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ALMA view of a Class 0 Protostellar system at disk scales

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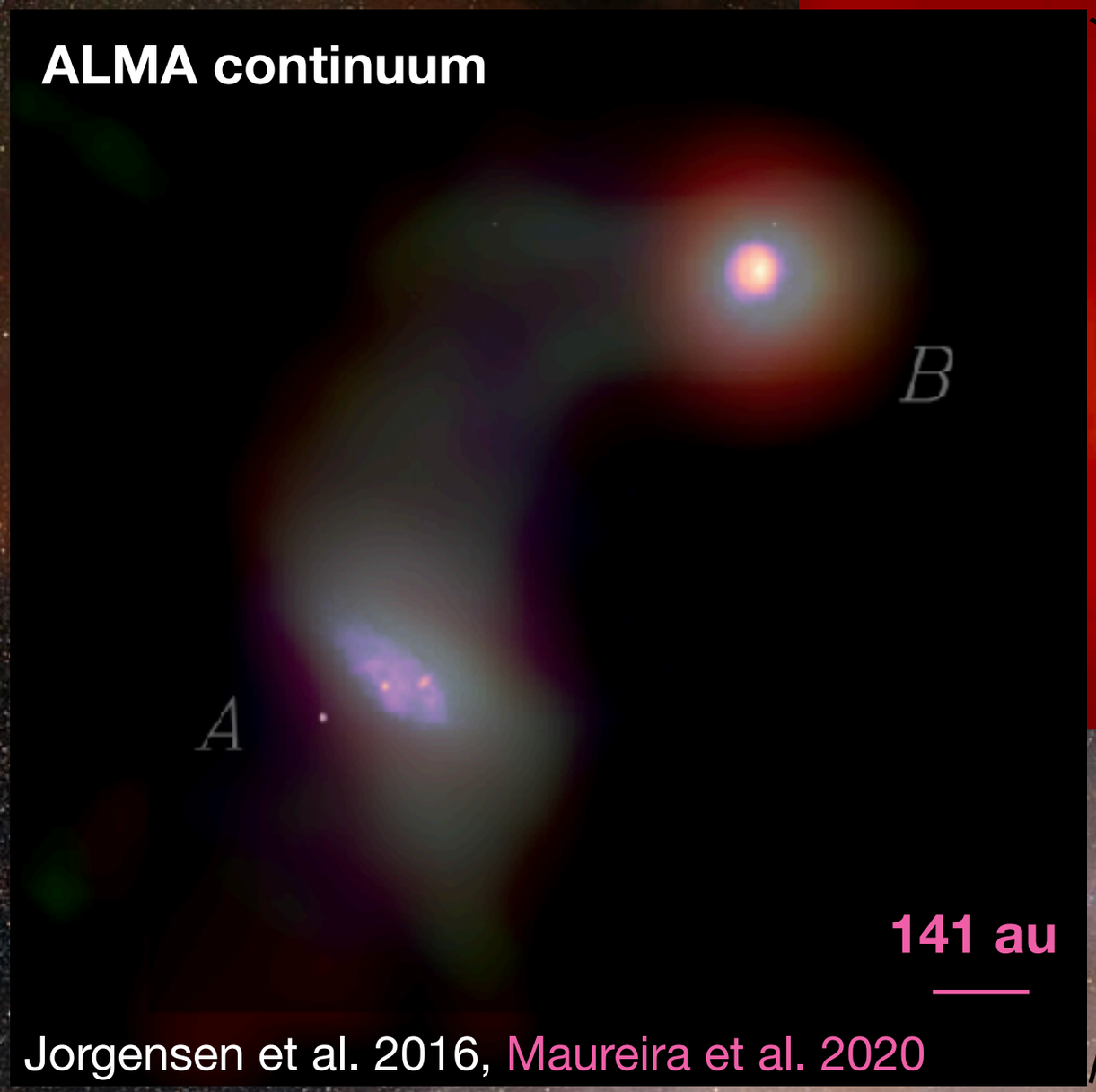
Class 0 Envelope

