

Constraints on the physical origin of large cavities in transition disks from multi-wavelength dust continuum emission



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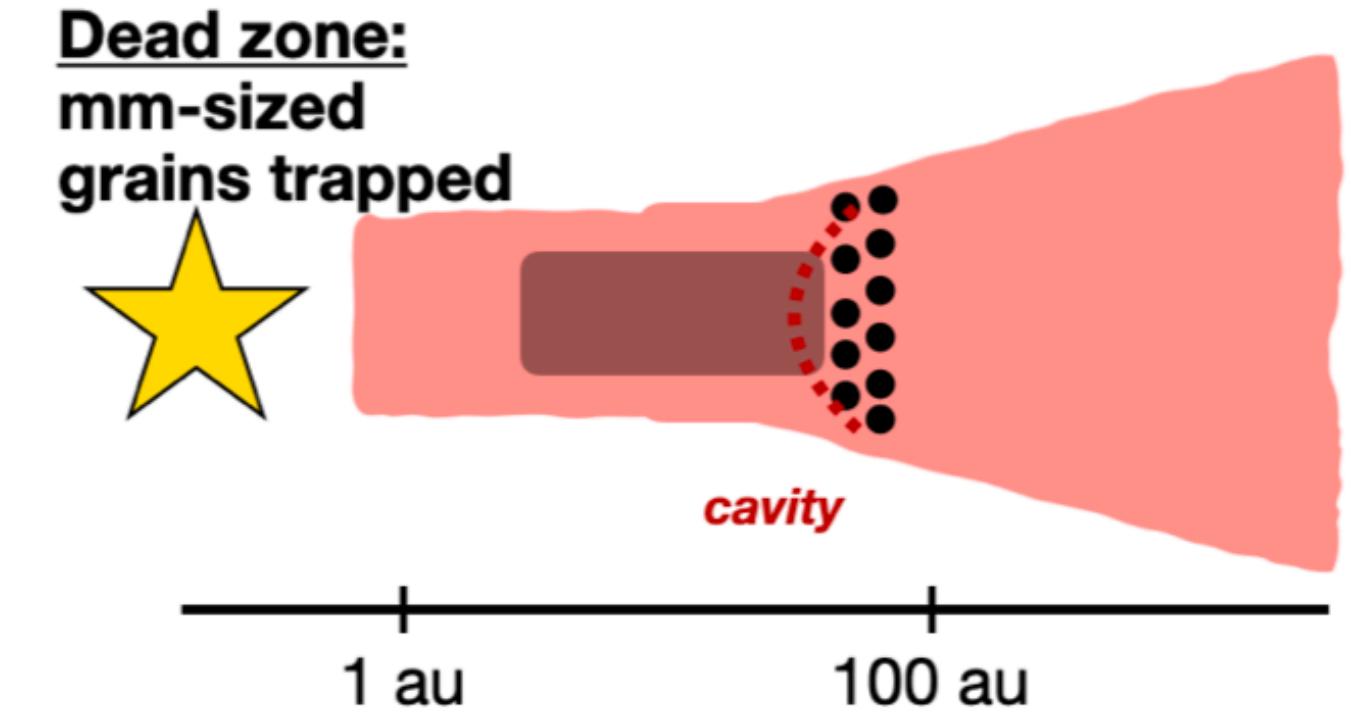
