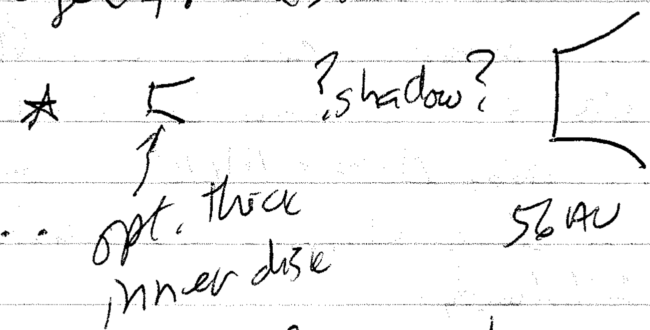
A. Scholz – B.D. discs
Upper Sco (5My) 37% have K–[24] discs (more than K–M stars) ⇒ longer lifetime
Silicate peaks weaker BD's shape vs strength ⇒ grain growth (he asserts) ⇒ Both found xtal!
¿sition; can't (easily) detect large holes (far IR)
S Ori 70 T-dwarf too faint

L. Allen – Disks Low Mass Regions < 500 pc
~~not~~ Orion (megacam) not Taurus (Rebull)
"complete" ⇒ $A_V \geq 3$ Cha, Lupus, Serpens, ...
~~plealons~~ ⇒ 450 [excise galaxies/AGN] < 1kpc
Per (400) Oph (300) Ser (200) Cha I (930) (low-mass)
Oph $A_V > 30$ ⇒ Class I really flat, flat really II (2c)
Using ~1700 YSO's $\nu F_\nu \sim \lambda^\alpha$
I / flat + I + II = 16/11+16+58 ~ 20% (vs 10%)
Longer lifetime of class I partly because def'n of ~~flat~~
Spatial dist. / clustering / "distributed" star formation
Xsition opt. thin – undetectable 0.4My
~~No discs @ > 10My~~

F. Comeron; New Members Lupus 3
Use 0.6–2.2 μ to identify members (6 bands)
restrict T < 3000 K (> M6)
31 objects ¿ True Lupus members? Older pop.?
Star formation started long ago? Proper motion?

N. Calvet – SED modelling [Tues.]
Hayashi $\Sigma \sim r^{-3/2}$; need better method
$\Sigma \sim \alpha^{-1} r^{-1}$ (more like r^{-1})
Note $M_{disc} \sim \dot{M}/\alpha$; IR excess $\propto \dot{M}$
$\epsilon < 10^{-3}$ @ 5My upper layers
Xsition TW Hya, GM Aur, DM Tau all accreting

Holes confirmed mm
CoKu Tau/4 – circumbinary disk
Tidal interaction clean disk
Xsition – most likely planets
$M_{disk}/\dot{M}$ larger for Xsitional
UX Tau A



$\dot{M} \sim 2\times10^{-9}$

LkCa 15   46 AU hole; no binary detected (?bd?)

Assert! SED could be fit without opt. thick inner wall

But 2.3μ CO lines veiled ⇒ excess ~~JH~~ K, M
~1500K ⇒ wall @ dust dest. radius
note GM Aur – no 2.3μ CO veiling (no inner wall, no opt. thick gas)
Rapid dust evol. inner disk; inner dust 2ndary? ie collisions

	Full disk →	pre-xsition →	Xsition disk
$\dot{M}$	10^{-8}	?	10^{-9}
g/d	10^{-3}–10^{-2}	?	?
		Low M planet	High M planet

¿ migration? –
Muzerolle – pre xsition more variable
Gas in hole ¿Leak past? viscous time 10^5 y

S. Basu Formation/Evol. Protoplanetary Disks
FU Ori bursts 10^4 @ ~10^5 y
0.1 pc core collapse to disk "Thin disk" approx.
¿ B-fields? basically ignore

between FU Ori: accretion events — very low luminosity

Spirals AB Aur, HD 100546

$\tilde{Q}$ c_s kepler/Σ regulated @ 1 ⇒ $\Sigma \sim$ kepler $\sim r^{-1.5}$

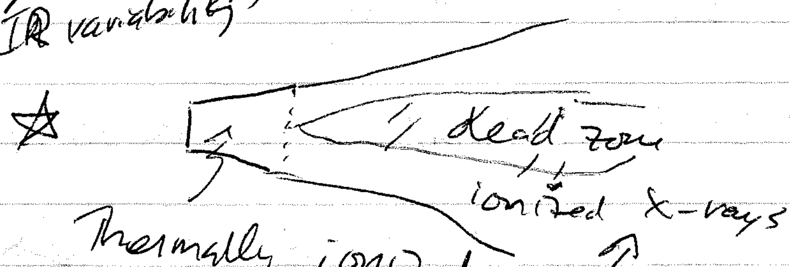
need disk mass ~ 10x MM (i.e., 0.1 M_* rather than 0.01 M_* — note .01 $M_\odot \sim 10\ M_J$ ∴ with 10% efficiency min mass s. neb ~ 0.1 $M_\odot$ — tell him

Mention MMSN + Shantanu @ end talk

N. Turner Protostellar Disks MHD — B-forces

Turbulence in disk cause variations mid IR (Weissenprog, Flaherty)

take IR variability



affected by L_x + grain size (recomb.)

