800 K
Power Law	0.81
Inclination	48.88
Position Angle	49.34

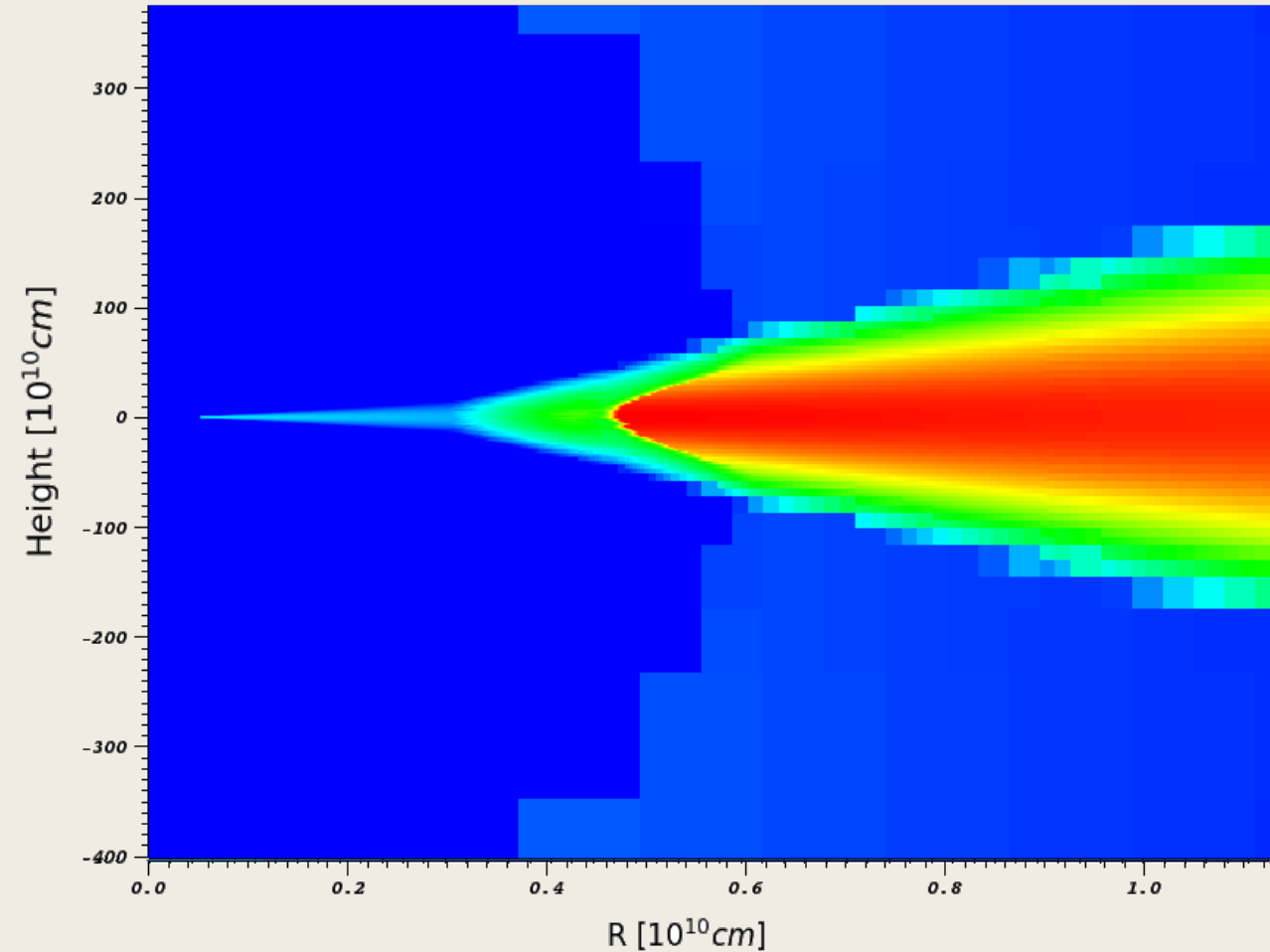