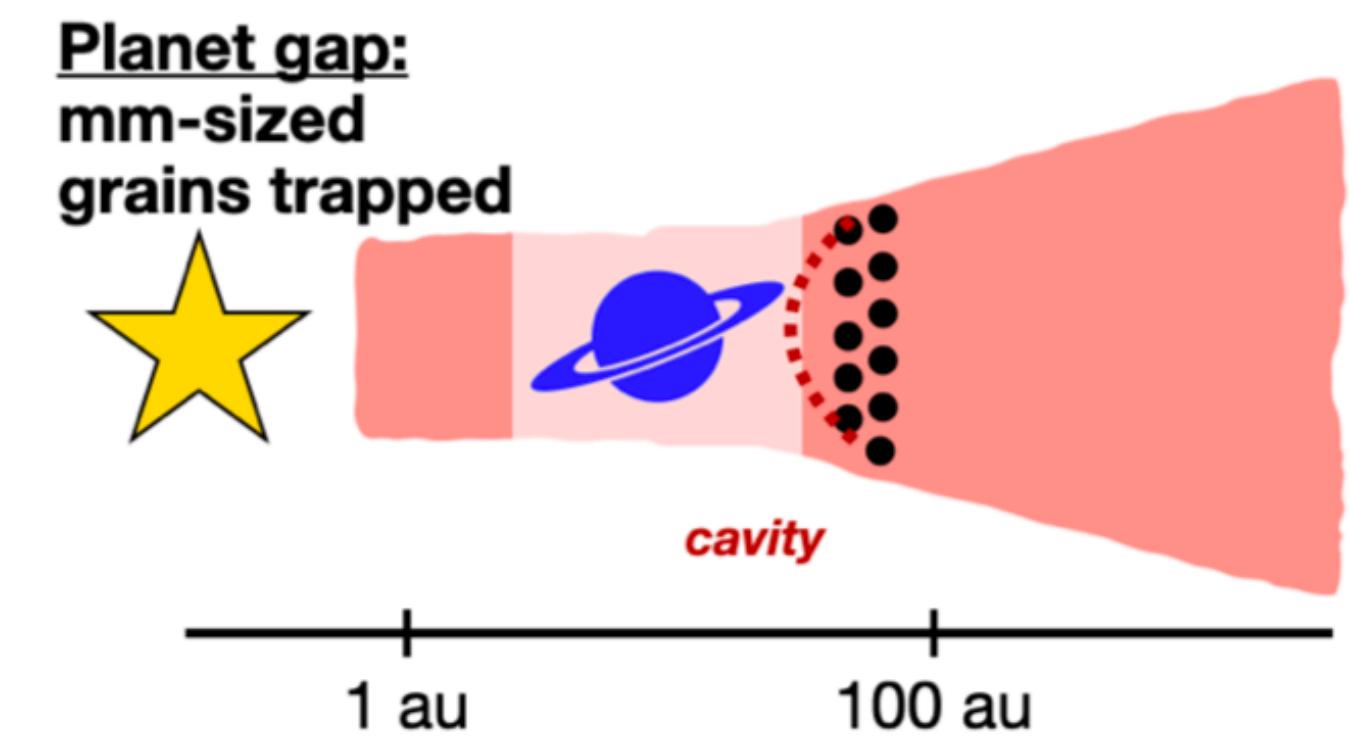
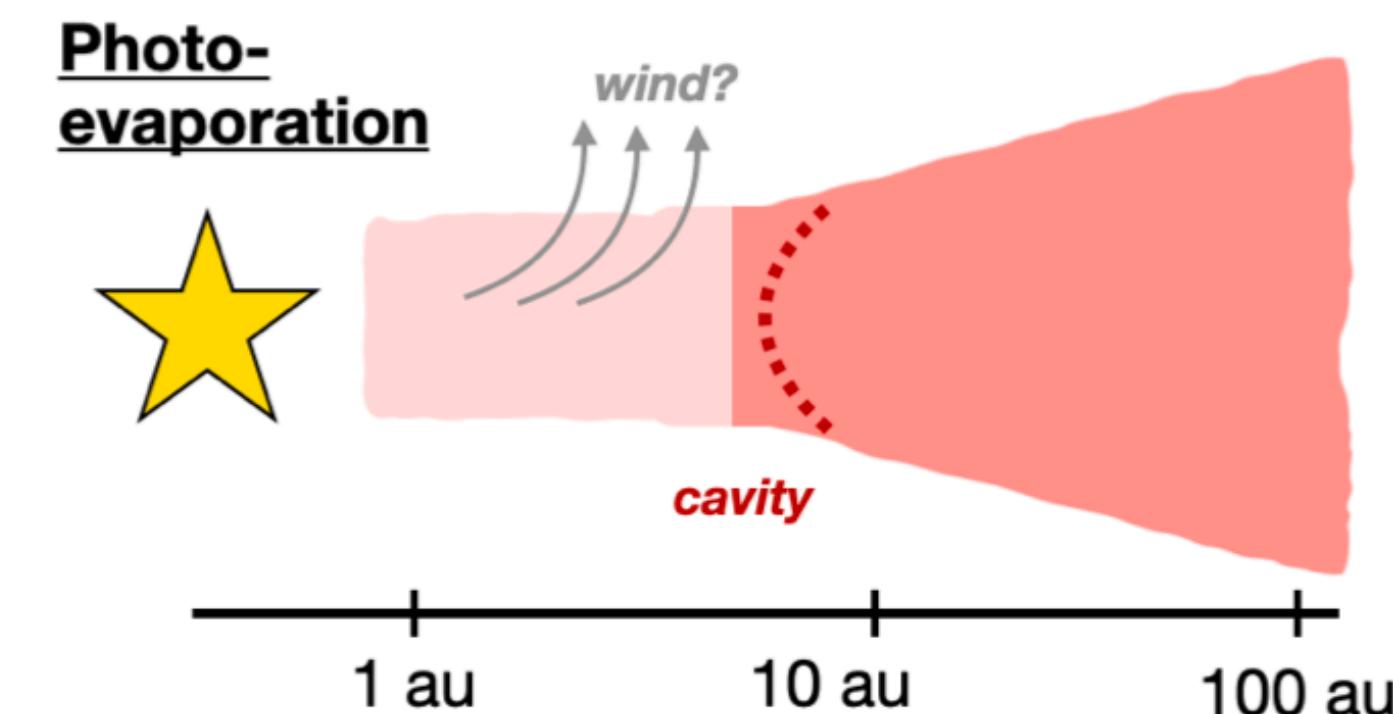
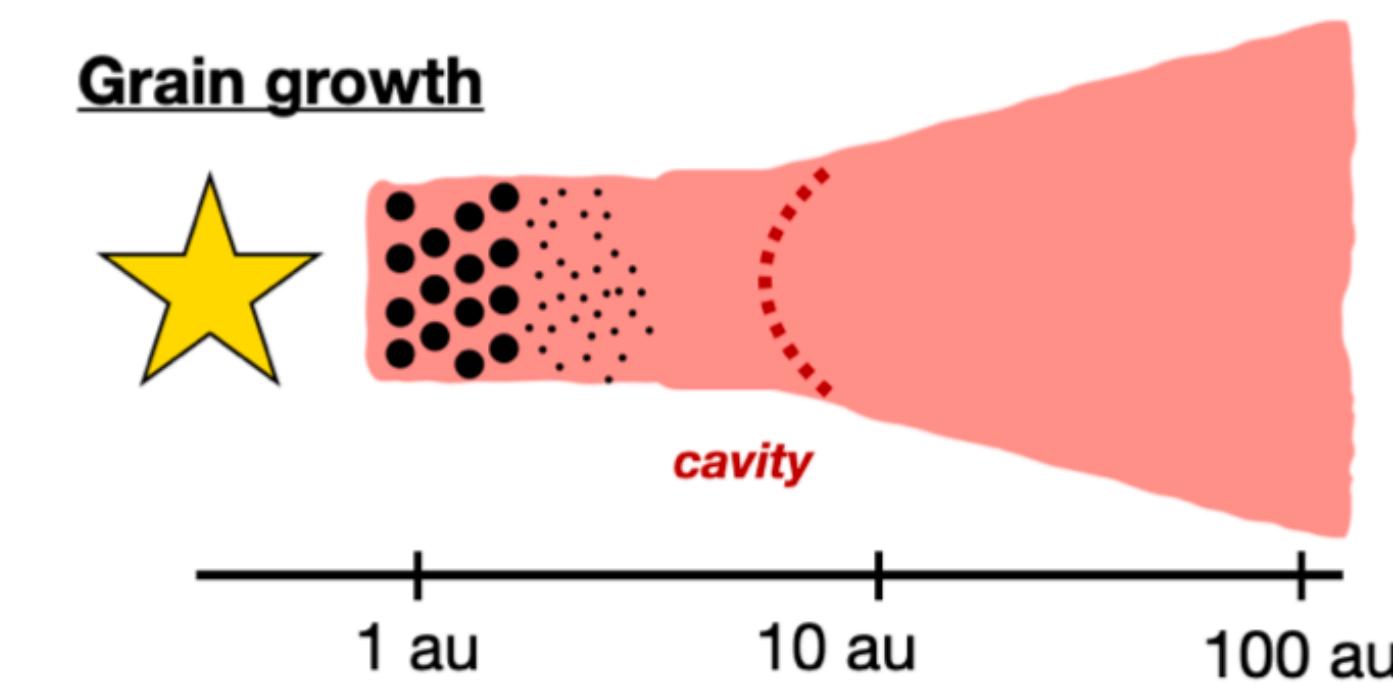
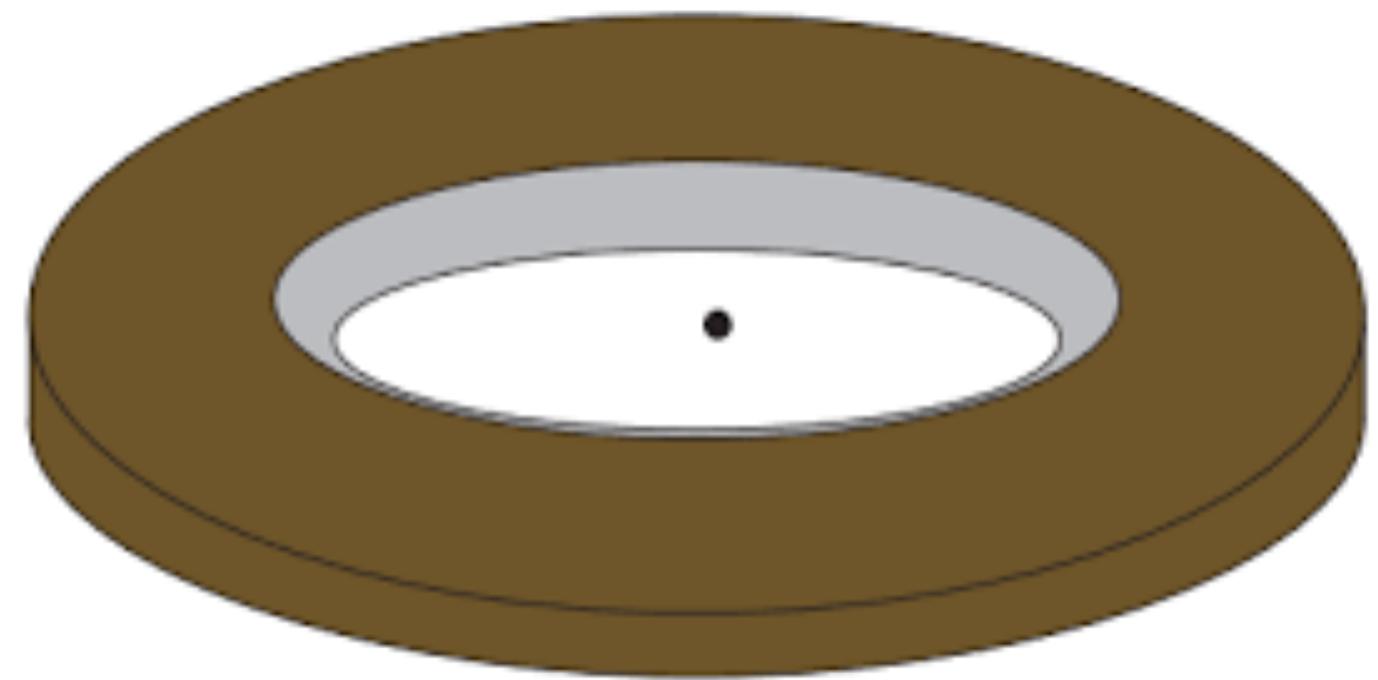


