

Scientific and Observational Goals

Scientific

- Determine timescale for planet formation as a function of orbital radius in protoplanetary disks
- Potential : *Lifetime of gas and dust*
- Actual : *Detection of planets*

Observational

- Measure distribution of gas/dust/companions around stars as a function of stellar
 - mass
 - age ($\lesssim 100$ Myr)
 - environment (*isolated vs. dense clusters*)

Progress in pre-ALMA/GSMT era

Dust

- Masses
 - LMT, SIRTf
 - IRAM, SCUBA, SHARCII, BOLOCAM
- Spatial Distribution
 - SED's : SIRTf
 - (Sub)mm imaging : SMA, CARMA, VLA
 - Scattered Light : HST, Gemini, Keck, ...
 - Interferometry : Keck, VLT, LBT, ...

Gas

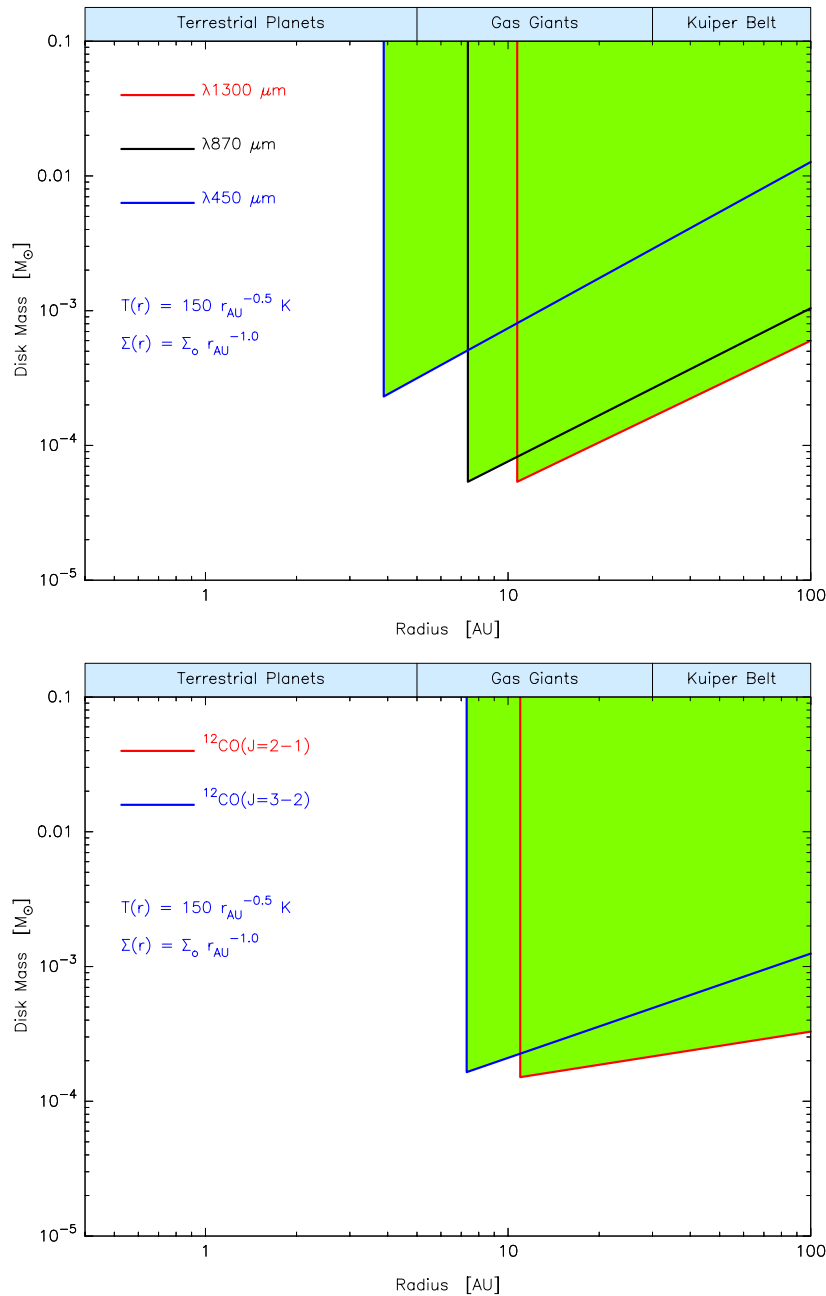
- CO : LMT
- H₂ : SIRTf, SOFIA, Gemini, Subaru, ...