Geometric modelling

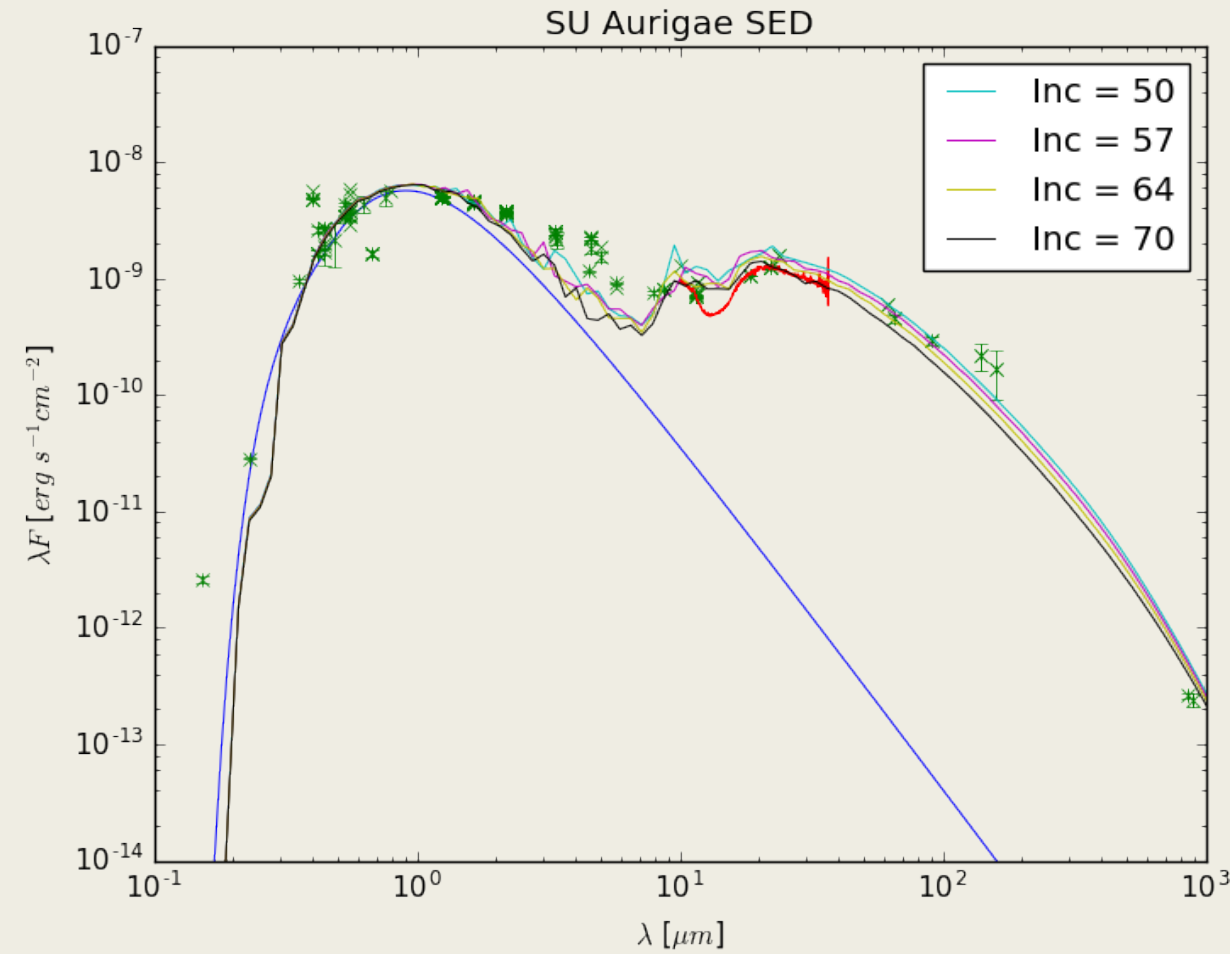
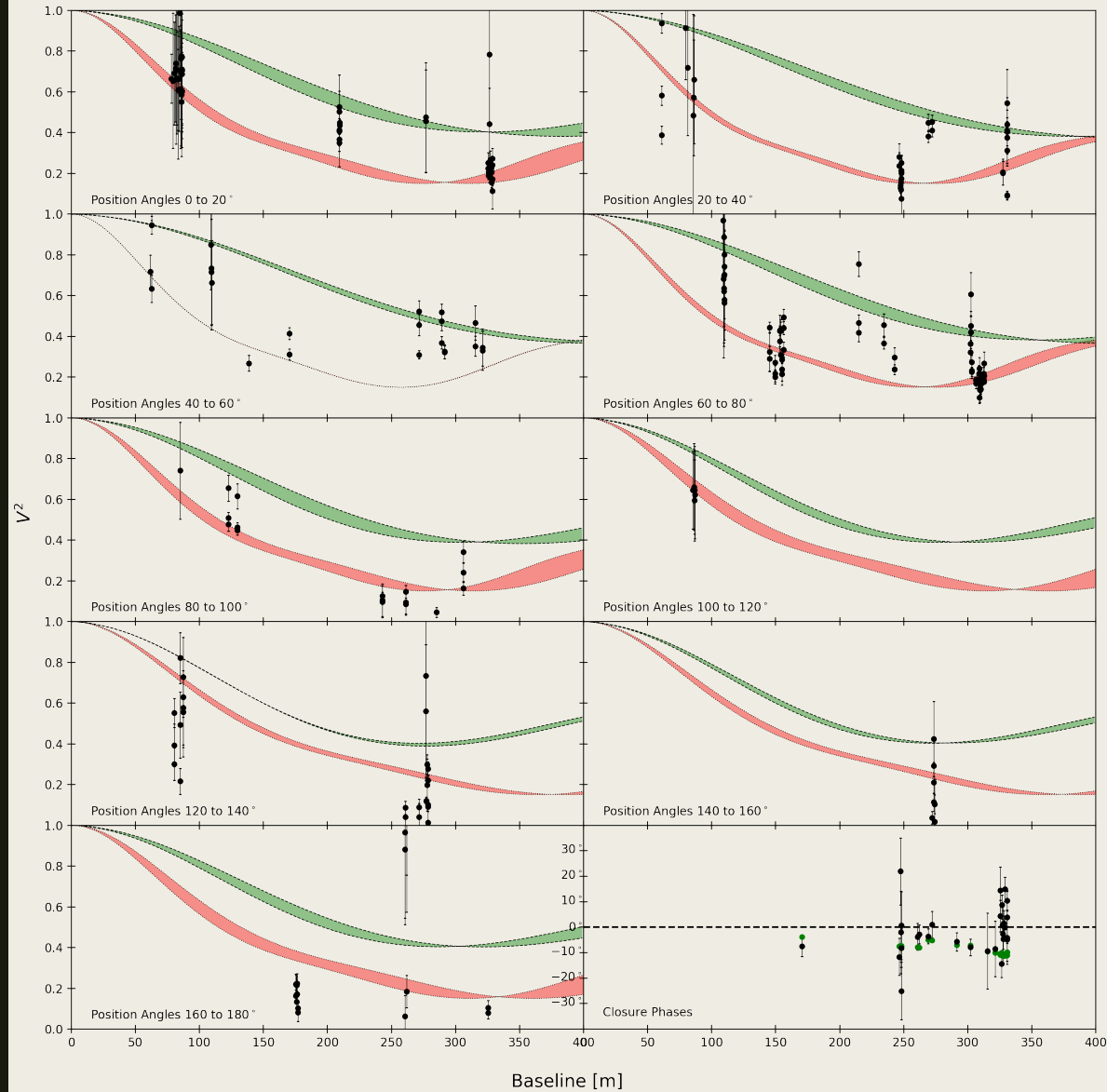