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Transition Disks

Mechanism to explain transition disks

Disks with large cavities



e.g. Dust Traps:

Characteristics:

- A local enhancement of:
 - a) the dust surface density
 - b) maximum grain size

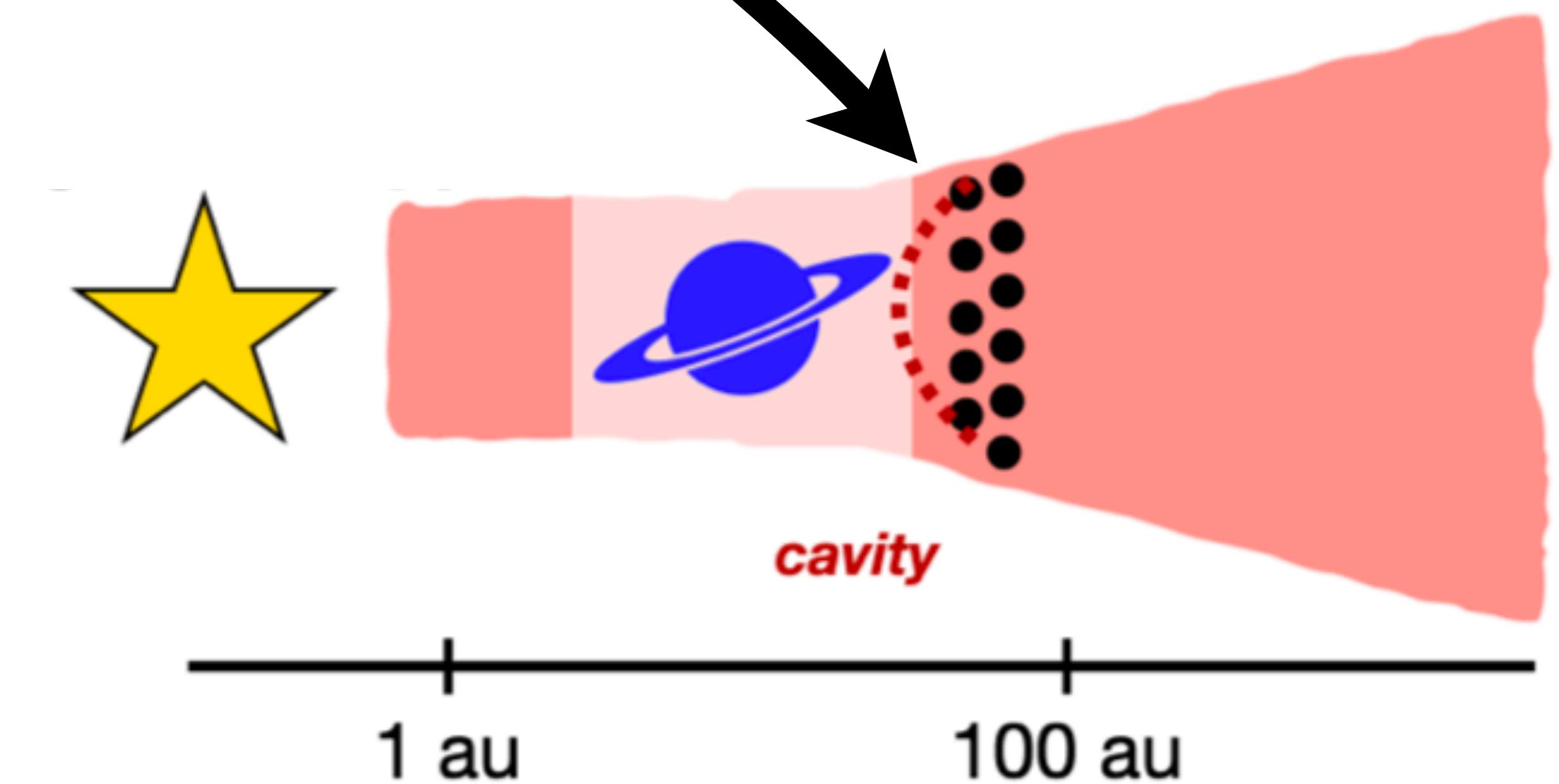
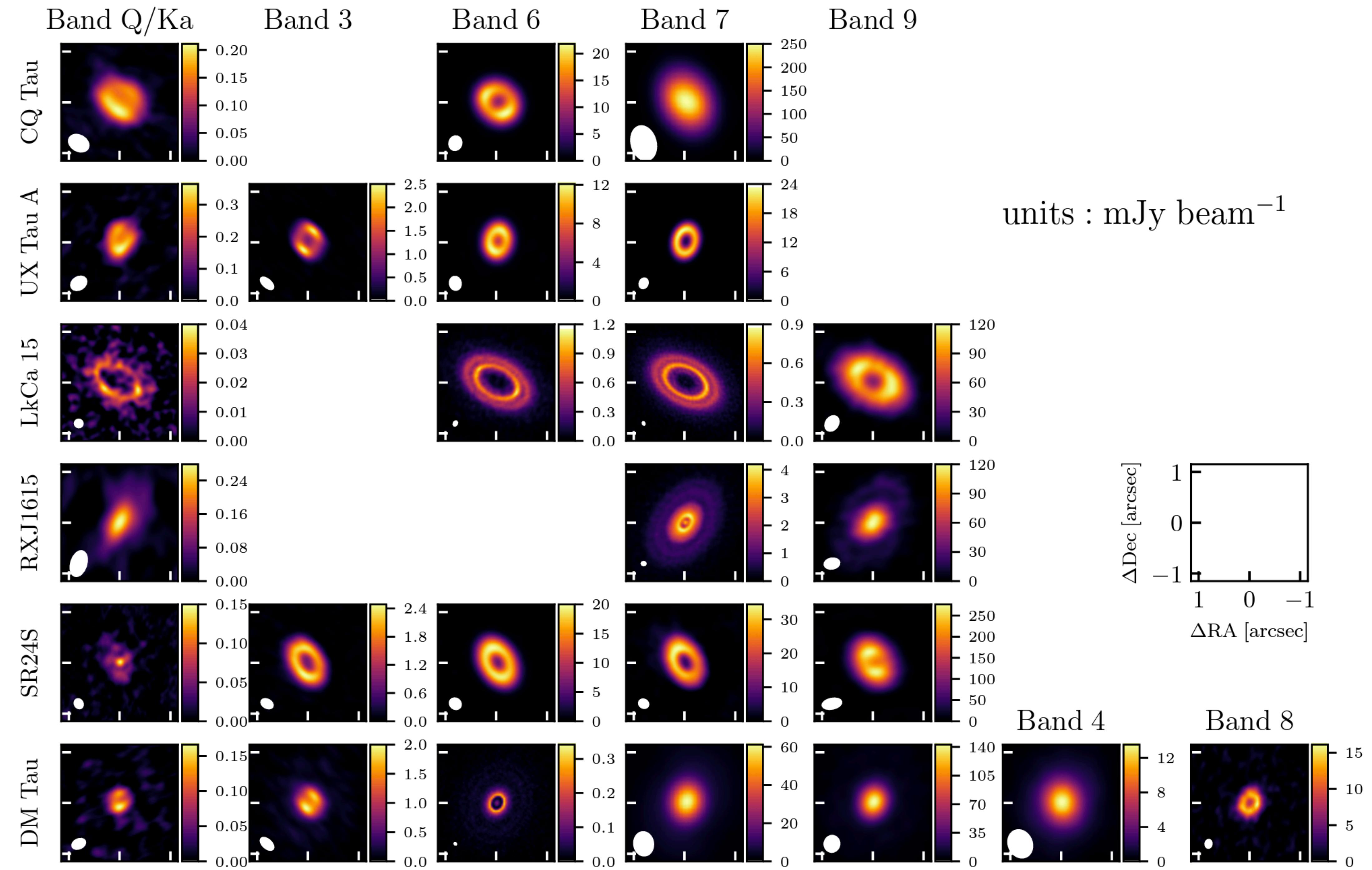


