

Sculpting the disk around TCha

An interferometric view

J. OLOFSSON, M. BENISTY, J.-B. LE BOUQUIN, J.-P. BERGER, S. LACOUR, F. MÉNARD, TH. HENNING, A. CRIDA
L. BURTSCHER, G. MEEUS, T. RATZKA, C. PINTE, J.-C. AUGEREAU, F. MALBET, B. LAZAREFF & W. TRAUB

The dissipation of gas-rich disks around young stars is expected to take place after a few Myr. Giant planet formation is believed to happen on a comparable timescale and may have a significant impact on the disk's structure. We observed the transition disk around TCha (7 Myr old) with several high angular resolution instruments. We present here a robust radiative transfer model that can account for all of them and we thus better characterize the large gap carved inside the disk.

Dataset: VLT/Pionier - VLT/Midi - VLT/Amber - VLT/NaCo/SAM - SED (optical to mm wavelengths)

Methodology: MCFOST radiative transfer code calculations of the SED, visibilities and closure phases.

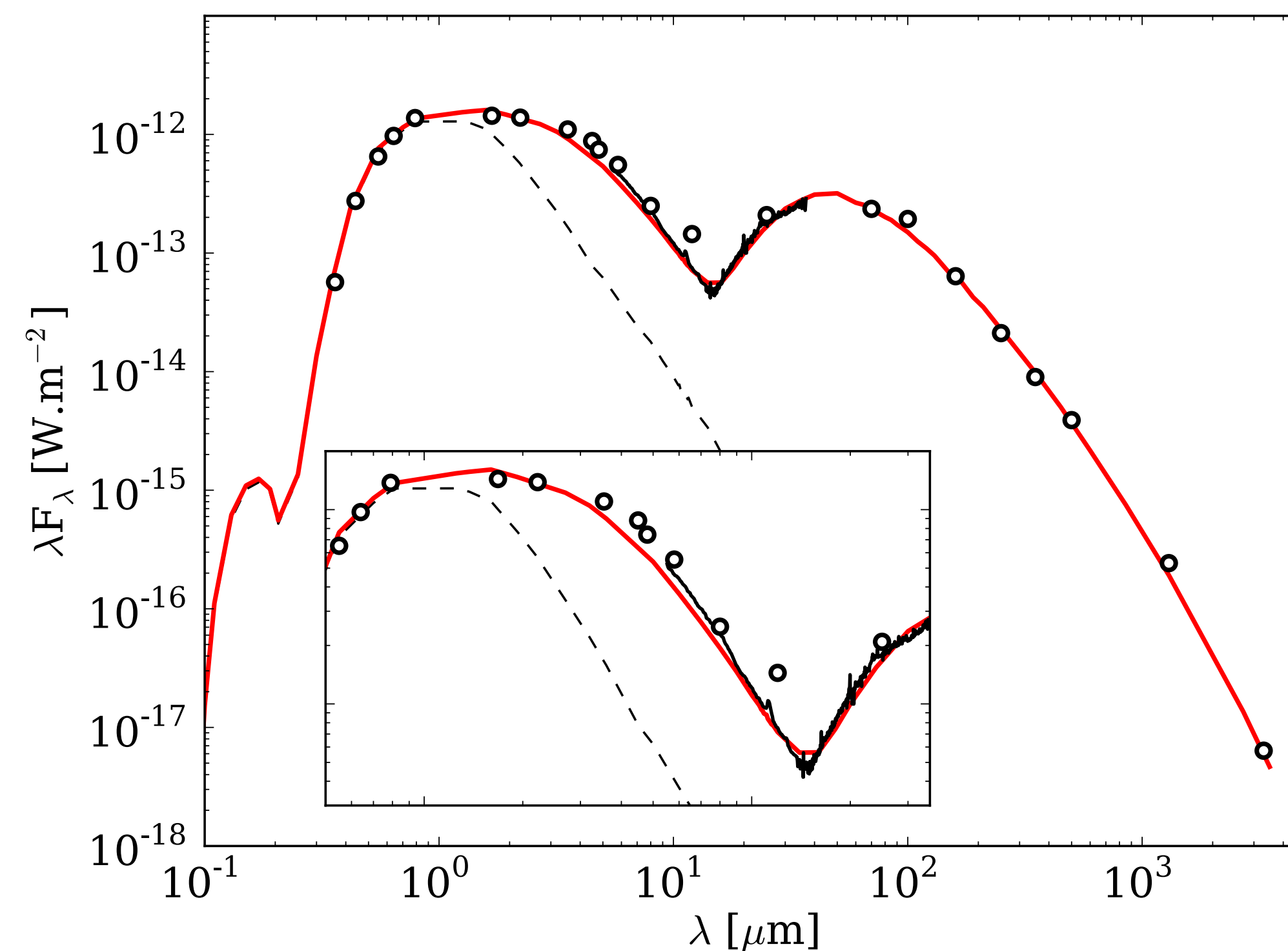
Results

The inner disk:

- Extremely narrow (0.07 - 0.11 AU)
- Large scale height ($H/r \sim 0.2$)

Constrained by:

- Near-IR excess in the SED
- Resolved by Pionier & Amber

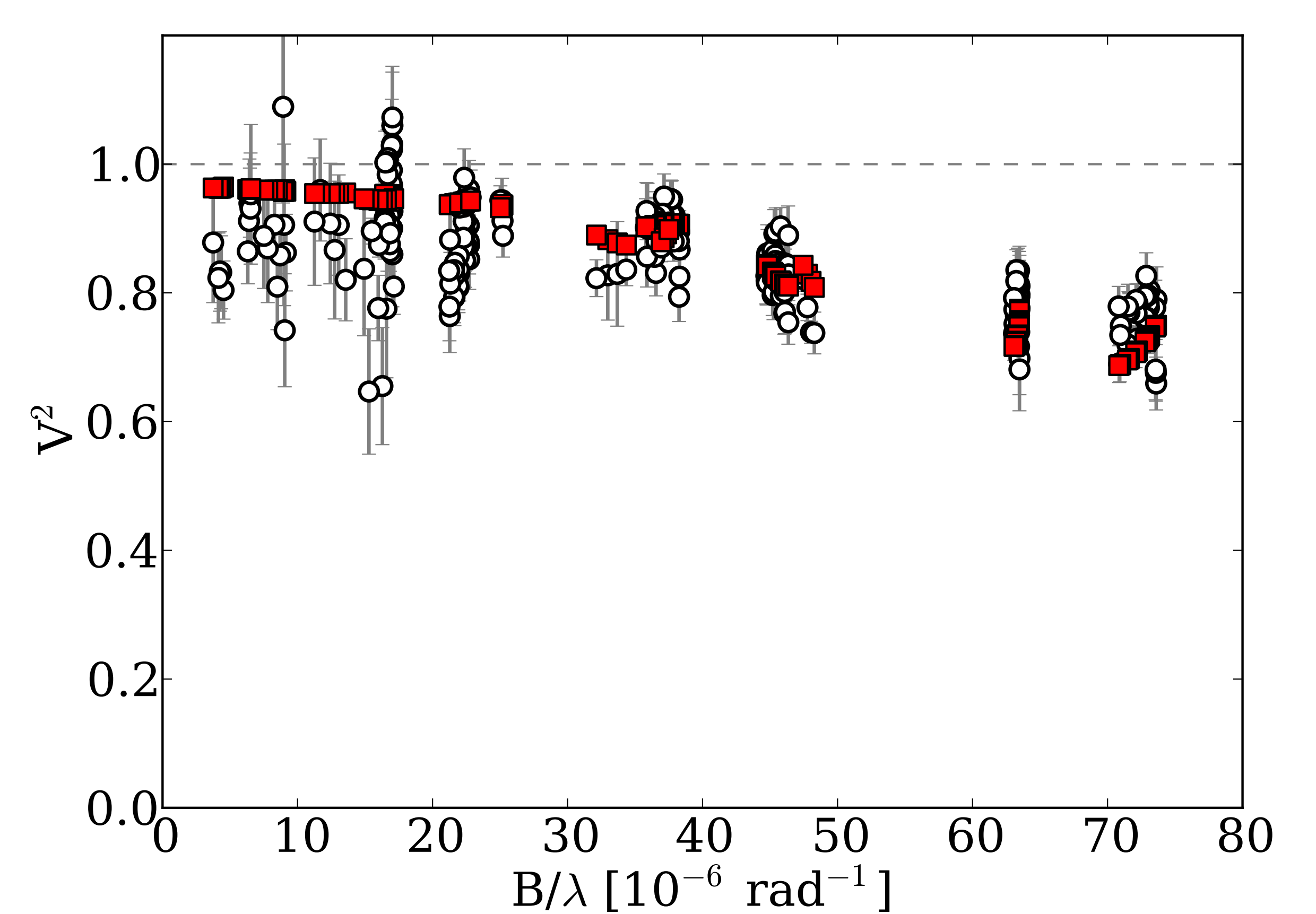
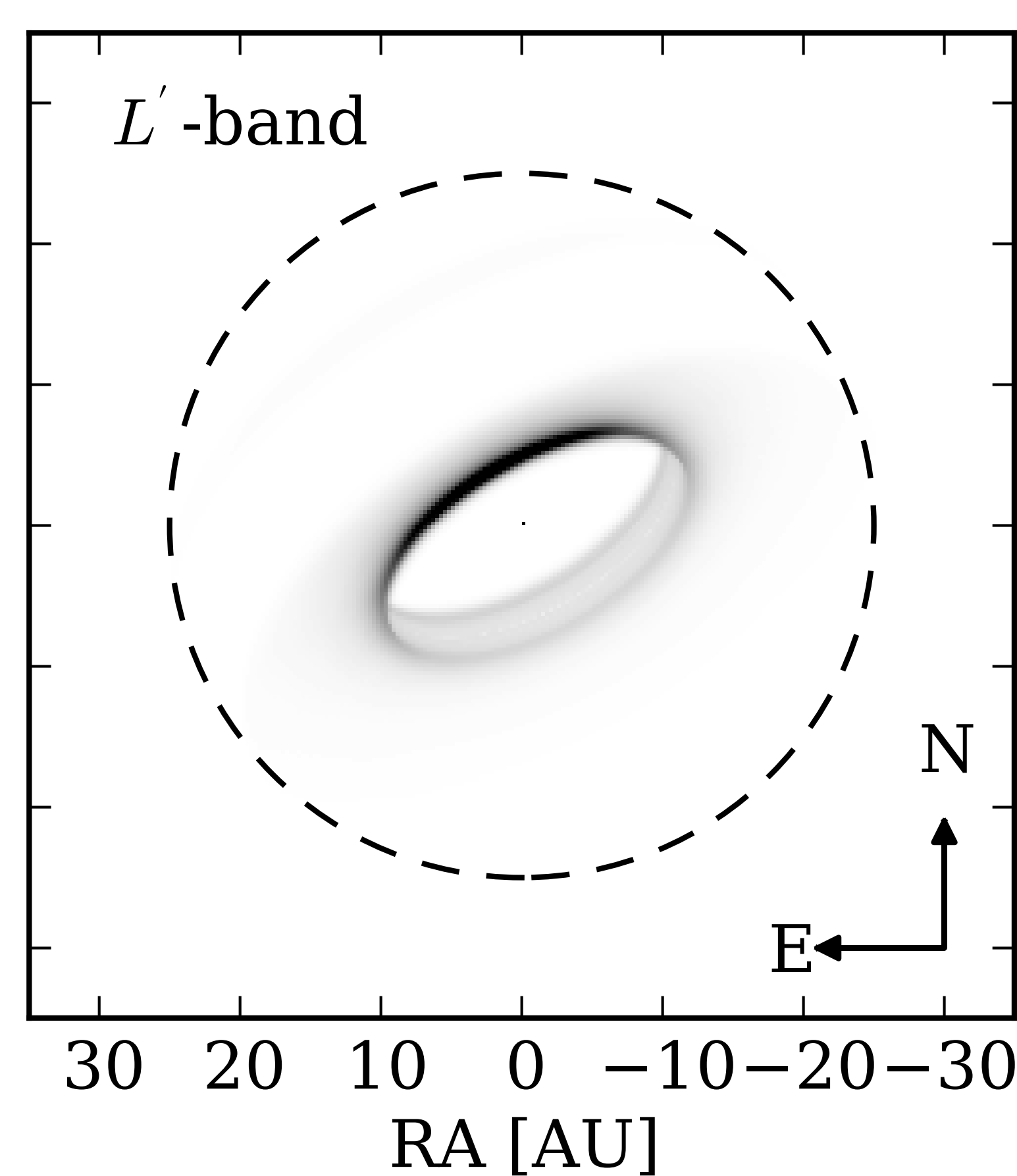