Sublimation Fronts

- Dust evaporation leads to puffed up rim
- Large density gradient leads to curvature
- IN05 prescription
 - *Single ($0.1\mu\text{m}$) grain species*
 - *Gas density dependent sublimation temperature*
- Using TORUS radiative transfer code

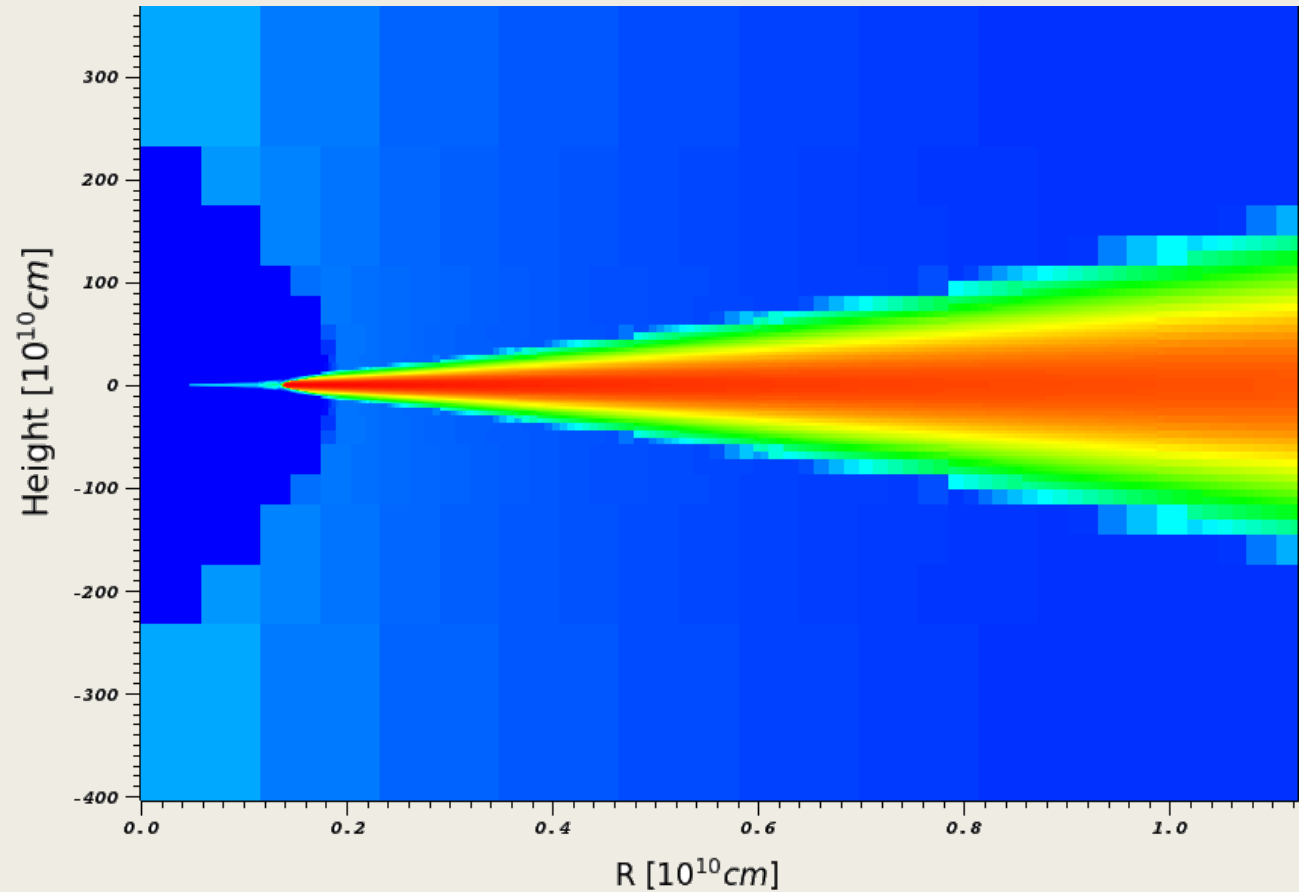


Sublimation Fronts

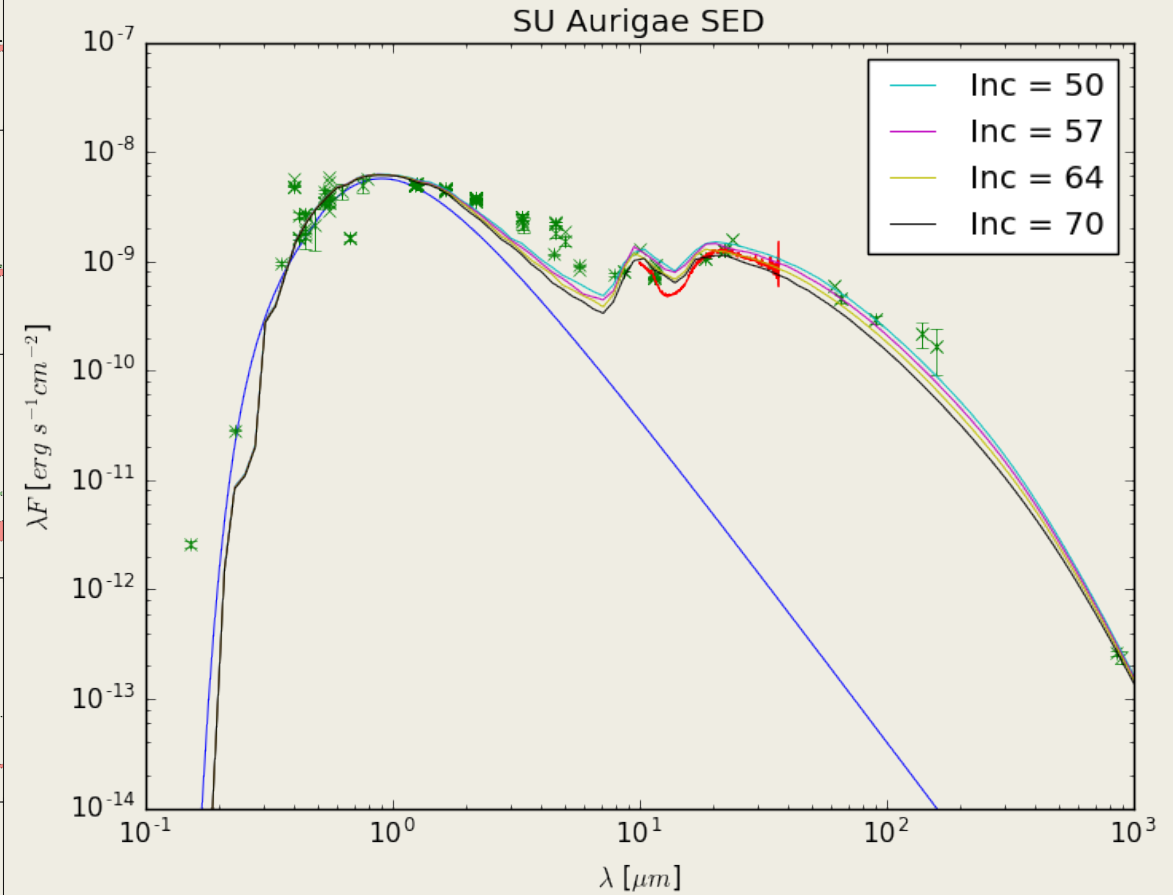
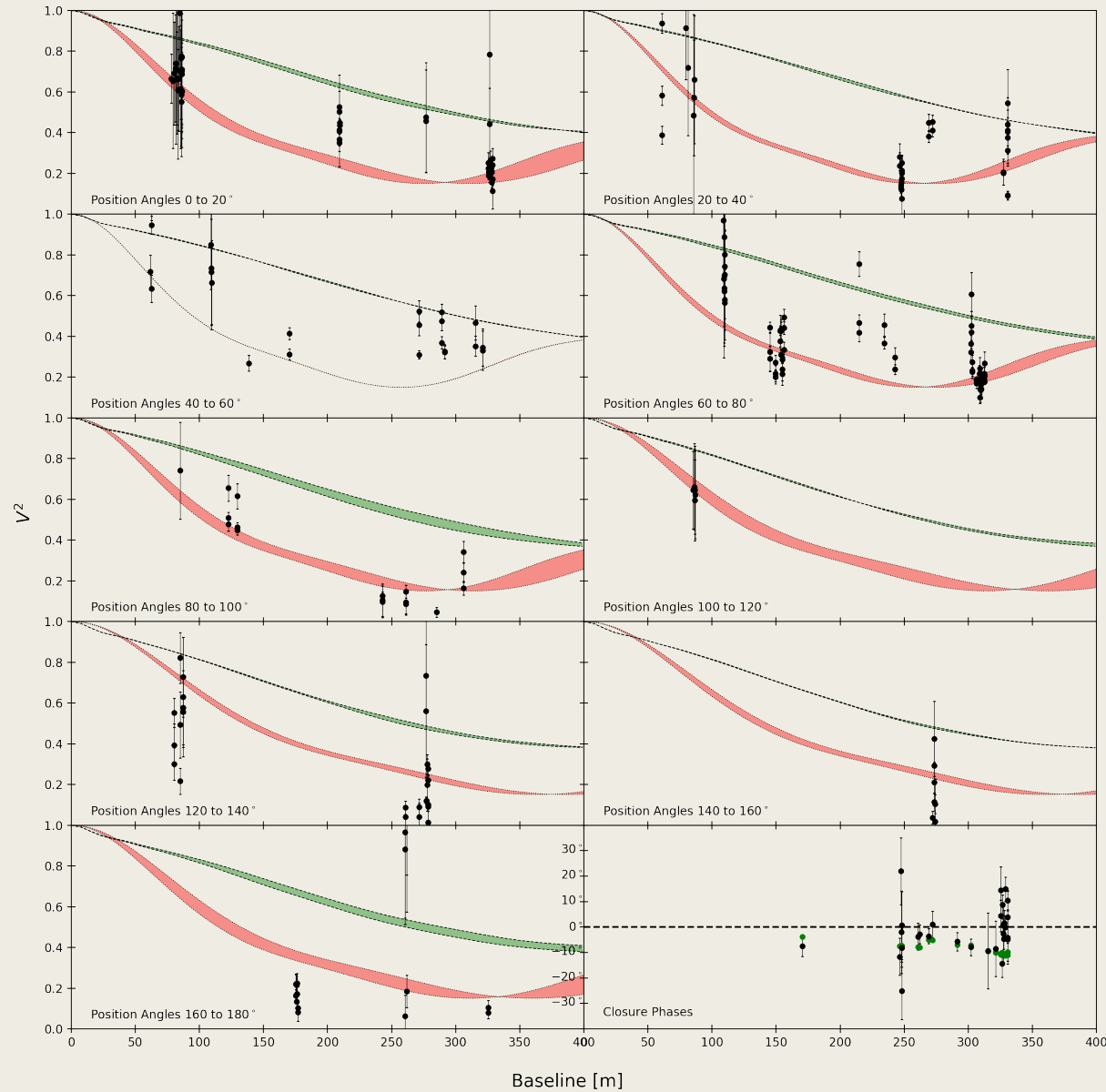