Image from van der Marel 2022

Data: 6 Transition Disks



Visibilities

$$T(x, y) = \iint V(u, v) e^{-2\pi i(ux+vy)} du dv$$

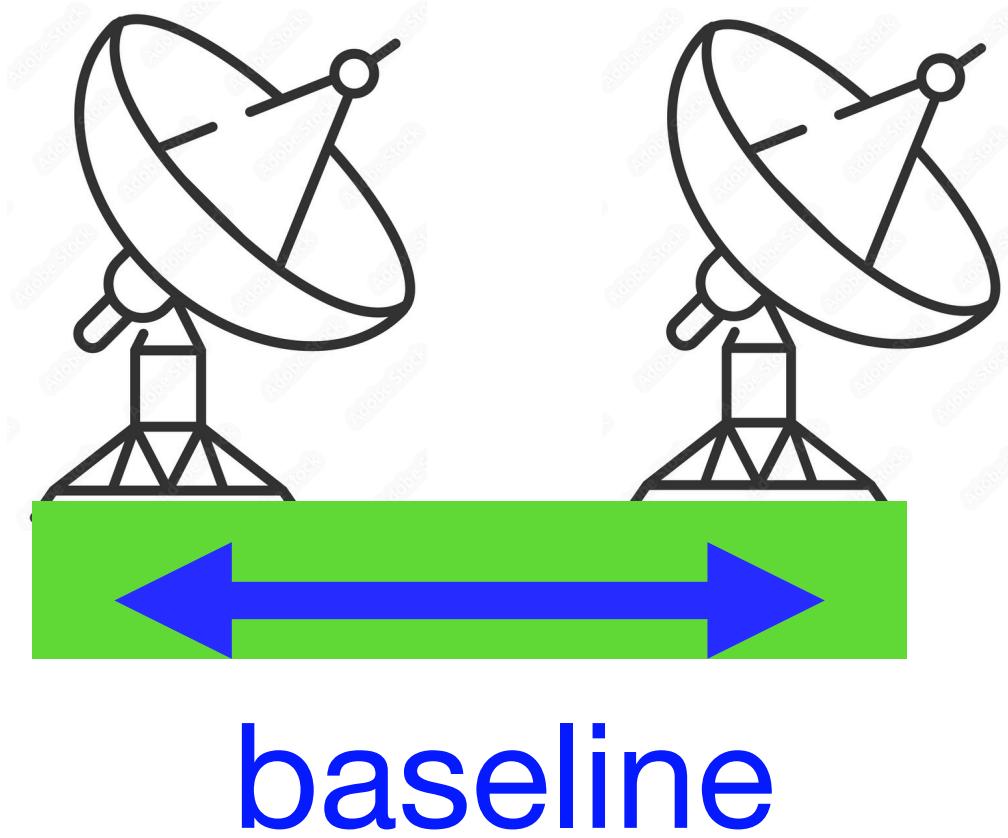
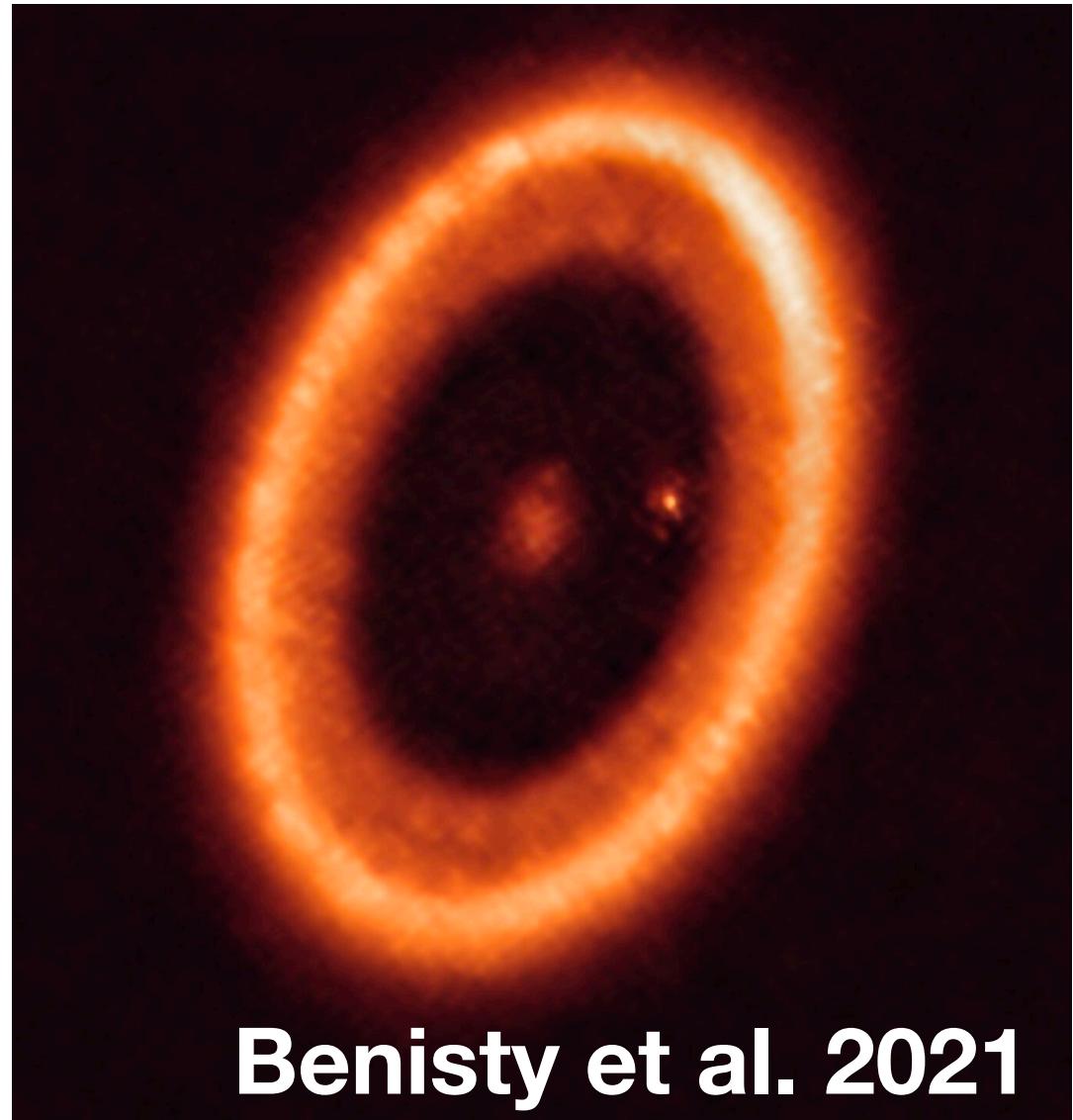
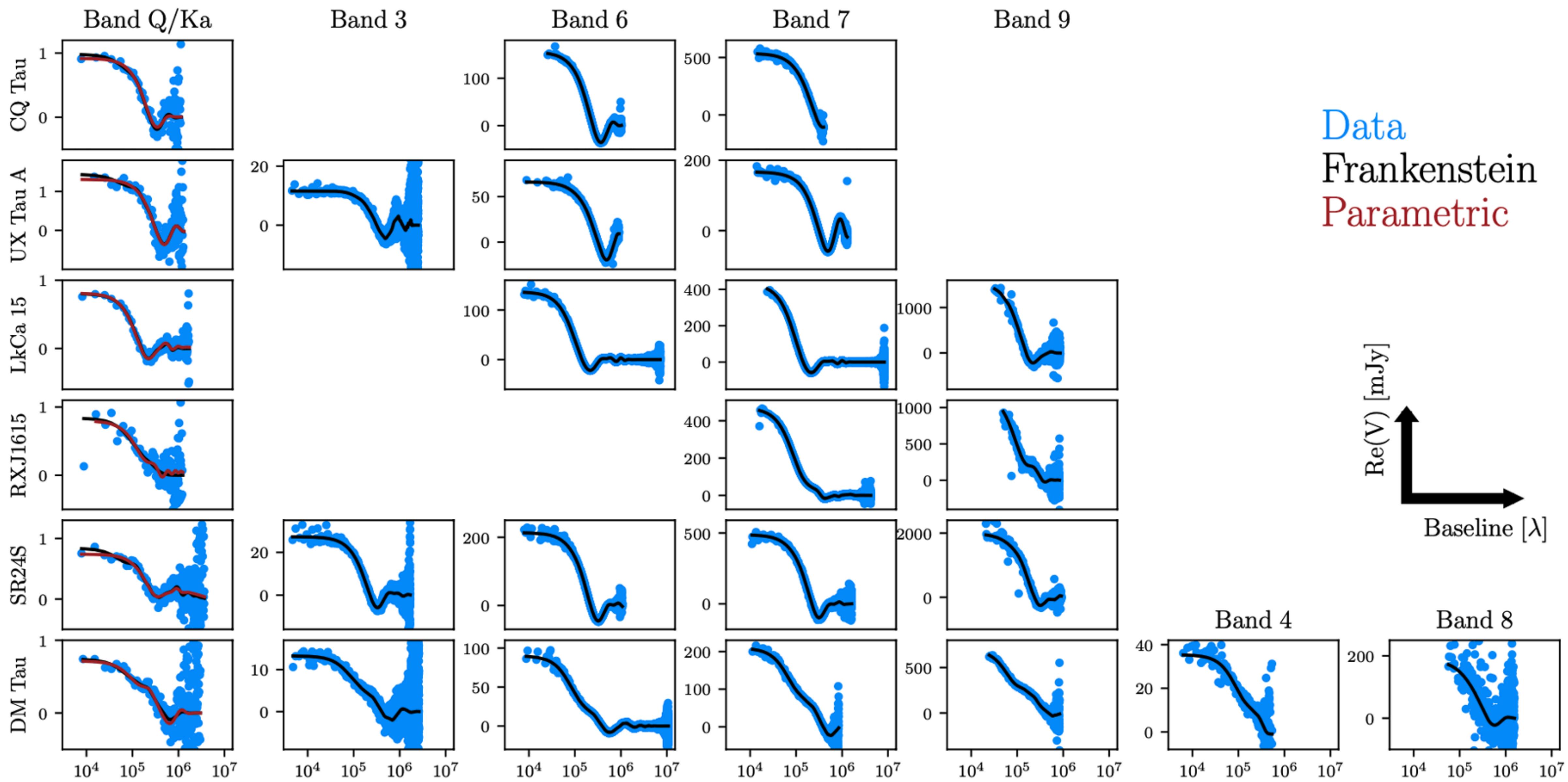