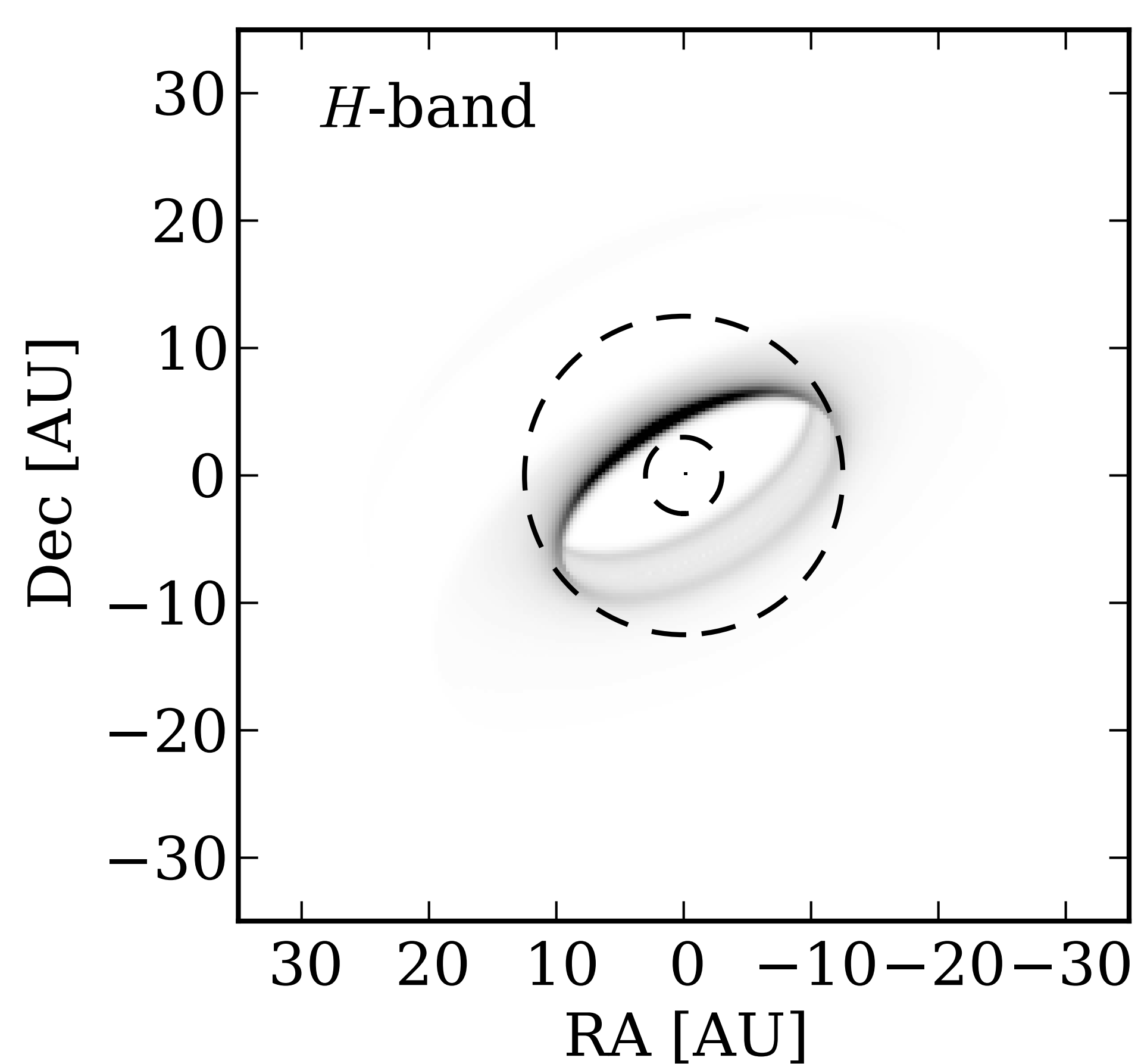