The laboratory: the deeply embedded Class 0 IRAS 16293-2422

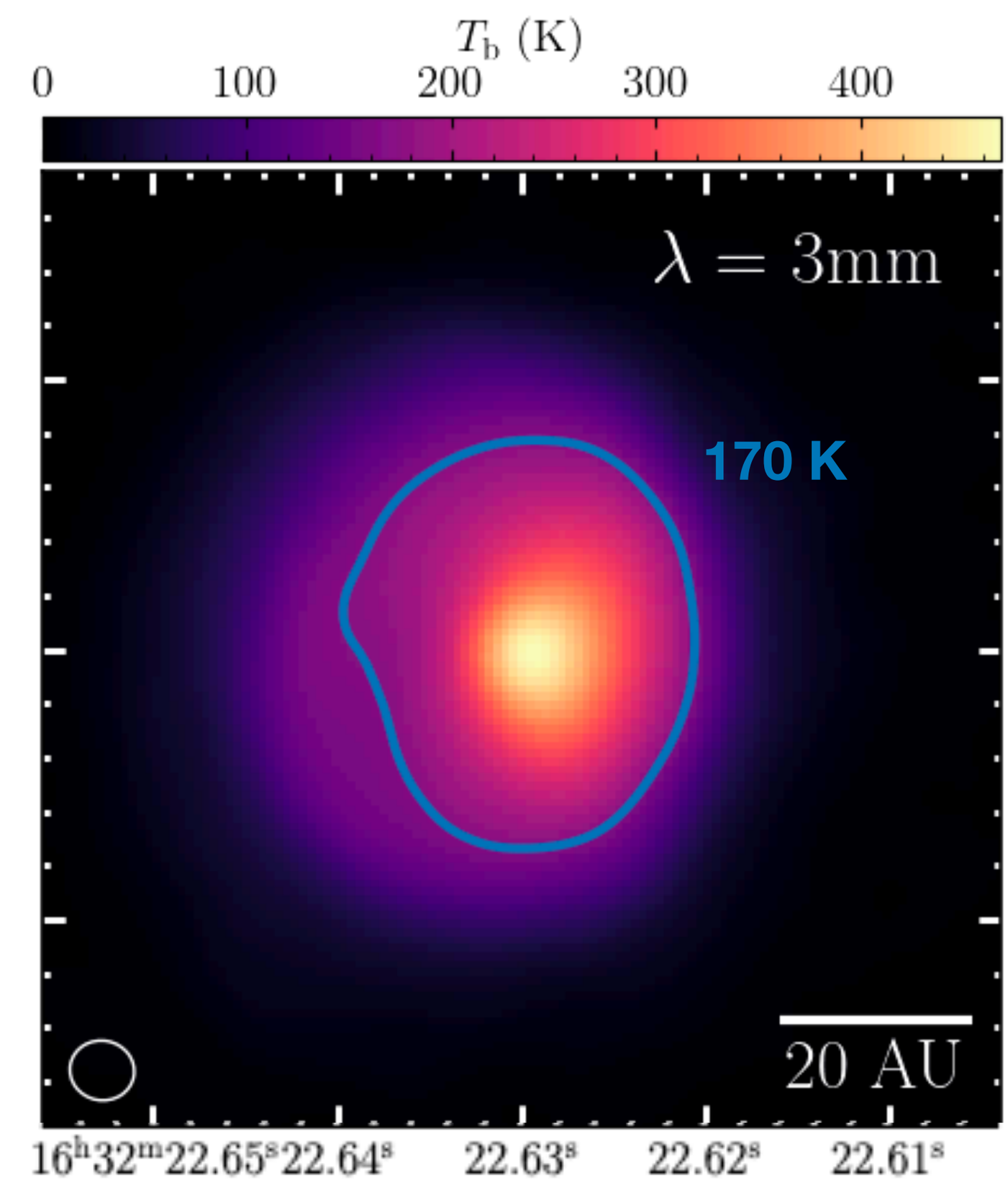
0.14 pc

Herschel column density
Ladjelate et al. 2020

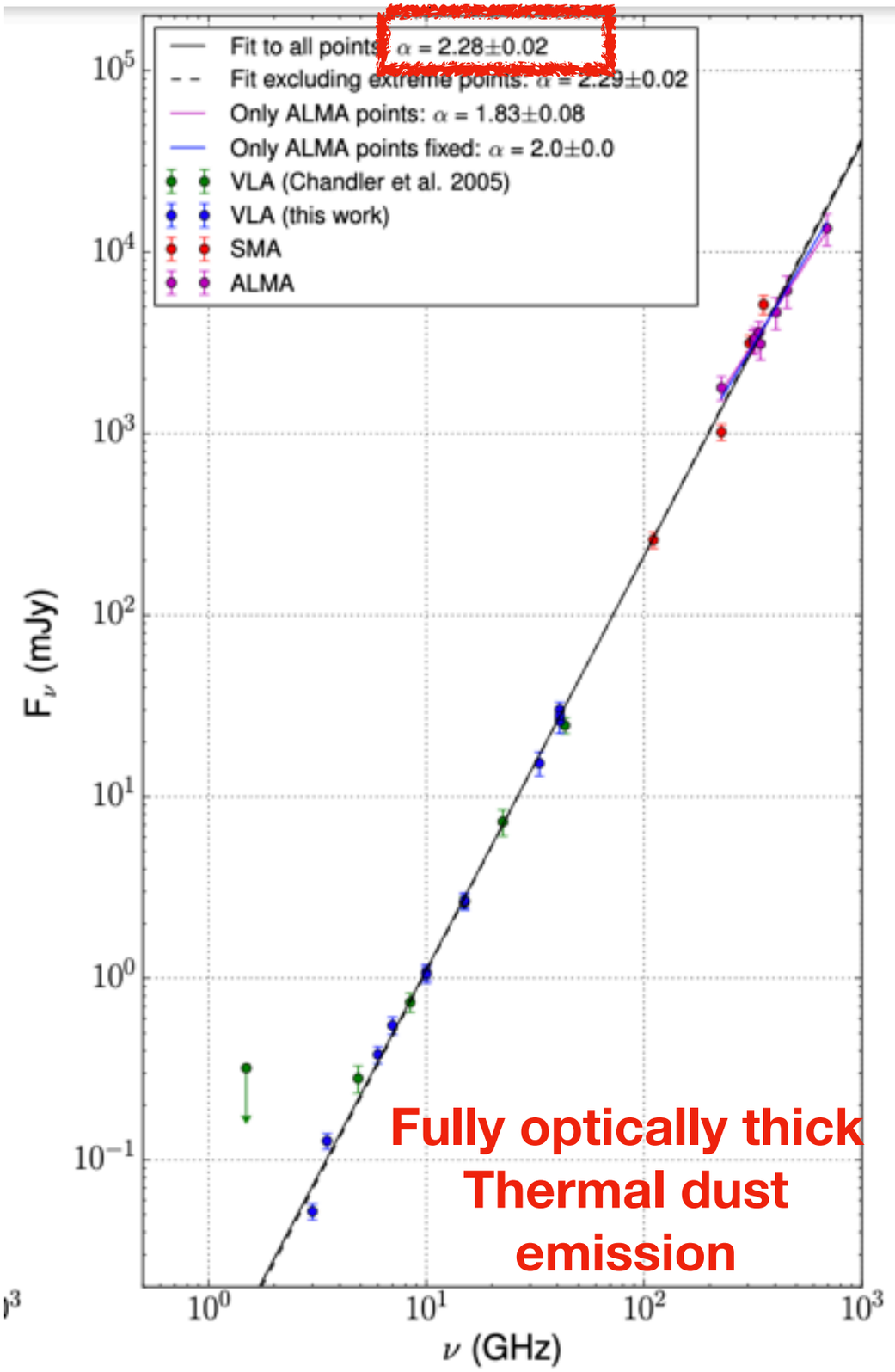
4-6 Msun within
few 1,000 au



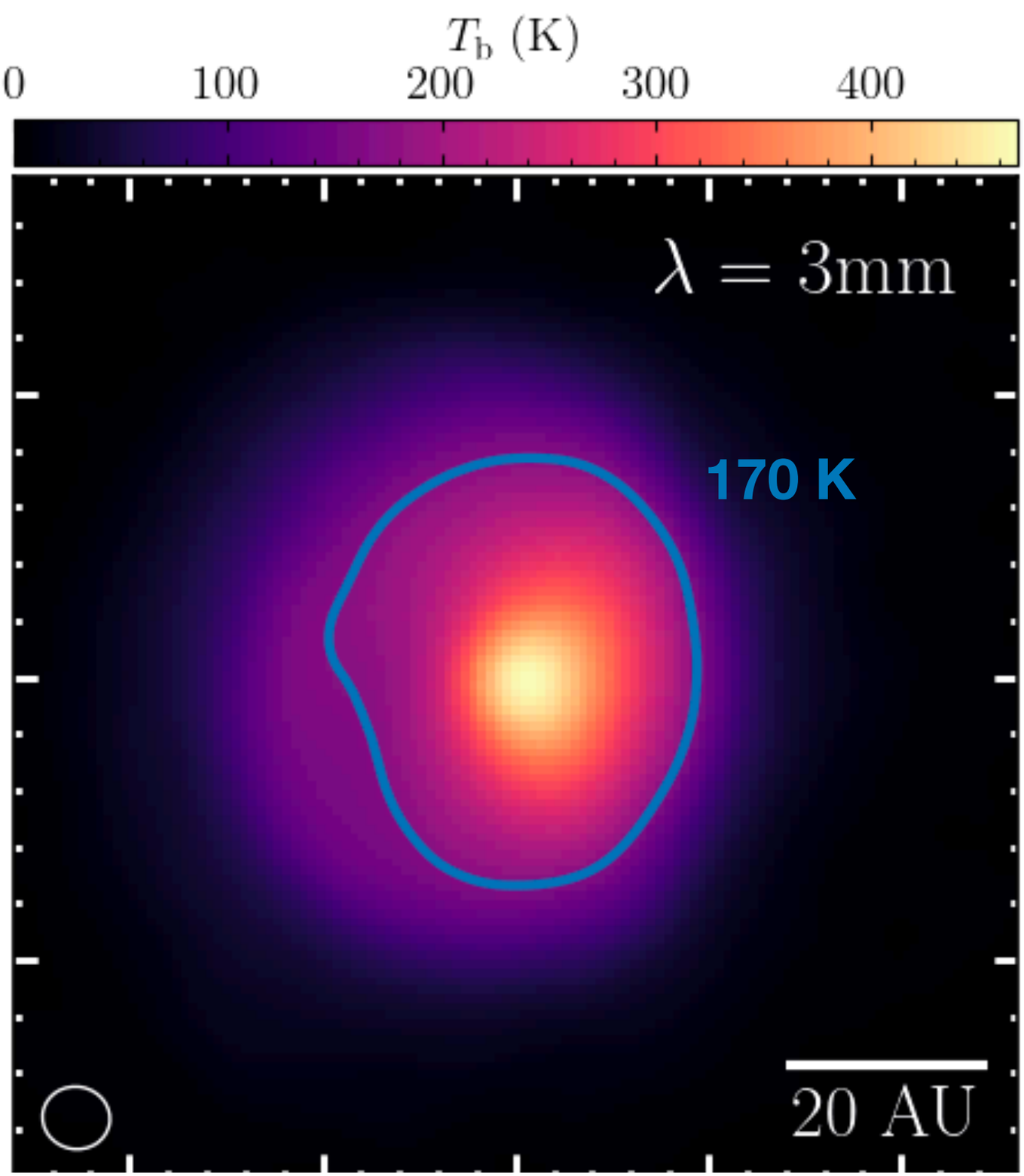
Jorgensen et al. 2016, Maureira et al. 2020