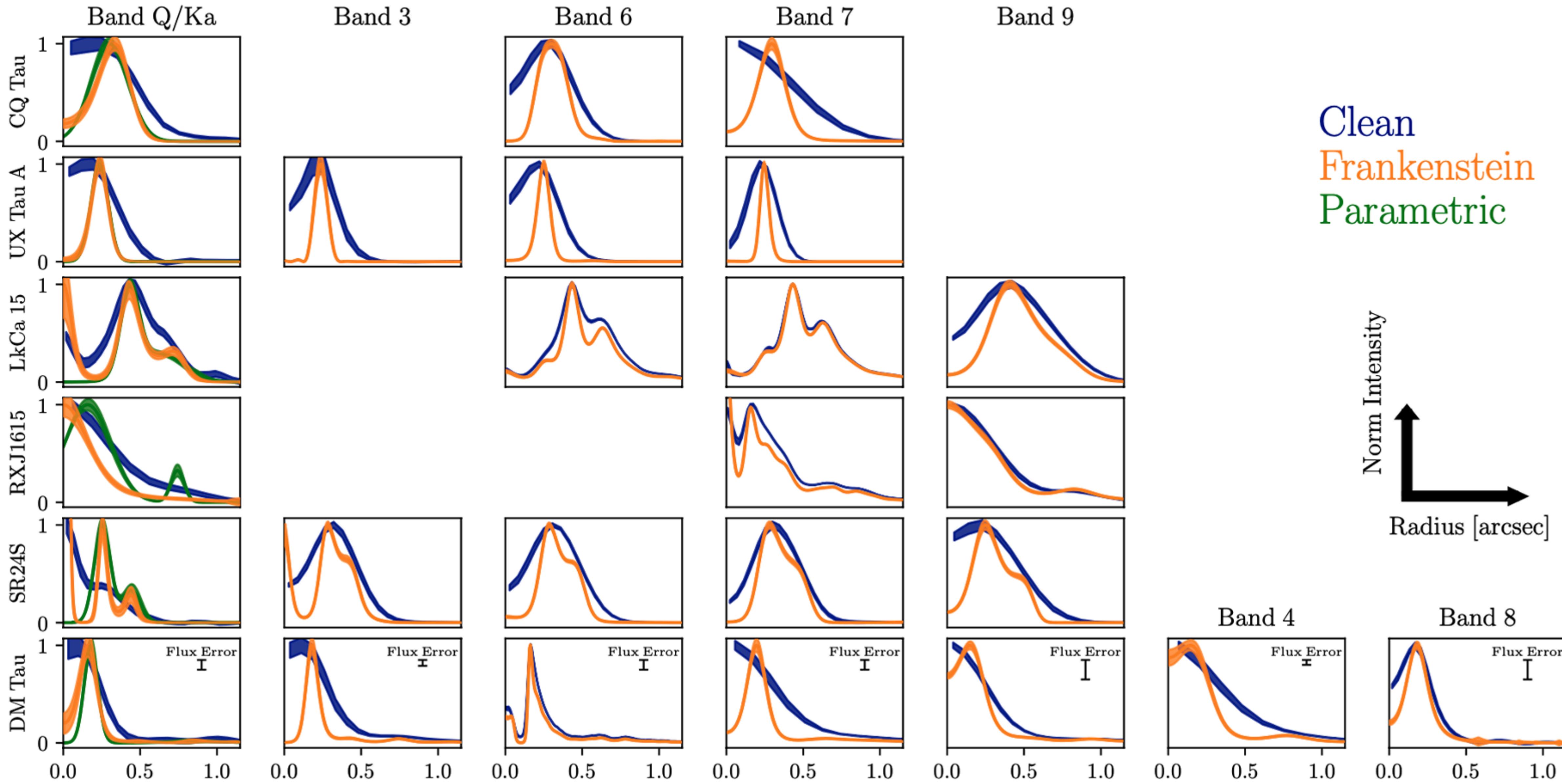
Image → data representation

Visibilities → robust data

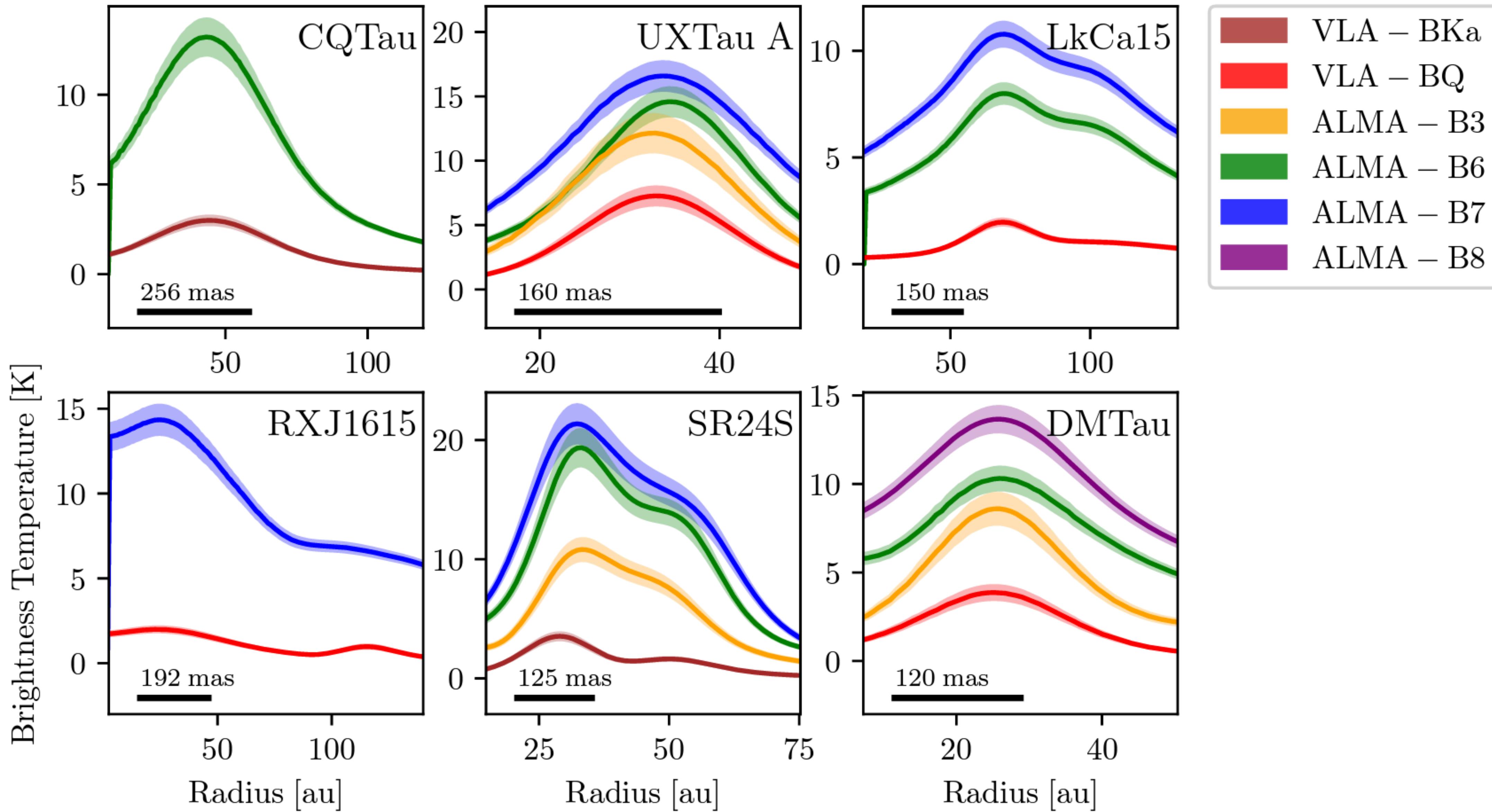
Data: 6 Transition Disks