The outer disk:

- Relatively narrow: 12-25 AU
- High inclination ($i \sim 58^\circ$)

Constrained by:

- Far-IR excess (see also Cieza+ 2011)
- Resolved in scattered light by SAM



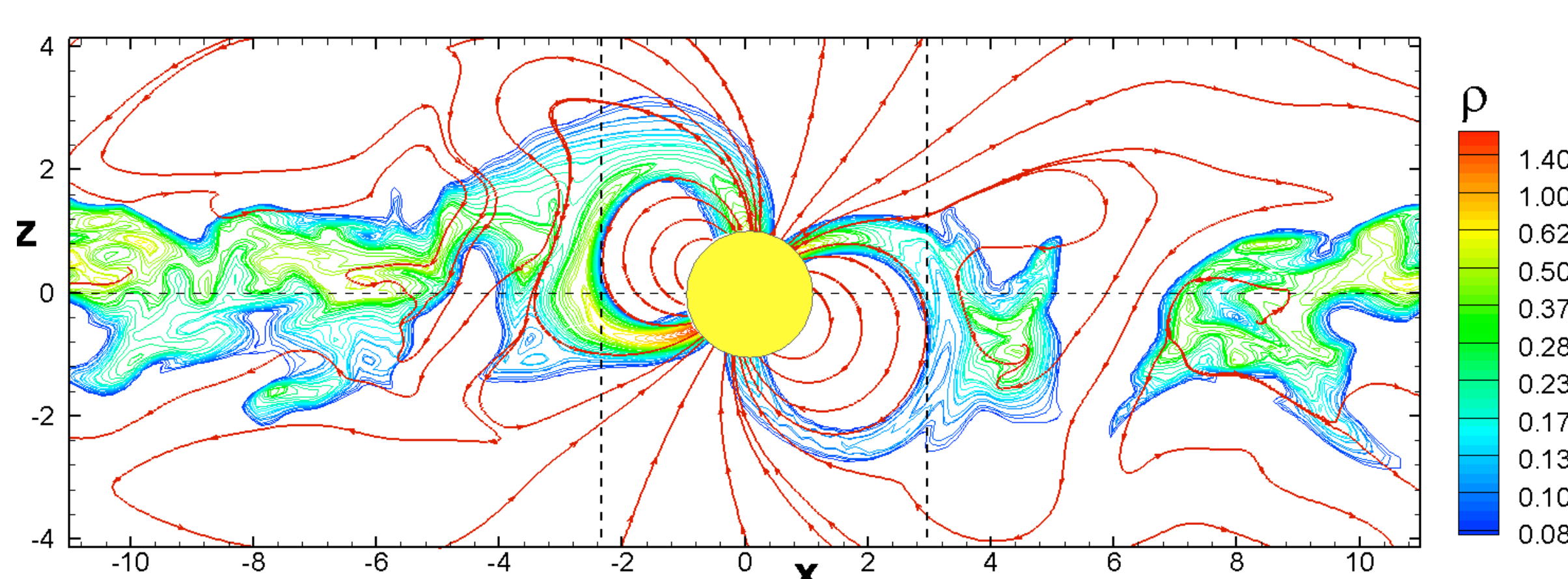
Top panel: SED of TCha from optical to mm wavelengths (best-fit model in red). **Bottom left and middle panels:** MCFOST raytraced images (H- and L'-bands) with the field of view of the Pionier, Amber, and NaCo instruments (250, 60, and 500 mas). **Bottom right:** observed and modeled Pionier visibilities (open circles and red squares).