$a = 1, 10, 100\mu$

$2, 3, 7 \times 10^{-8} M_\odot/y$

Turbulence can actually help settling to midplane

note: Turb ⇒ Δp ⇒ enhanced settling

Turb brings up dust + increases IV flux

Magnetic eruption ⇒ IR increases (0.1–10 orbits)

Cosmic rays penetrate ≈ 10x further than X-rays

B. Merin — Diversity YSO disks (C2D)

primordial — anemic (Lada et al?) — Xsition — diskless

Taurus ~1 My IC348 ~2–3 My IC5146 <2 My

WTTS, low disk mass, photoevaporated?

Cold disk, Xsition, only 24μ

Small abundance Xsition

$\dot{M} \sim M_*^2$ + big variation

2X
noble gases ⇒ Jup. formed late in dispersing disk
Growth protoplanets stops accretion?
Lower mass stars lower mass Extra solar planets + multiplicity
Hot Jup from massive disk + migration
$\dot{M}$ vs hole-size?
Saturn ~2My (Japetus shape) not late
Stop photo evap. after accretion stops?
(F)UV + X-ray (from corona) effective photo-evap.
EUV (H-ionization) can't penetrate disk-wind well
C. Salyk – H_2O Protoplanetary disks (+ other gas)
Earth H_2O: primordial, comet, asteroid
H_2O Balance accretion + evaporate ⟷ diffuse outward
UV dissociate H_2O; dust settle enhance H_2O
AS 205N, AA Tau · $H_2O + CO_2 + OH$
HCN C_2H_2
H_2O 30-50% CTTS C2D
Keck H_2O @ 2.9μ ΔV = 40 km/s ⇒ 1AU ~1000K
also VLT H_2O @ 2.9μ + CO (snow line?)
RNO ? H_2O, OH, HCN C_2H_2
OH from dissociate H_2O (OH harder)
new data 80% H_2O
J. Bouwman – Dust Comp. Disks
6.0μ = CH_3OH+?
DISM < 1% xtal
AGB – no silica
T-dependence of opacity
Lattice ~~ke~~ ⇒ fine structure
cont. dist. of T's – better, more accurate fits
HD 104237 Herbig
$\beta_{10\mu}$ vs 11.3/9.8
Inner disk Enstatite, outer disk Forsterite?

S/N 5200 Herbig Ae

10 + 16 μ feature forsterite same axis (violate 1/3 1/3 1/3 rule)

J Olofsson Xtal Silicate —

As_2O_5 prism

ISO Cha 54 xtal

Diopside @ 25 μ ? Colored warm red

0.1 AU = 15×10^6 km cold blue!

SR21 VLT N Interferometry resolve

~~hole~~

K. Pontoppidan – Gas 1AU scales (Spectroastrometry)

1–10 AU (7–70 mas @ Taurus)

CO < 1 mas 4.7 μ VLT SR21 Keplerian

shift of centroid with $V_{Doppler}$

TW Hya $i = 4°$ (vs 7° from mm)

D. Wilner – Spat. Resolved Disks

Alma 10 mas ⇒ 1.4 AU

TW Hya scatt light grey ⇒ large grains

HD 163296 CO rot'n curve

DoAR 25 resolved 865 μ SMA

HH 30 – 40 AU hole – binary clearing 1.3 mm

CO 3–2 HD 163296 TW Hya

disk mass < 15% M_{star} (Keplerian)

A. Isella: CARMA + disks

6 × 10 m + 9 × 6 m + 8 × 4 m 1.1–1.4 + 2.6–3.5 mm

0.15 – 5" @ 1.3 mm

~ 10 T Tauri model R_t ~ 20–60 AU (40% mass)

initial R_t ~ 20–40 AU time scale ~ 4 My 90% ")

mass ~ 0.1 M_*

TW Hya 8 or 15 My (He uses Baraffe; D'Antona)

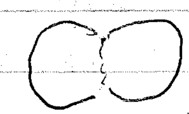
~ 3× younger

note; assumes opacity K = const.

S. Andrews : Disk structure/SMA Class II
disk spreads
$0.3''$ ~Uranus AS 205, GSS39, AS 209, DoAr 25
2-D monte Carlo Rad'ive Xfer 5 parameters
Wa Oph 6, VSS61, WSB 60
500 m baseline
$\alpha \sim .01$ Initial R 40 AU
Central cavities SR21 + DoAr 44
Visibility $\lesssim 0 \Rightarrow$ hole size ~20-50 AU
GM Aur
confirm 24 AU hole .86 + 1.3 mm
Different results than Isella

E. Chiang - Xsition Disks **Wed. 1**
LkHα 330 40 AU "hole"
$\dot{M} \sim 10\%$ T Tauri
gas > 0.1 g/cm² hole
LkCa 15 opt. thick inner wall (K-L-M ~1600K)
large $\dot{M} \Rightarrow$ not photo evap.

dust 1μ < 1 m/s stick theory



Hertz
fall - grow to equal stress
~1 cm in ~100 y from strain
terminal V ~ 1 m/s @ Vcrit
~1 m/s a = 1μ surface tension
Fragmentation => renew $n \sim a^{-5/6}$ 0.1 eV / Å²
small sizes c vander Walls
Heating (chondrules) related to growth - no!

Dust sub-layer - stable if disk mass ~5 x min
+ super solar metalicity
Quillen et al - start with hole!
prefers Lubow + D'Angelo '06