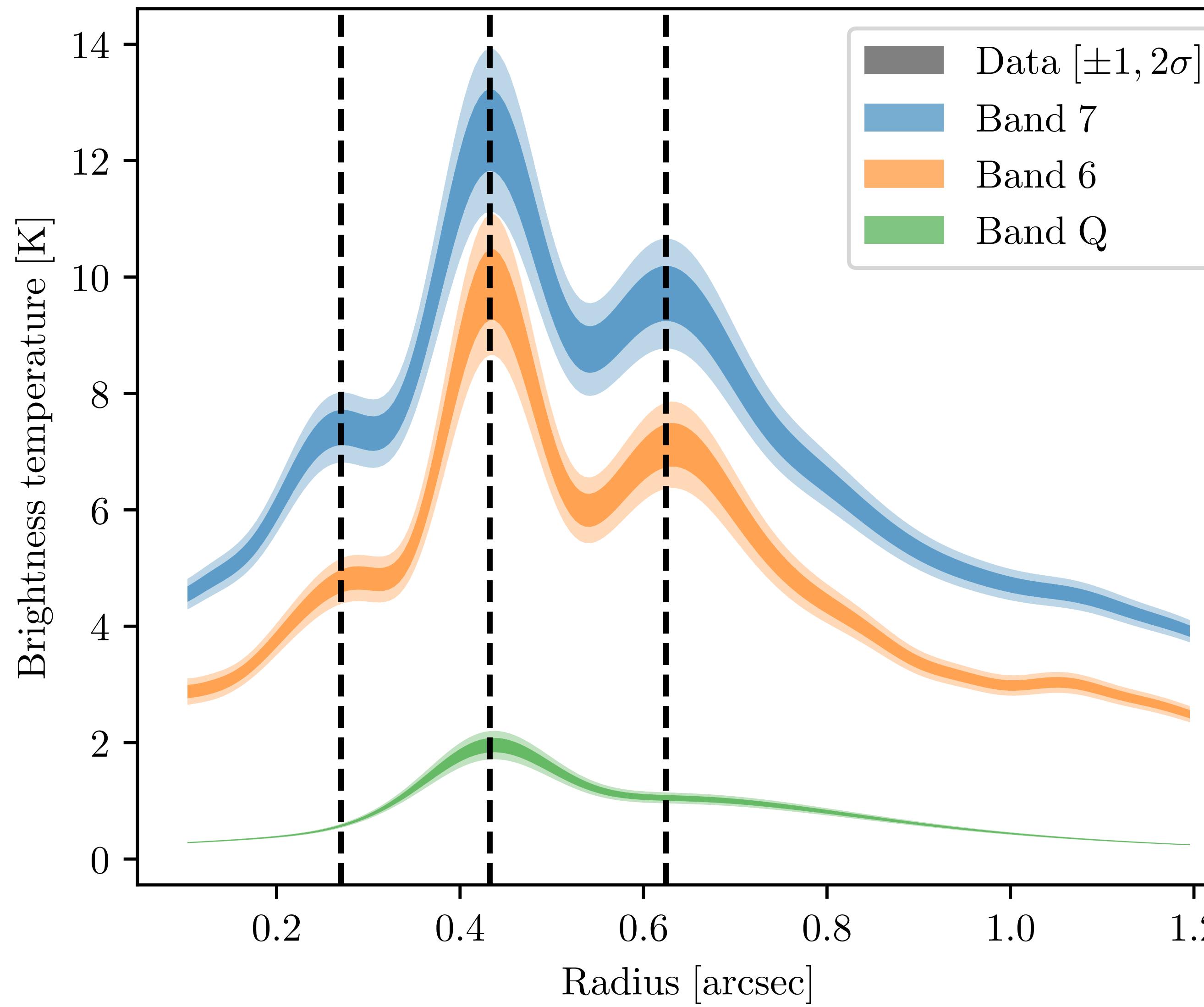
Data: 6 Transition Disks



Multi-wavelength data



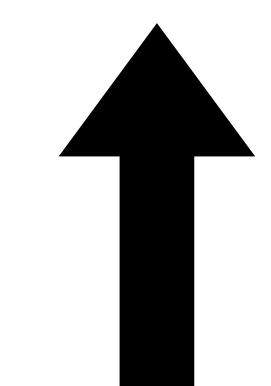
Dust properties constraints, e.g. LkCa15