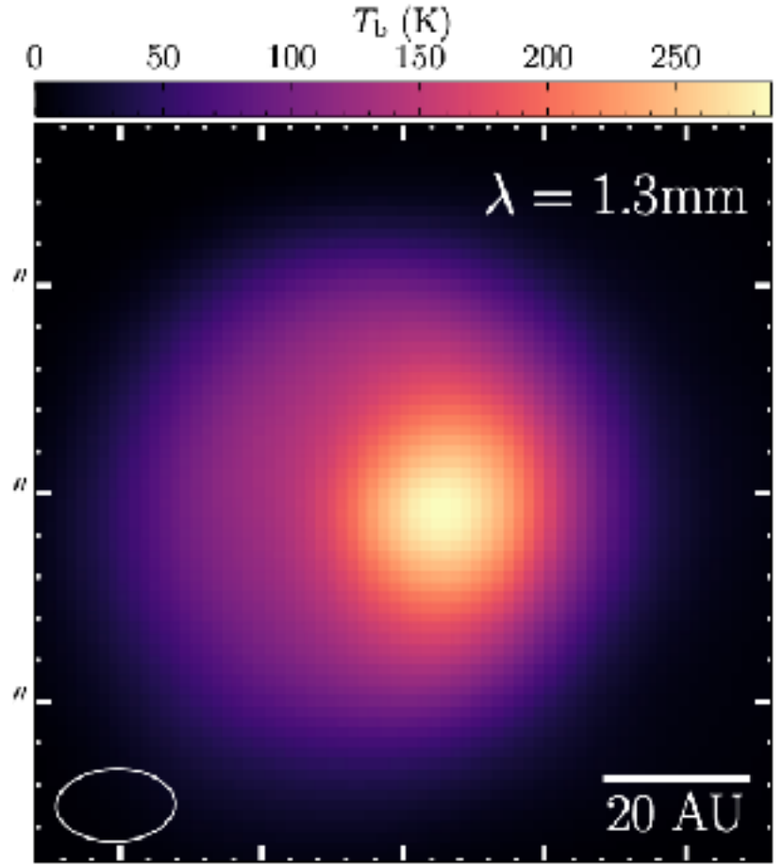


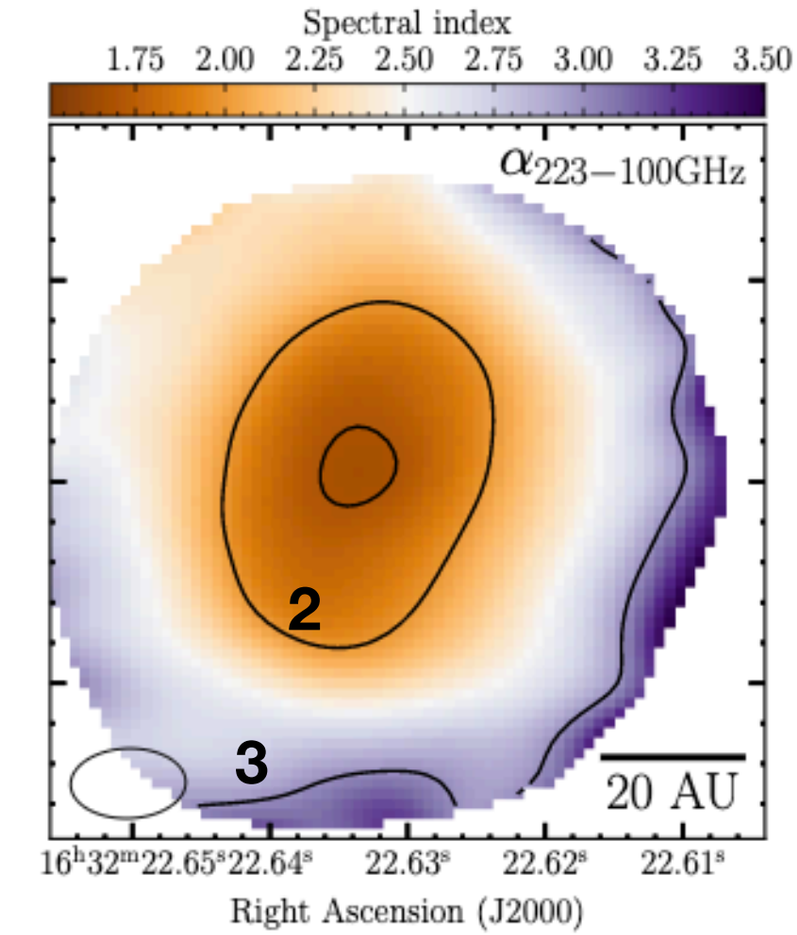
***Zamponi**, Maureira et al. 2021*



Hernandez-Gomez et al. 2019

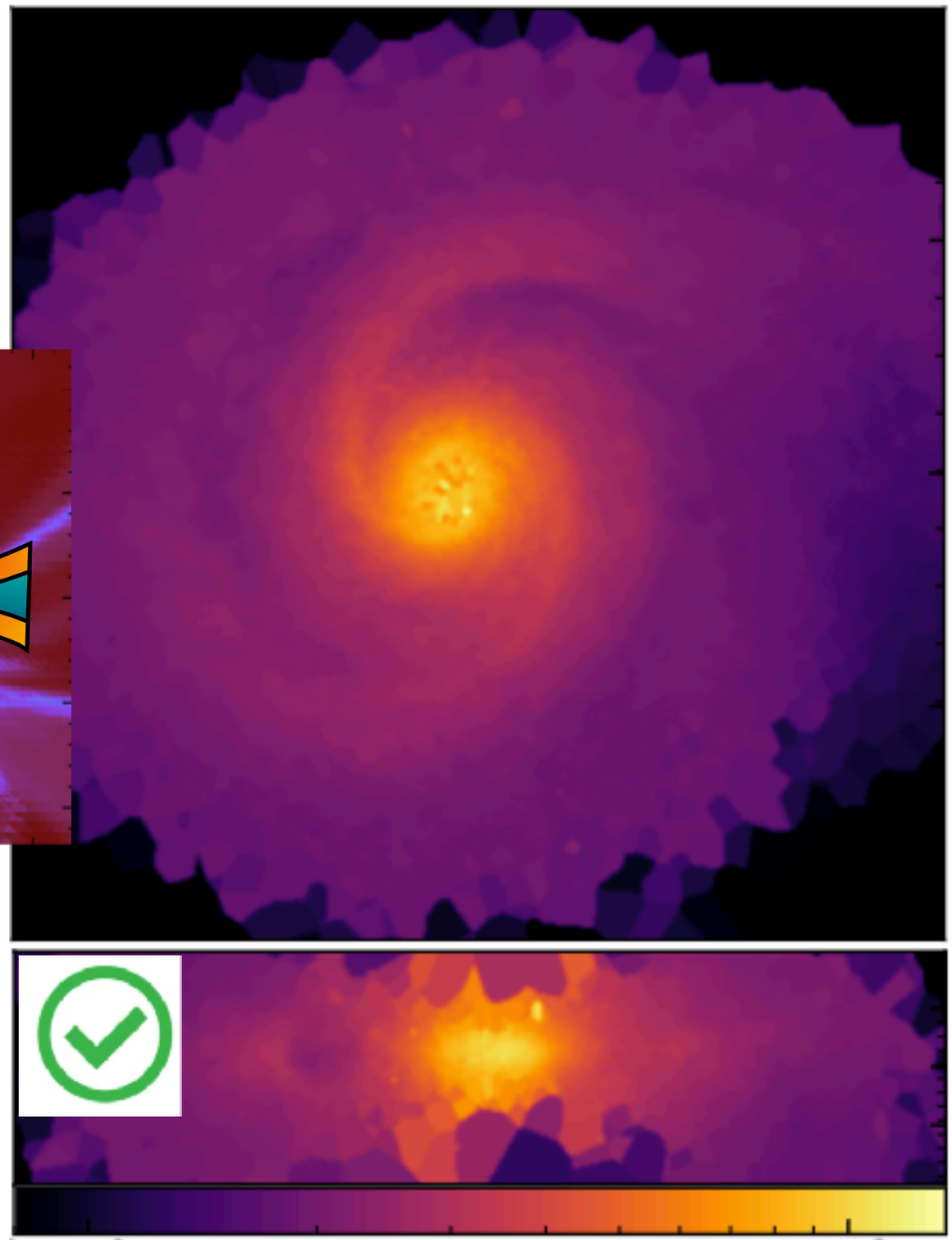






***Zamponi**, Maureira et al. 2021*

Gas temperature (RHD model)