Sublimation Fronts

- THM07 prescription
 - *Mostly small ($0.1\mu\text{m}$) grains*
 - *Few large ($1.2\mu\text{m}$) grains*
 - *Grain-size dependent cooling effect*
- Different sublimation radii creates extreme curvature
- Dust present closer to the star

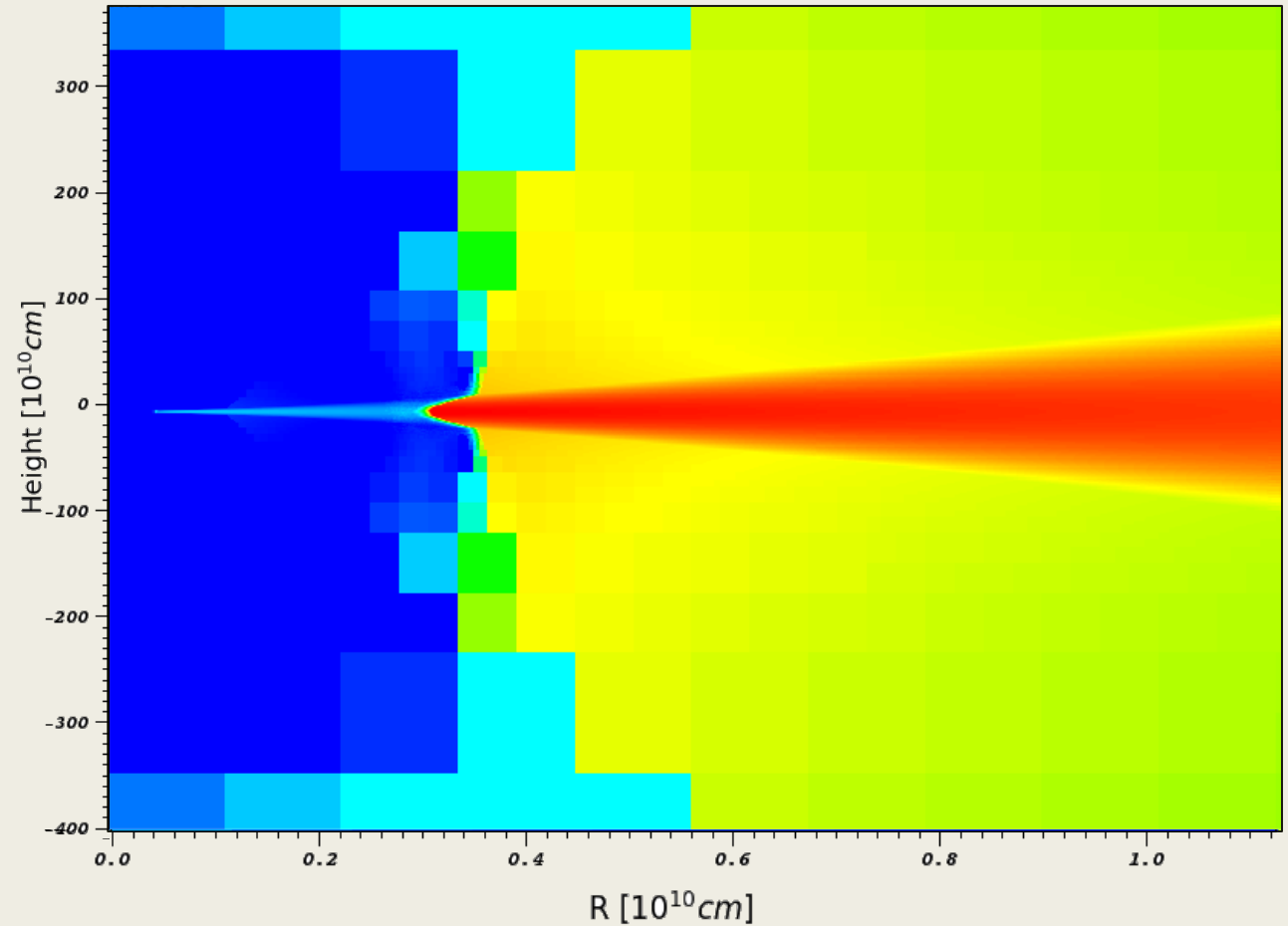


Sublimation Fronts

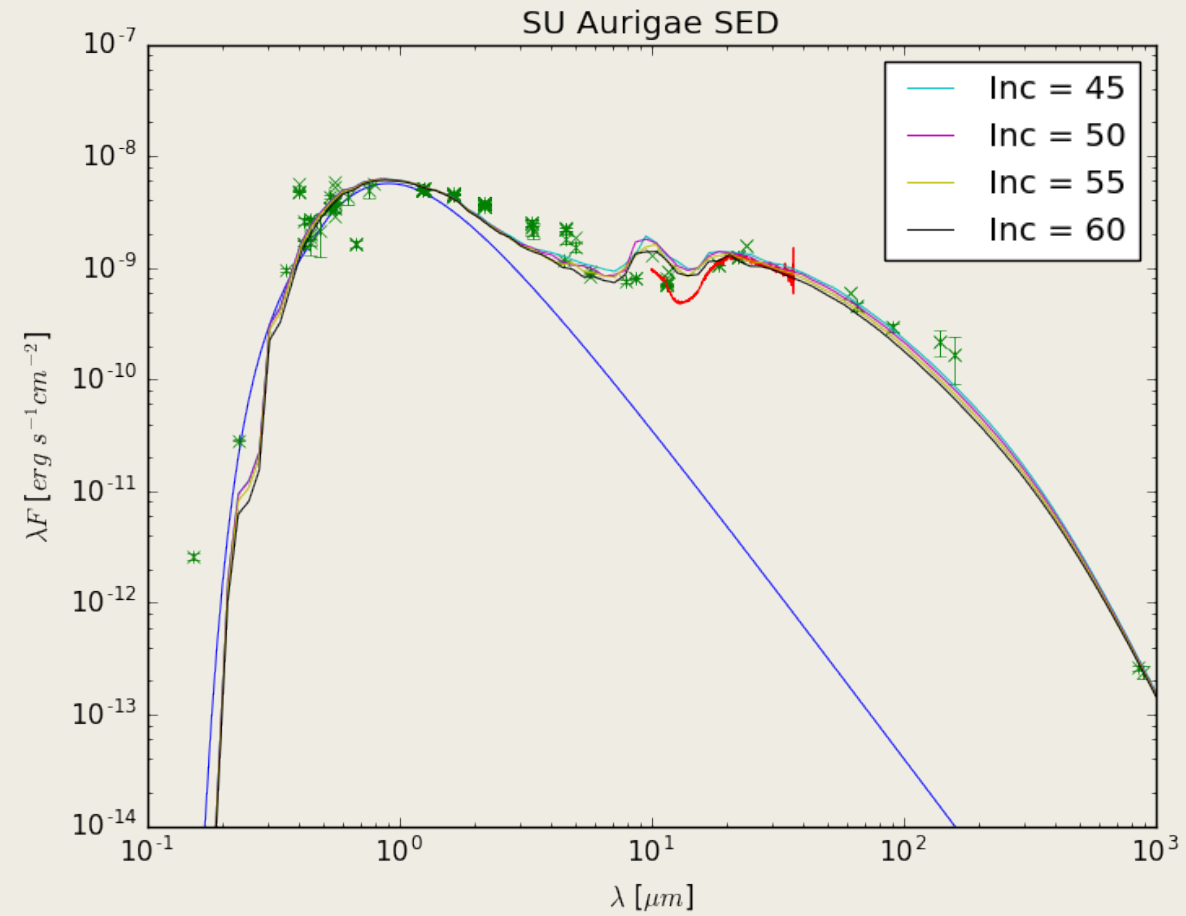
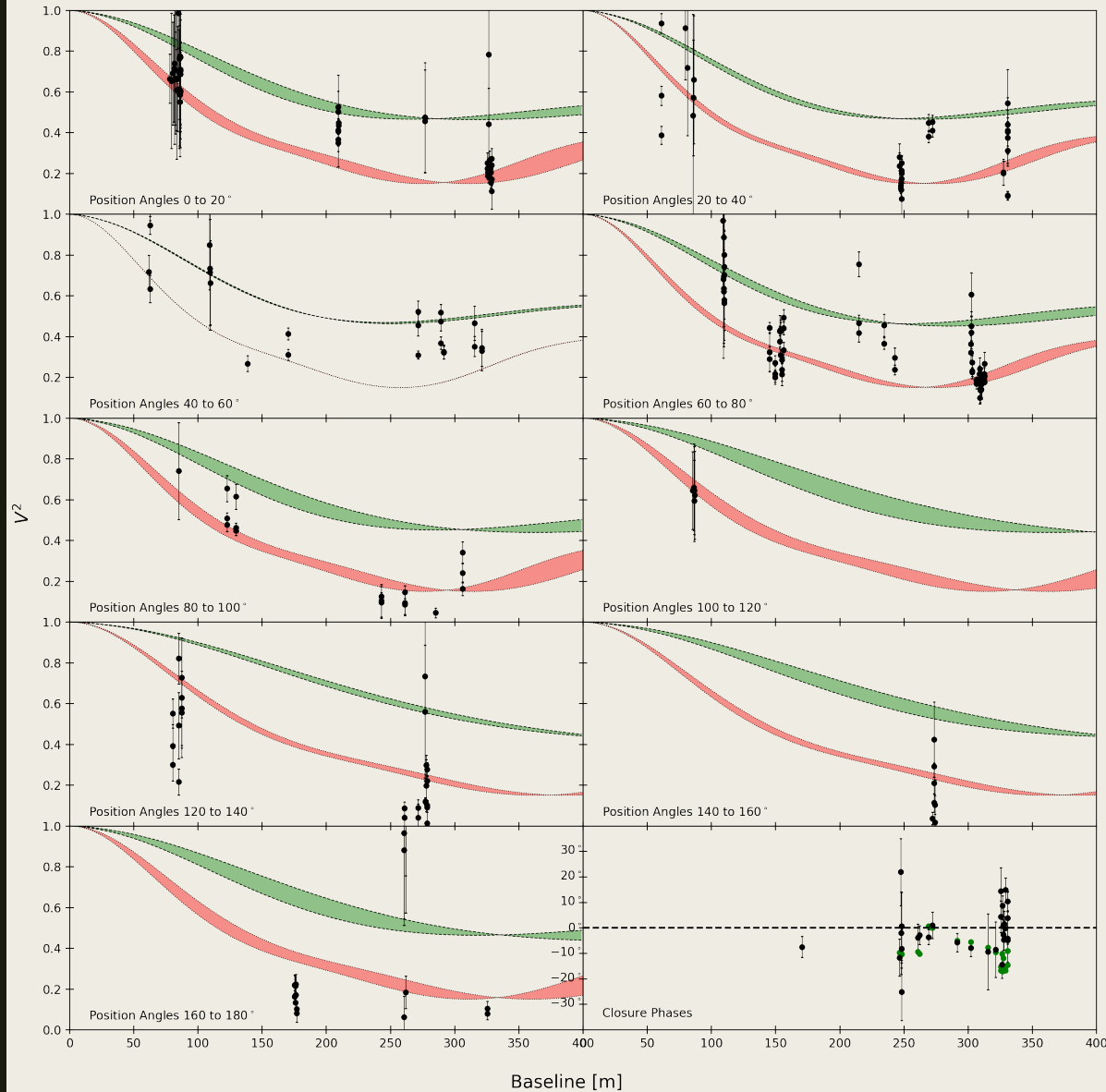