Planetary Companions

- HST, Gemini, Keck, ...
- Infrared interferometers
- SIM

Role of ALMA

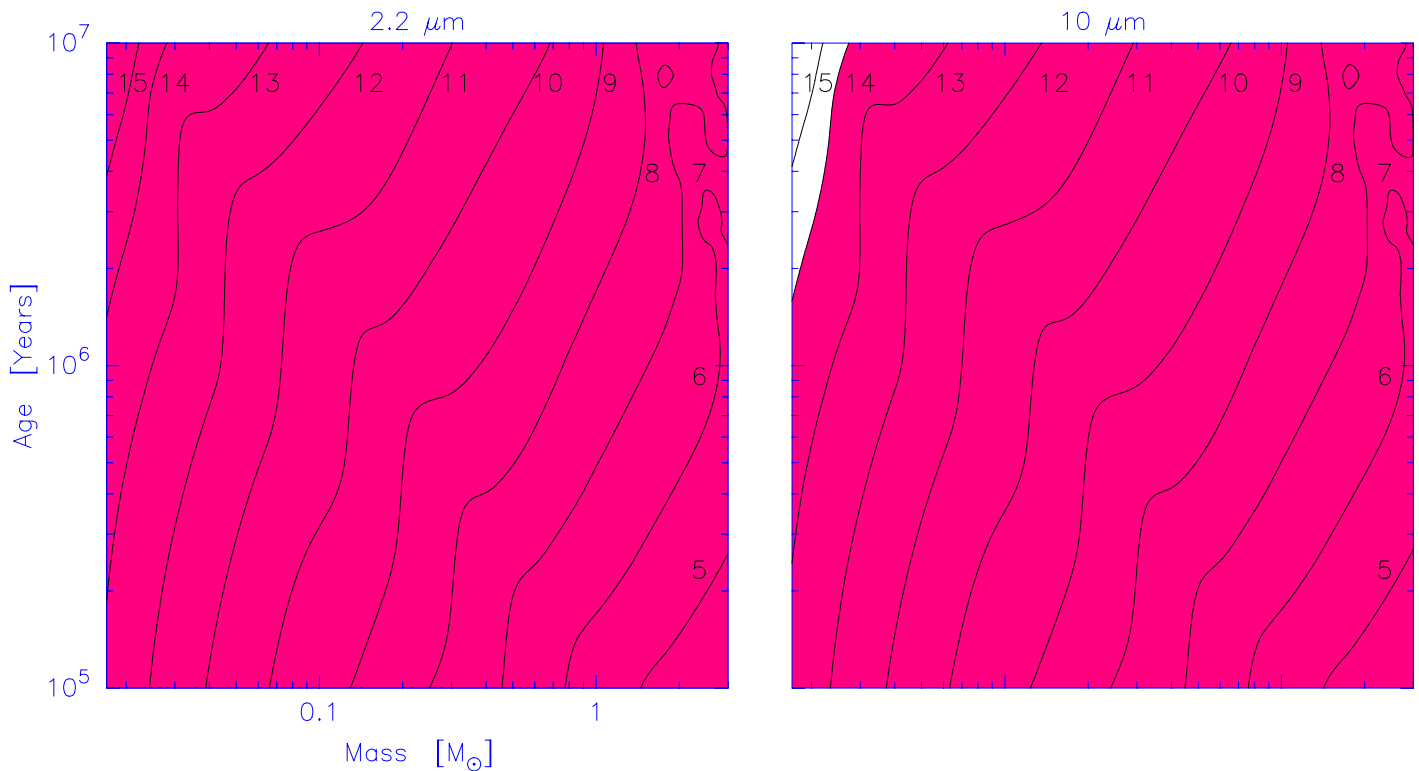
- Sensitive, high resolution imaging of gas/dust



The shaded region in these figures show the orbital radii that ALMA can resolve and detect as a function of the total disk mass for various continuum wavelengths and molecular lines. A “standard” disk model is assumed with CO depleted by a factor of 1000.

Role of GSMT

- High resolution imaging of H₂
- Search for planetary companions



This figure shows isomagnitude contours of low mass stars and brown dwarfs for 2.2 μ m and 10 μ m continuum emission as a function of age (0.1 - 10 Myr) and mass (0.017 to 3 M_⊙). The shaded region shows the parameters space that the GSMT can probe, although it does not take into account the performance of adaptive optics that will limit the sensitivity close in to the star. This figure will be much more interesting by extending it to planetary masses with Burrow's models.

Items to work on...

- **Sensitivity of GSMT to planets as a function of orbital radius**
 - Wavelength/instruments/telescope design
- **Sensitivity of GSMT to molecular hydrogen**
- **Structure of disks vs. planets**
 - What range of planetary masses will produce gaps/asymmetries in the disk that are detectable with ALMA?