Reproduces fluxes and produces asymmetries

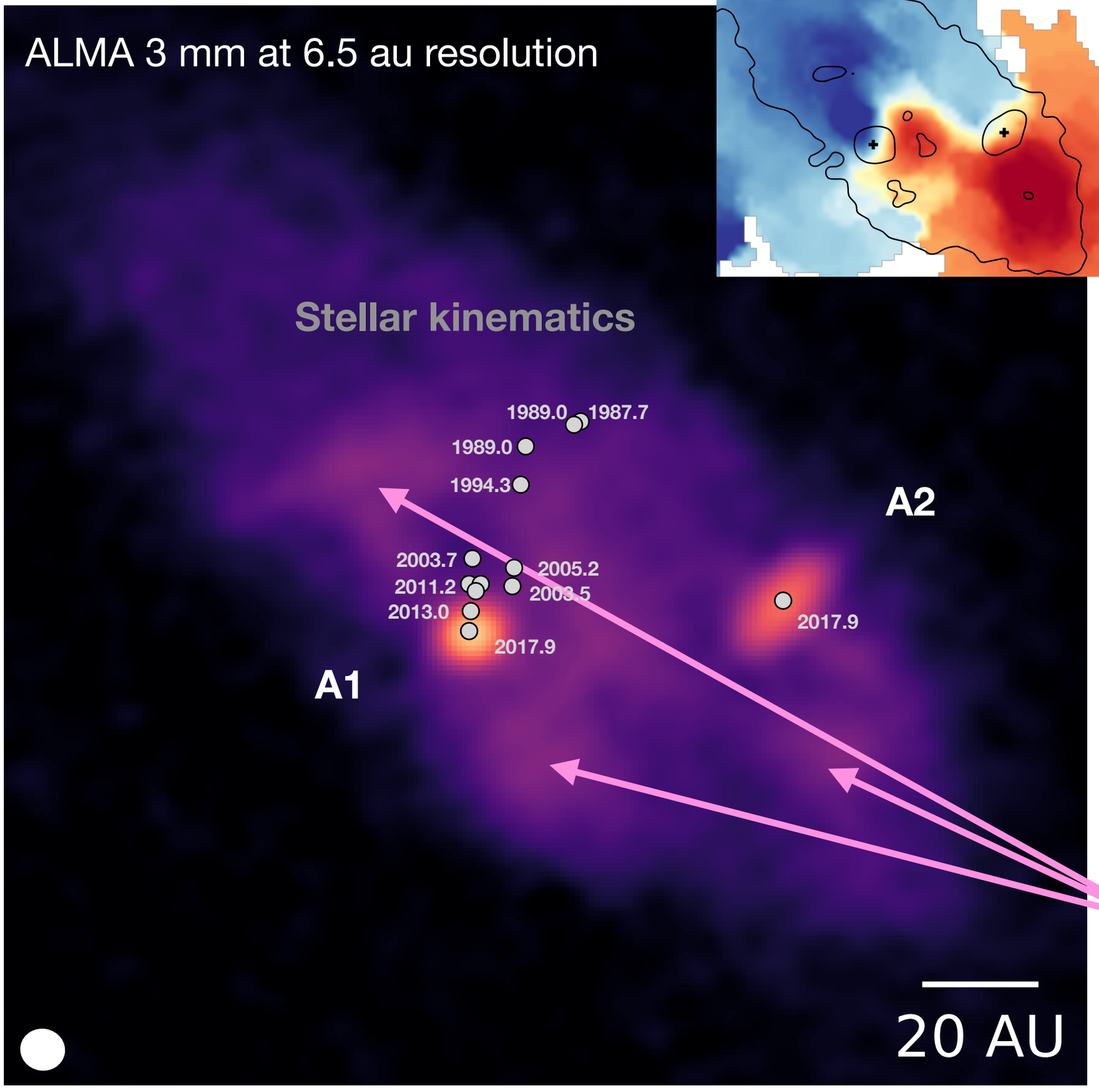
Gas temperatures needed to match observations

Protostellar radiation Irrelevant (disk too optically thick)

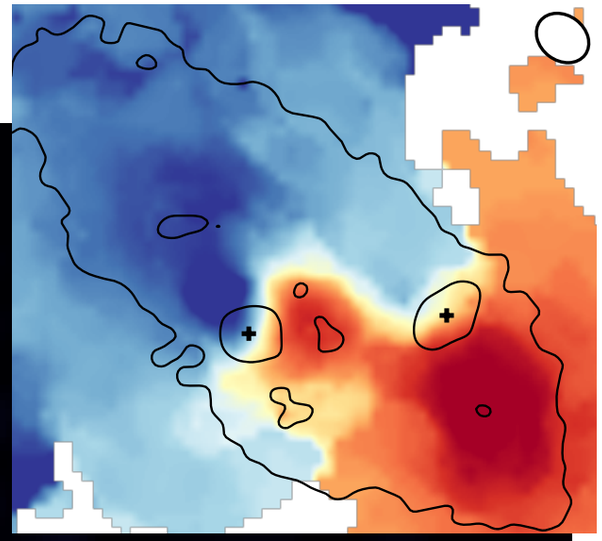
Spec index naturally explained by reverse temp gradient and high optical depth