We explore the dust properties space parameter at each radius

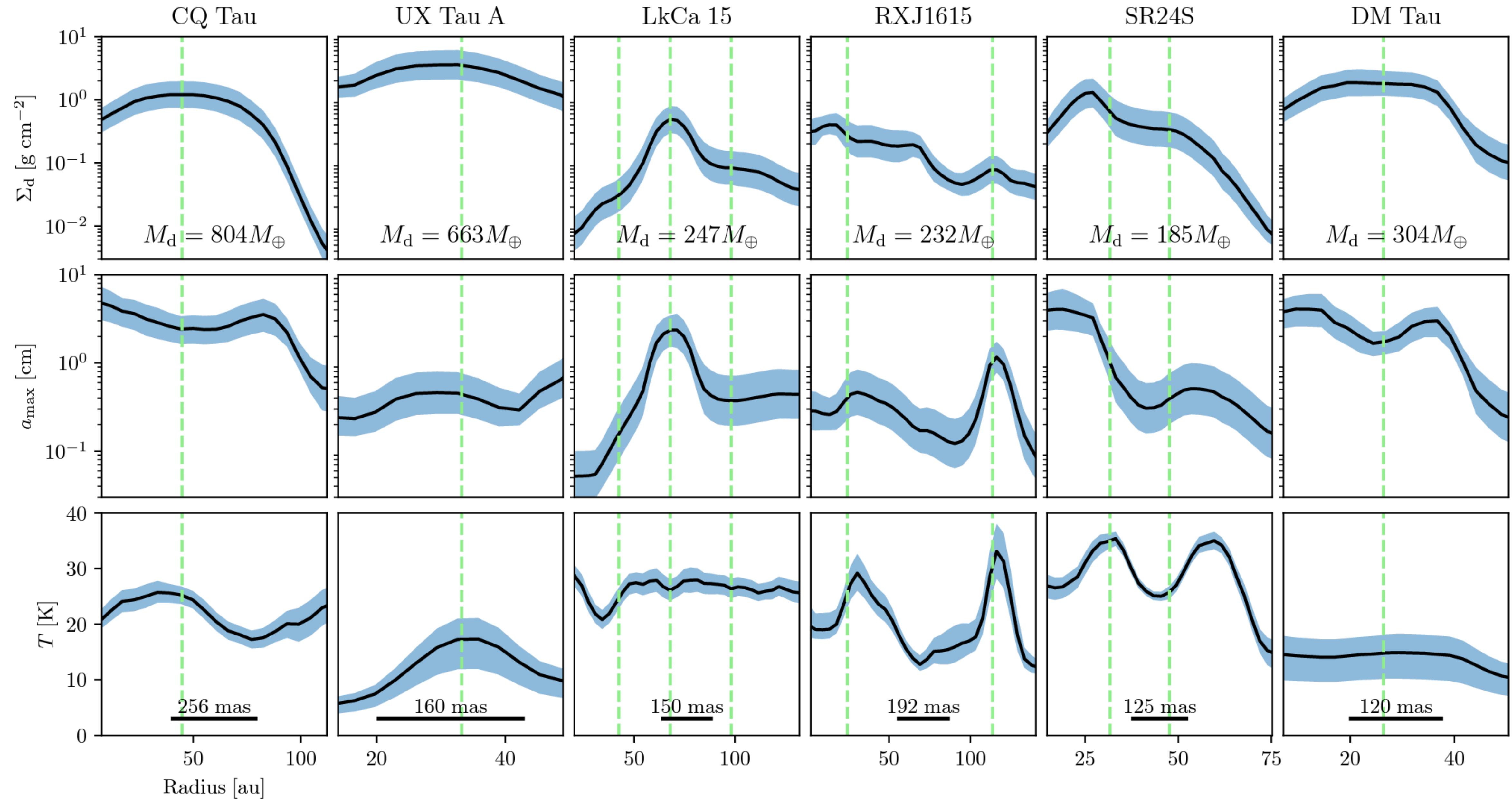
$$p(I_{\nu_1}, I_{\nu_2}, \dots, I_{\nu_n} | a_{\max}, \Sigma_d, T_d) \propto \exp(-\chi^2/2),$$

$$\chi^2 = \sum_n \left(\frac{I_{\nu_n} - I_{\nu_n}^{\text{model}}}{\delta I_{\nu_n}} \right)^2 + \chi_p^2,$$