Sublimation Fronts

- BK12 introduce dusty disk winds
- Rim shape follows IN05 prescription
- Material driven along field lines inclined to disk surface

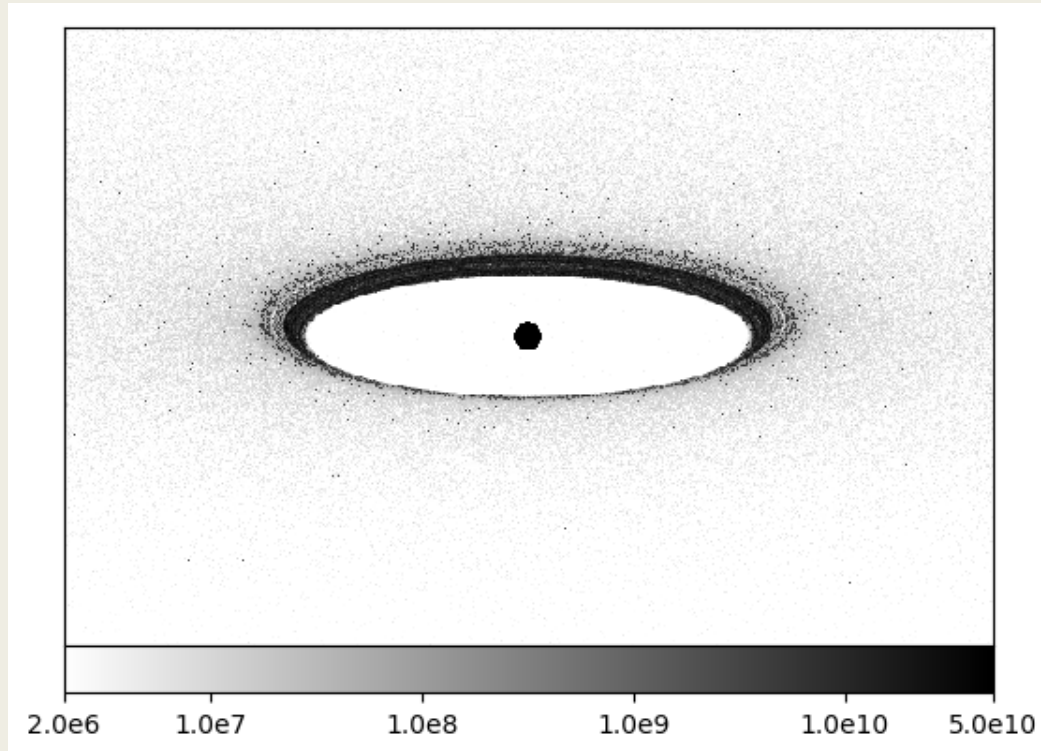


Sublimation Fronts

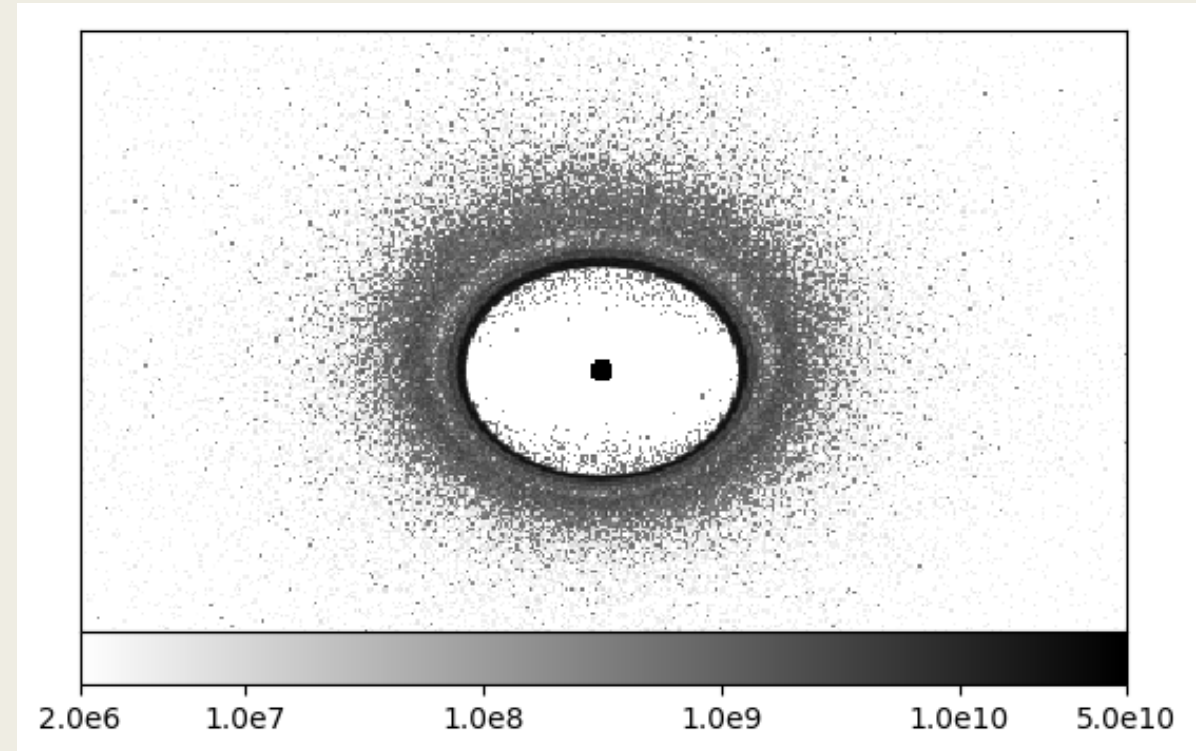


Radiative Transfer Images

IN05

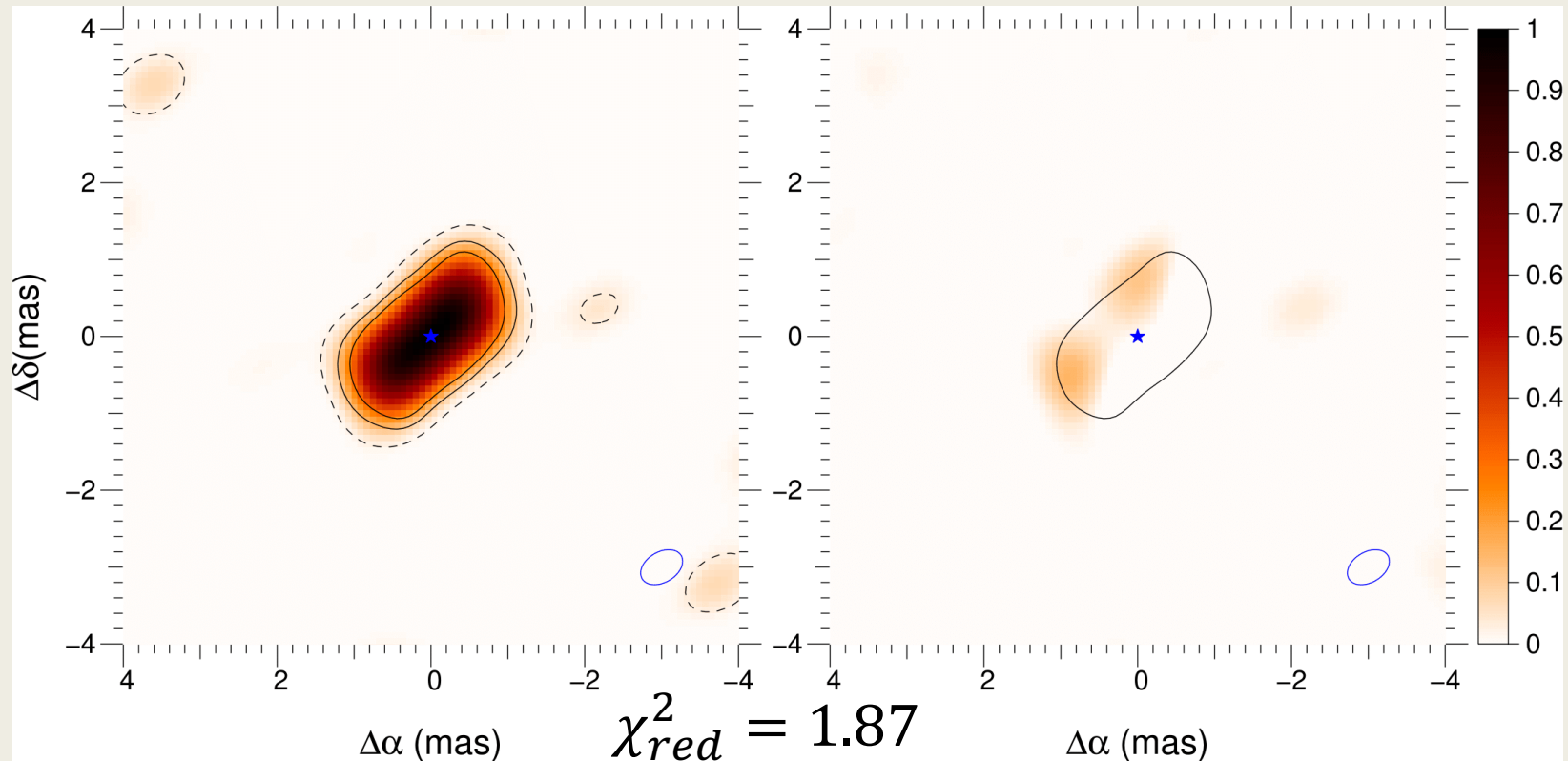


IN05 + Dusty Wind



SU Aur: Reconstructed

- Polychromatic Image Reconstruction Pipeline
- Utilising MiRA reconstruction routine
- Smoothing regularisation technique
- Bootstrapped for 500 iterations



Summary

- Hard inner rim required to fit visibilities.
- Closure phases can be fitted well with zero closure phases.
- Only dusty disk wind models can closely reproduce the observed IR excess.
- Curved inner rim consisting of single silicate grain species.
- Image reconstruction confirms inclination, position angle and radius.
- Asymmetries found are consistent with back edge of a heavily inclined disk.