a_max ~10um- few 100um

***Zamponi**, Maureira et al. 2021*



Gas kinematics



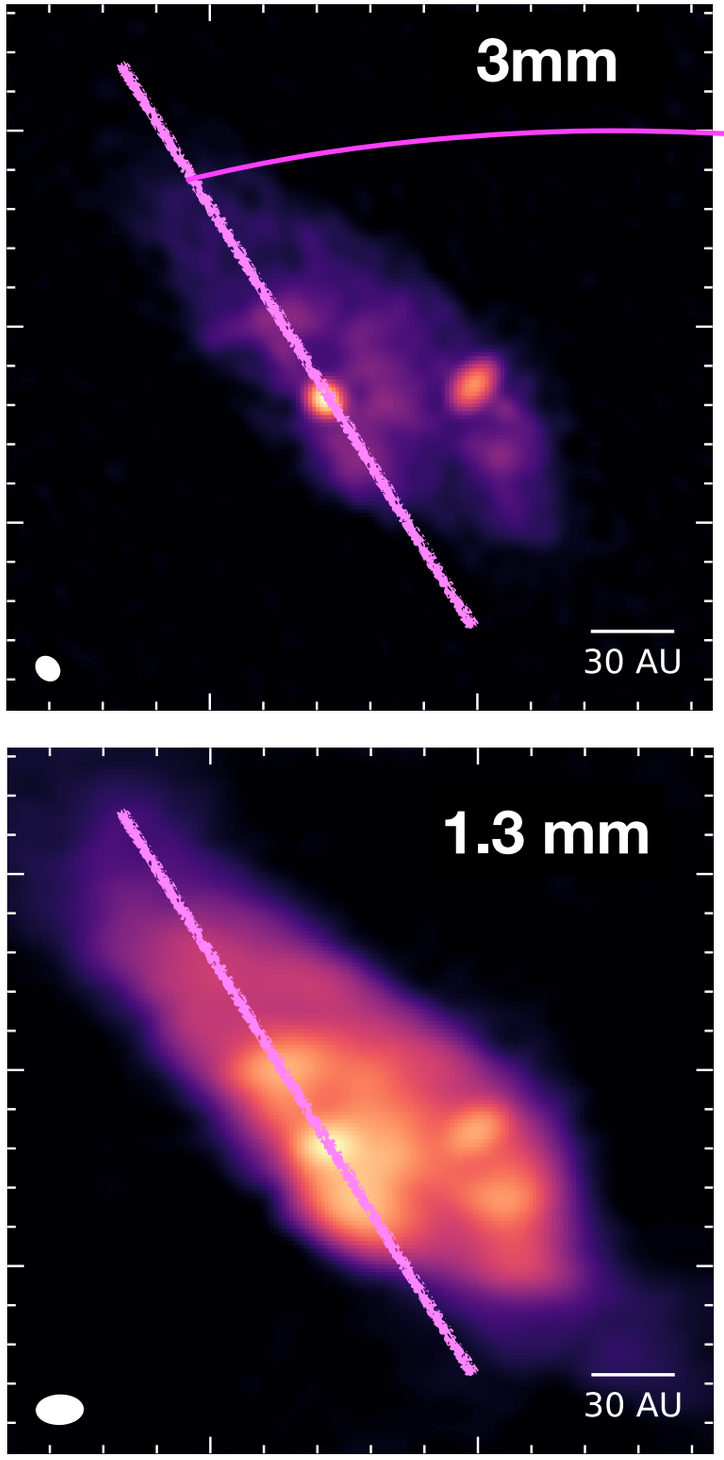
Bound system

At least 2 Msun in protostellar mass

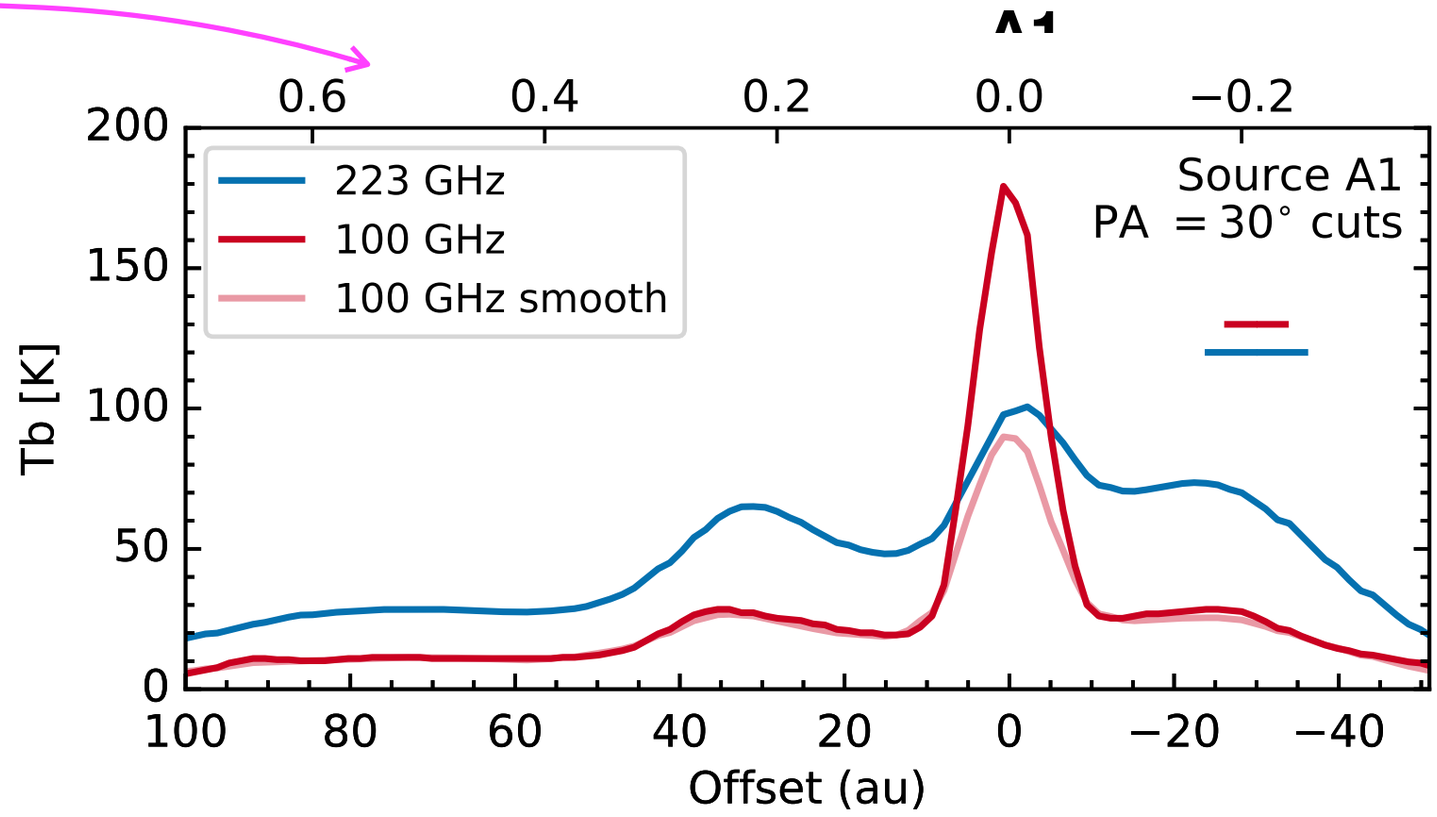
Complex circumbinary substructures