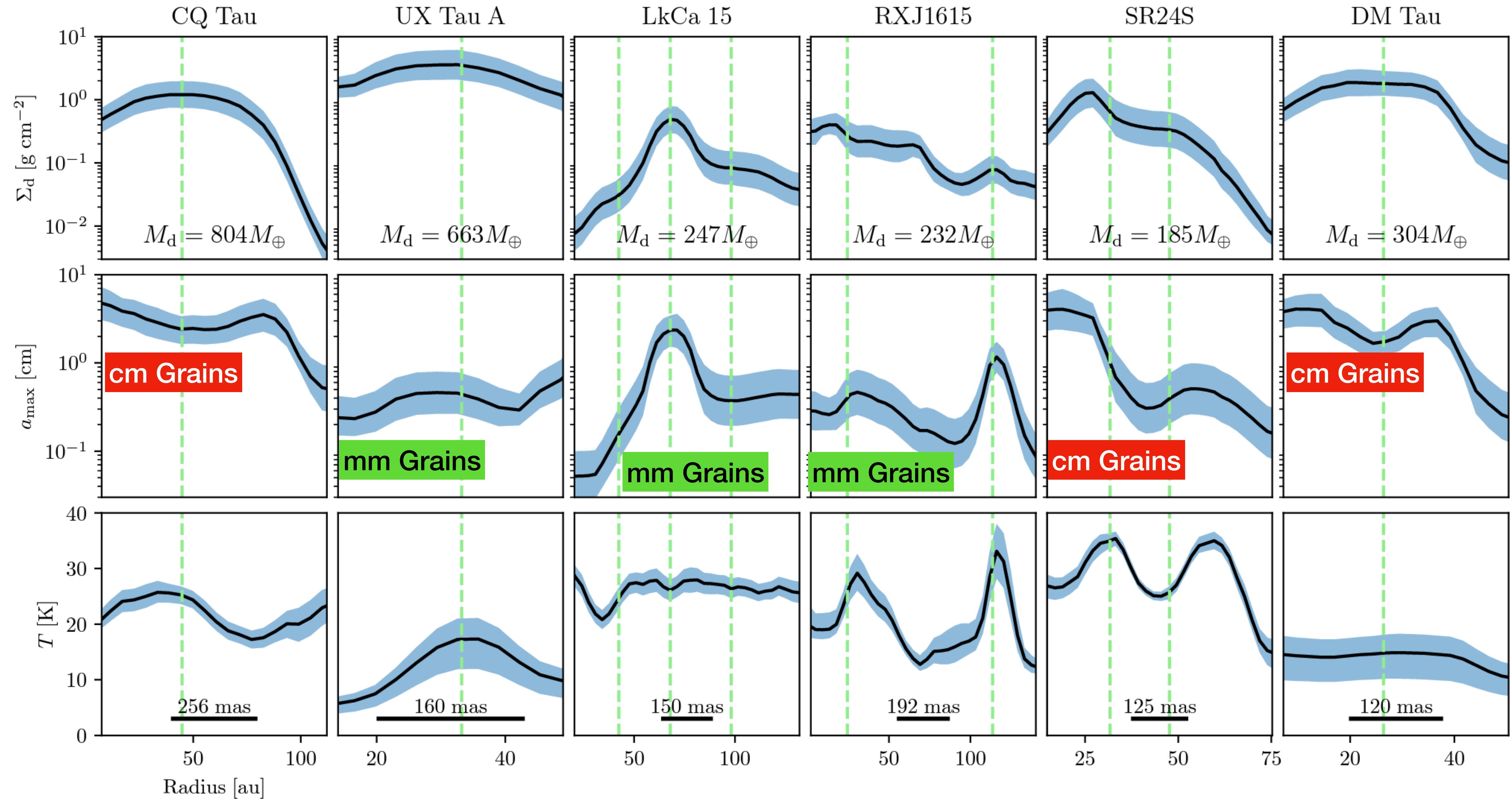


Prior

Dust properties constraints



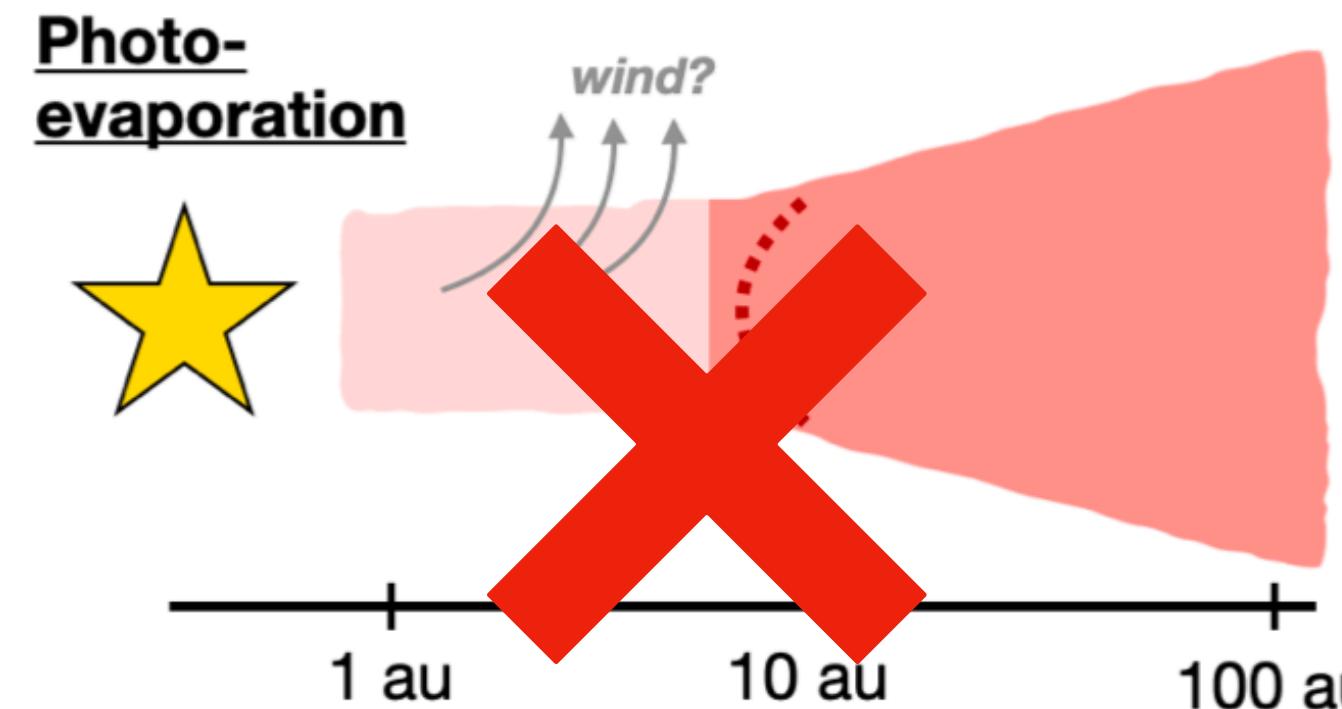
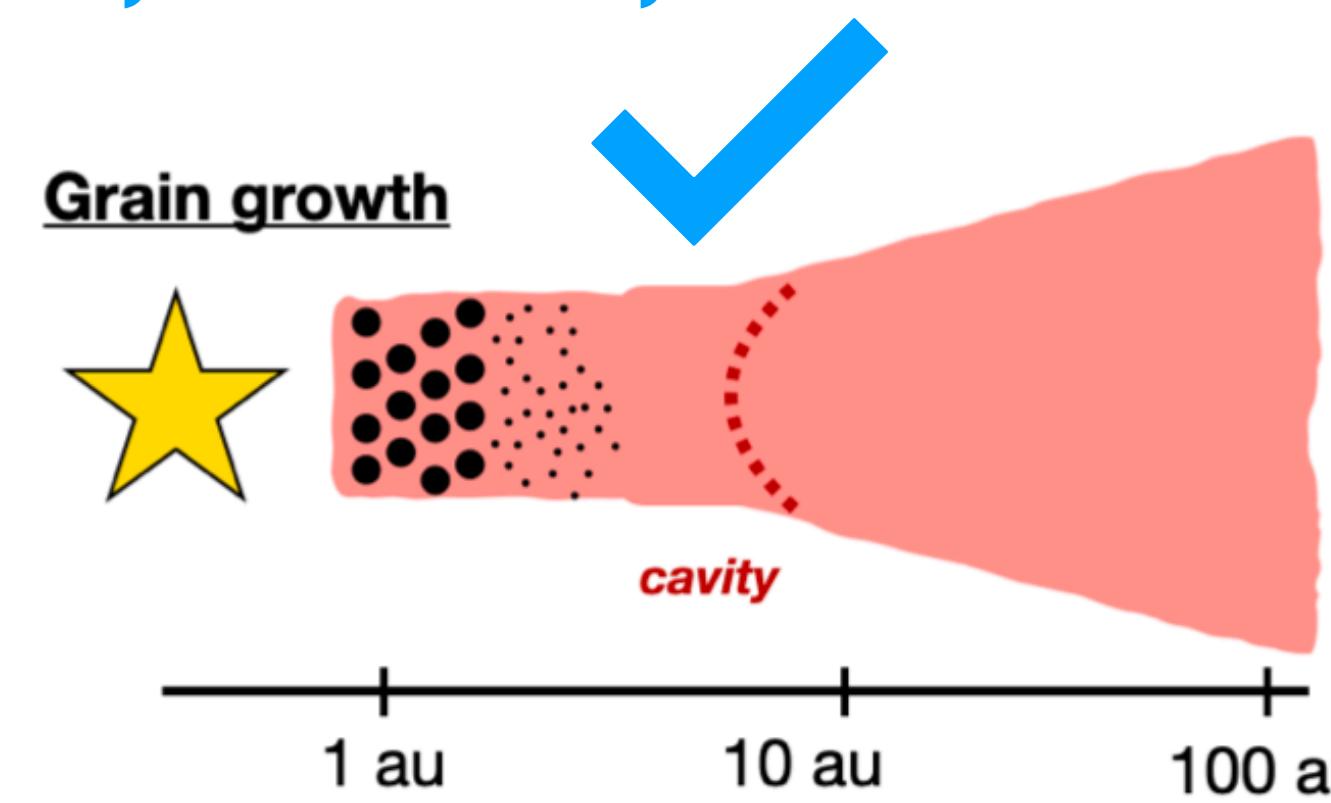
Dust properties constraints



What did we learn?

- There may not be a single mechanism responsible for all transition disks.
- The disk cavities are consistent with following mechanisms

CQTau, DMTau, SR24S



UXTau A, LkCa15, RXJ1615