Discussion

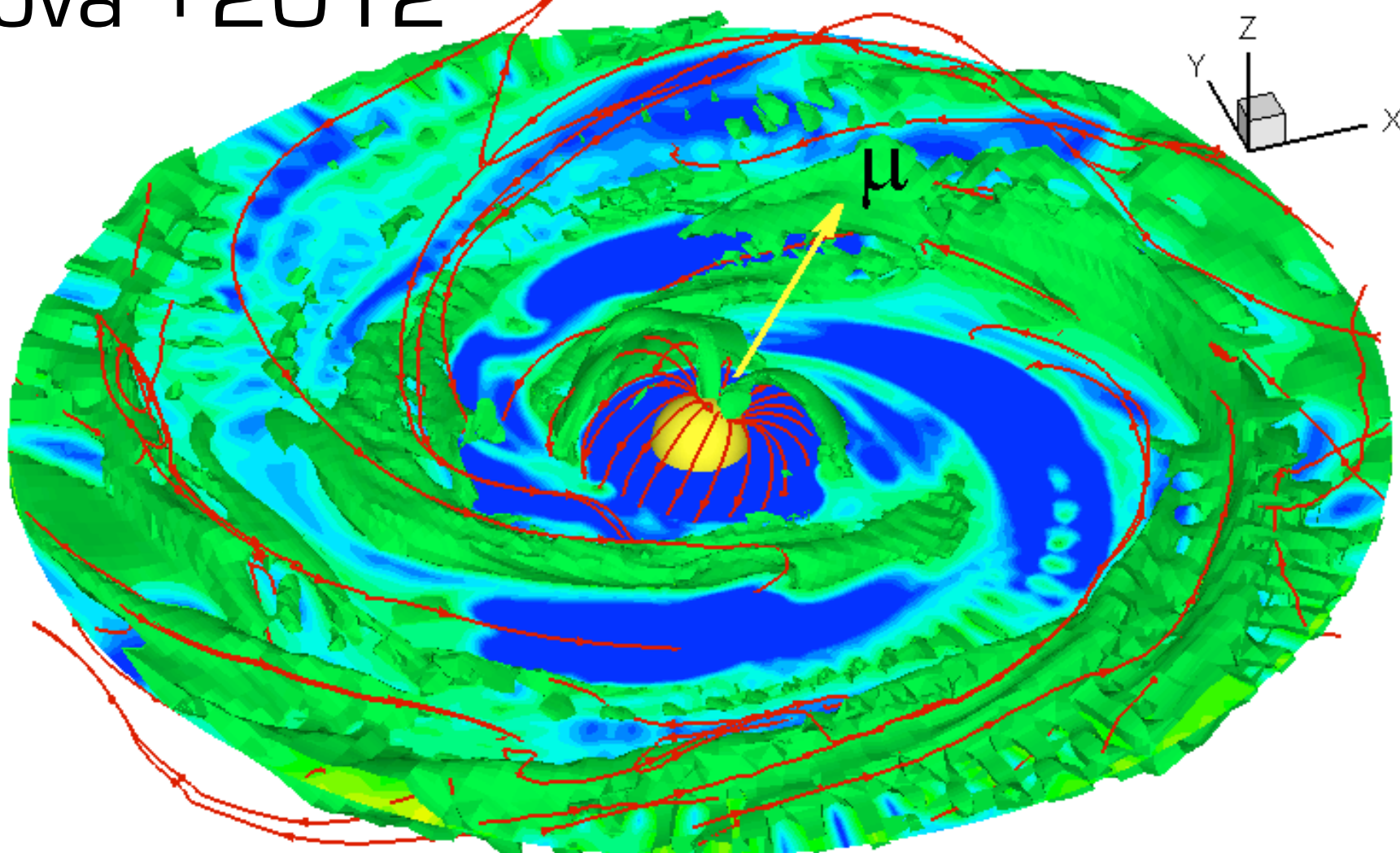
The inner disk: a warped disk ?

TCha is highly variable in the optical on a daily timescale ($\Delta V \sim 3$ mag): would a warped inner disk with a locally increased scale height match the SED ?

Current ISAAC monitoring of TCha



Romanova +2012



The gap: is there a planet ?

NaCo/SAM closure phases originally interpreted as the signature of a companion (Huélamo+2011). But, high inclination + large NaCo field-of-view + forward scattering in the outer disk = non-zero closure phases.

The disk must be accounted for when modeling NaCo/SAM observations. Any possible companions still have to be unambiguously detected.

Olofsson et al. (2013) A&A, 552A, 40

Contact:

olofsson@mpia.de

mpia.de/homes/olofsson



The outer disk: ~10 AU wide ?

Dust trapping by a few Jupiter mass planet inside the gap (Pinilla+2012) ? Mm-sized grains, piled up at the edge of the outer disk, could mimic a narrow outer disk (good far-IR emitters).

More extended disk in the gas or in the μ m-sized dust grain population ? Need for Sphere and ALMA observations !