Maureira et al. 2020

Comparison between spectral index and Brightness Temperature distribution

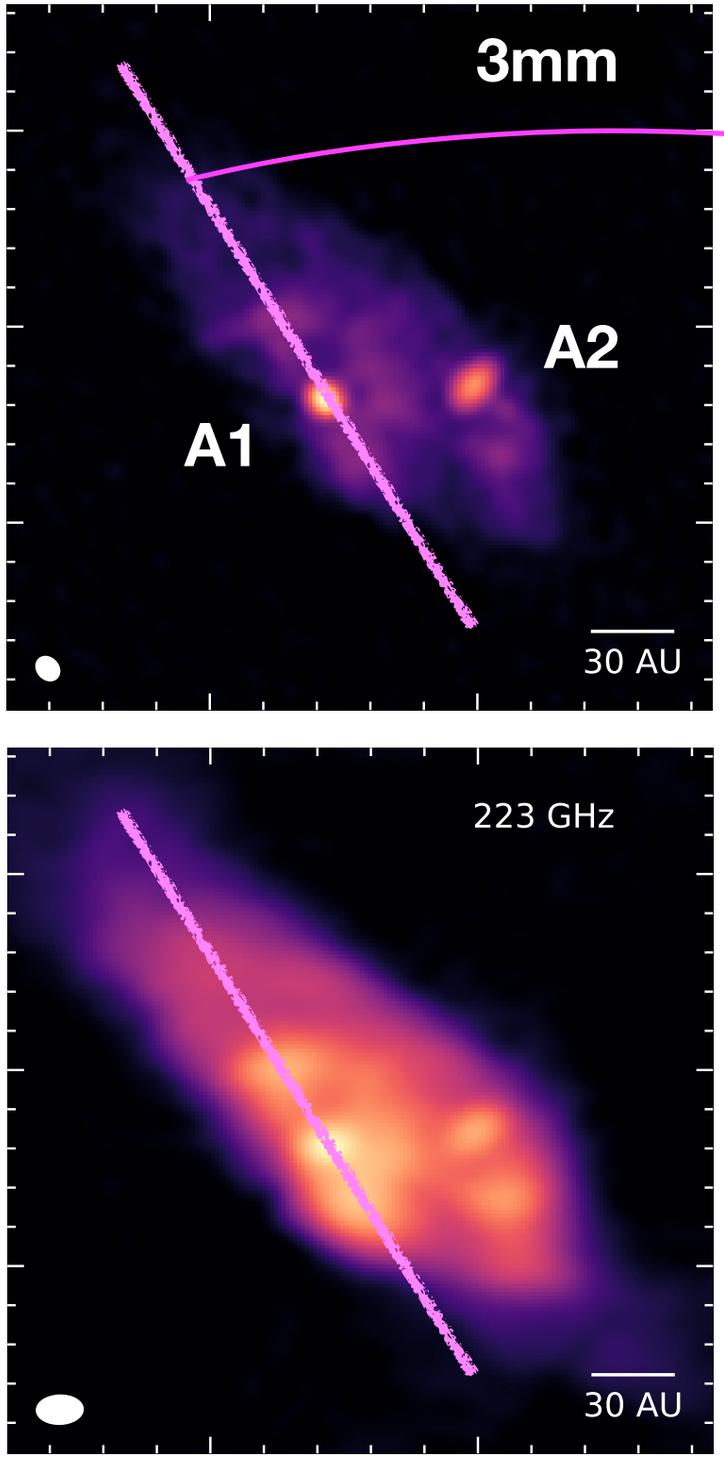


Profiles



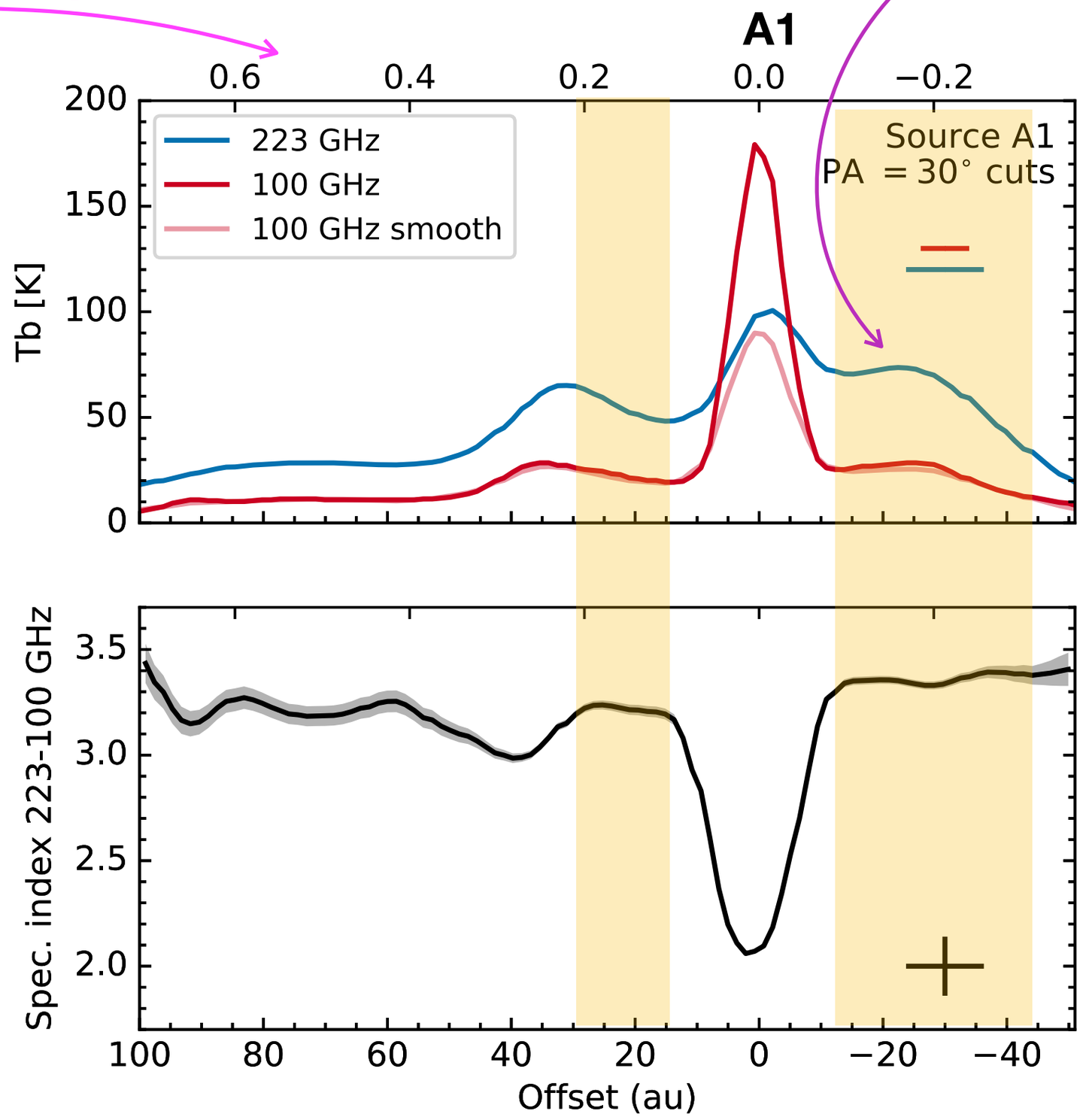
Maureira et al. (to be submitted)

Comparison between spectral index and Brightness Temperature distribution



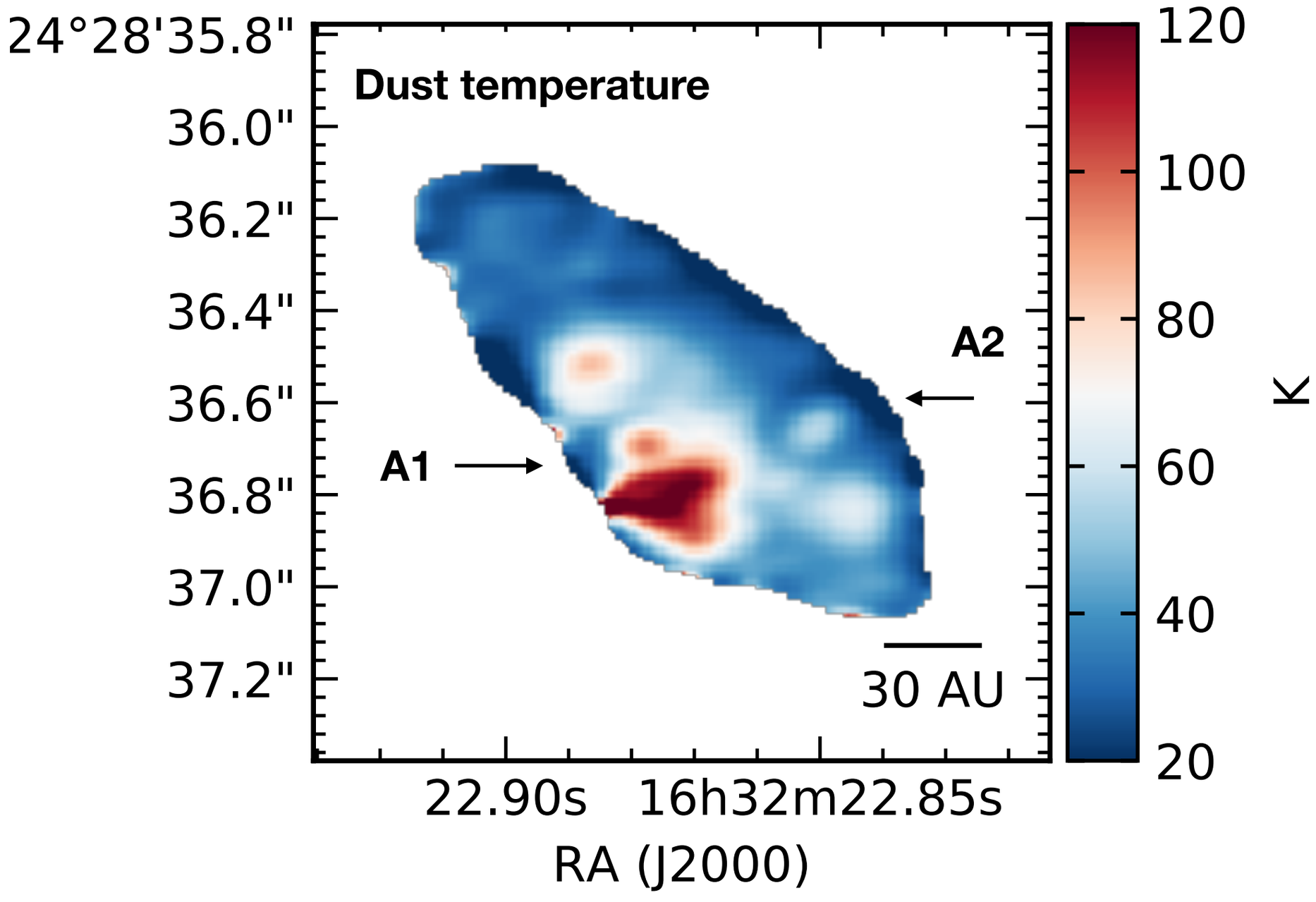
Profiles

Temperature substructures



Maureira et al. (to be submitted)

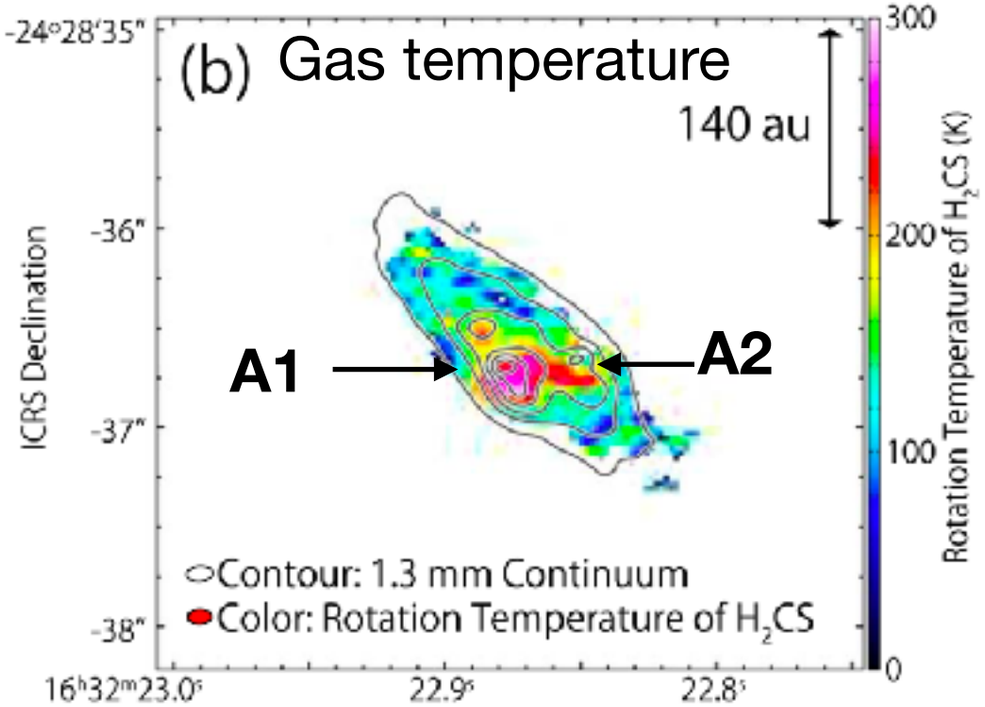
Dust temperature distribution NOT a smoothly decreasing with distance to the protostars



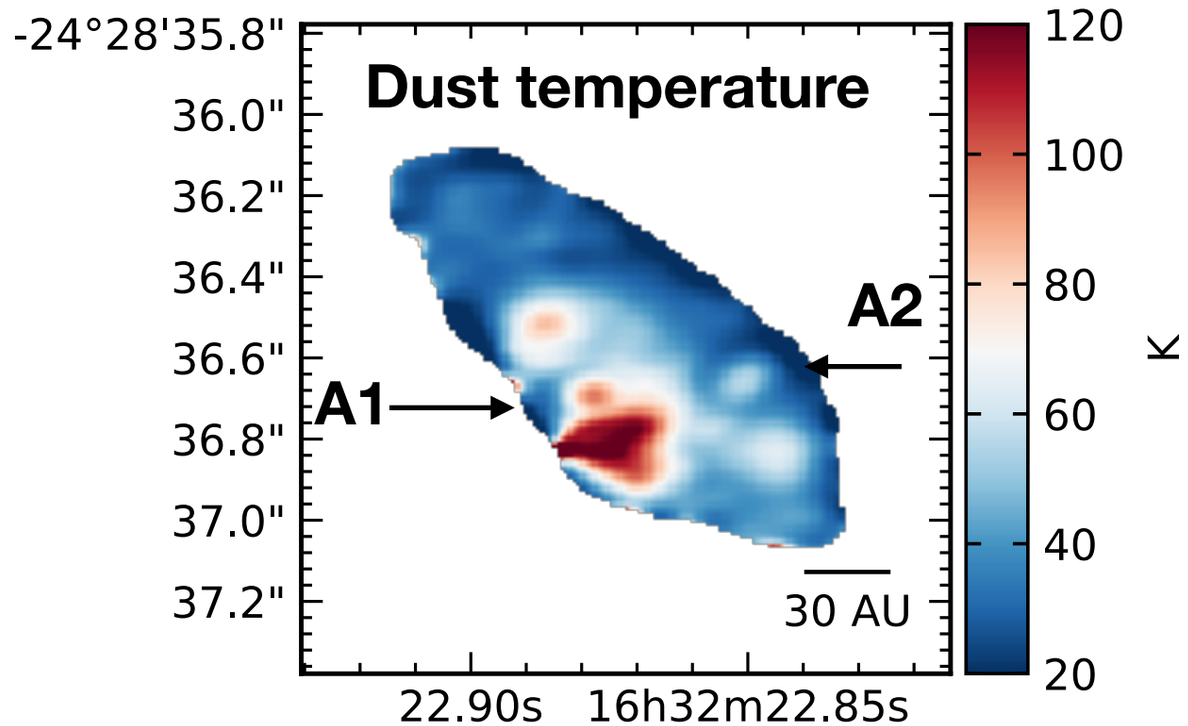
*Lower limits assuming beta=1.7

Maureira et al. (to be submitted)

Gas and dust show localized enhancements of temperature

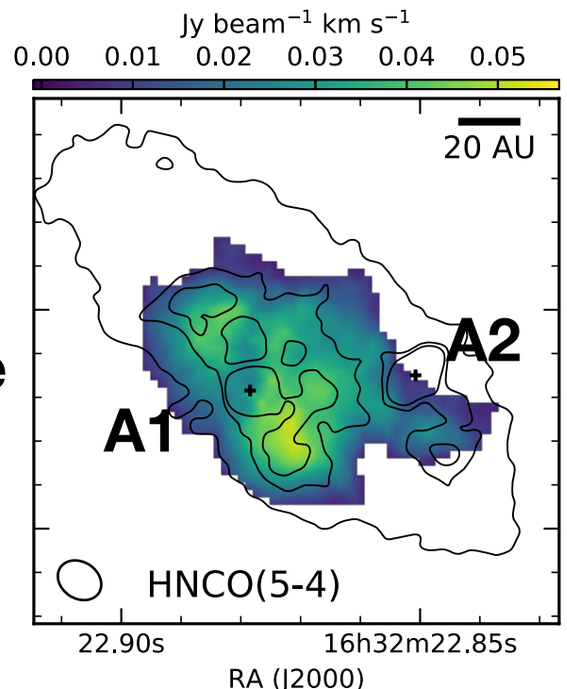


Oya et al. 2020 (see also van't hoff et al. 2020)

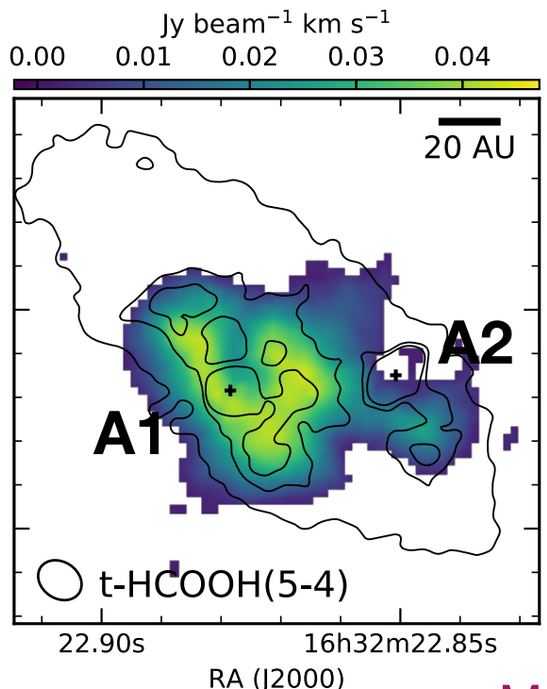


Maureira et al. (to be submitted)

COM emission at 10 au scale



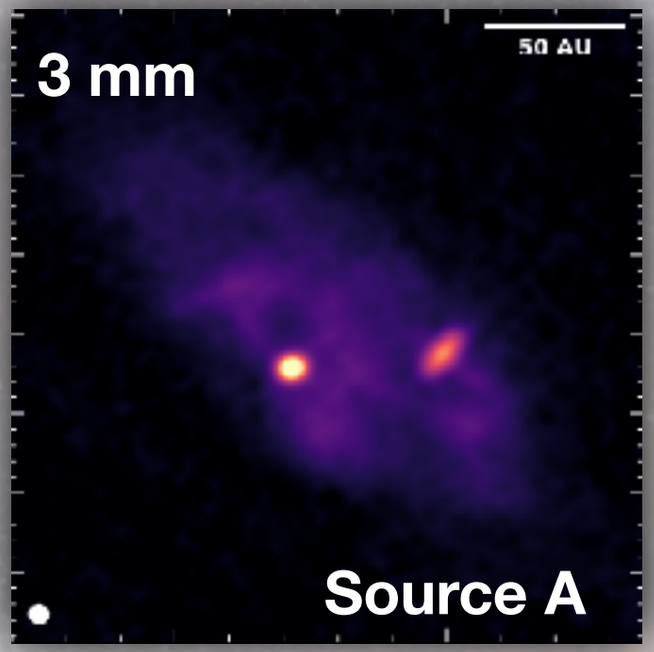
contours: 3mm continuum

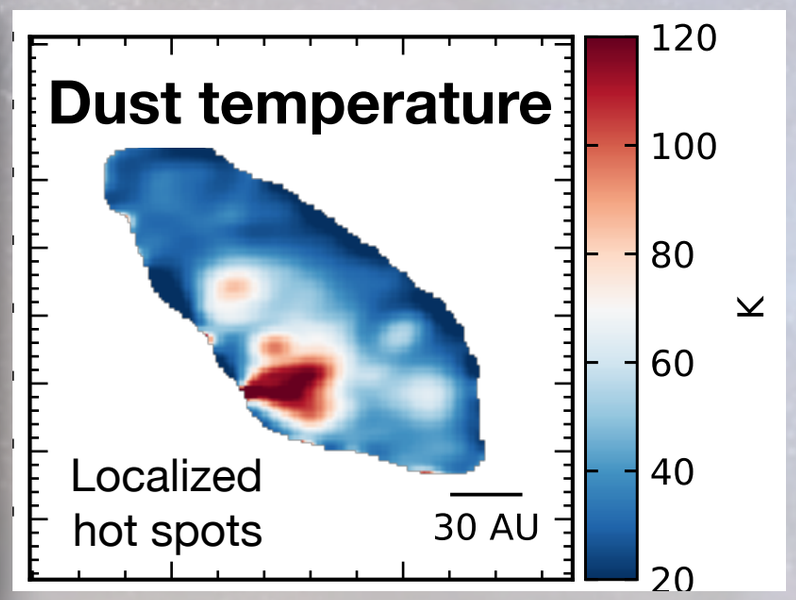


Protostellar radiation cannot explain the temperature distribution in the gas and dust (shocks???)

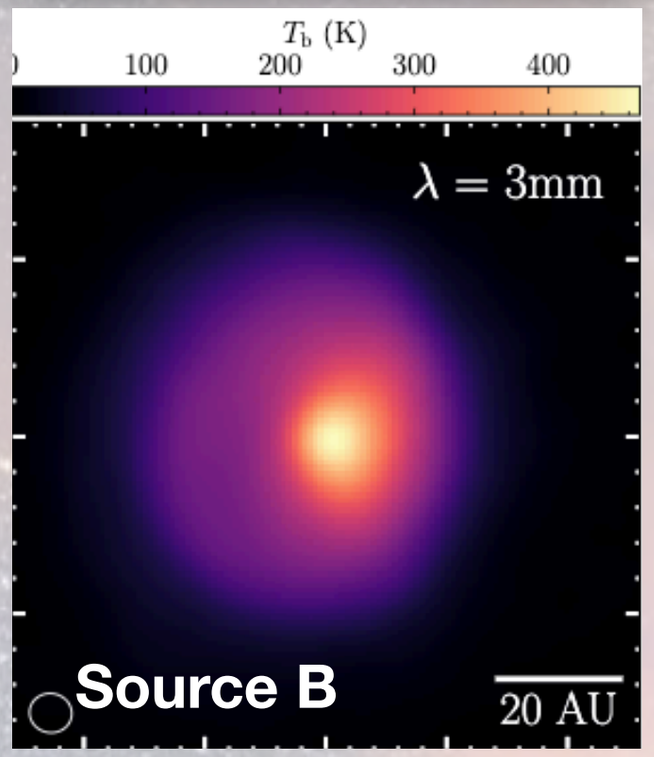
Maureira et al. 2020

Conclusions and questions

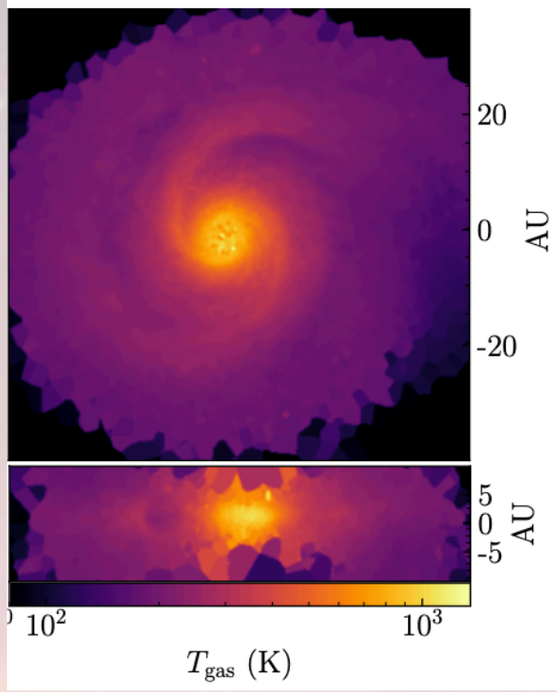




Passively radiated disk not good representation of the disk structures in the Class 0 IRAS 16293-2422



Reversed temperature gradient



What about others? More obs please! (Lin et al. 2020 HH212)

Implications for calculations of masses, and interpretation of spectral index (Li et al. 2017, Galvan-Madrid et al. 2018)

What are the implication for planet formation?