Disk Census in Star-Forming Regions of the Orion OB Associations

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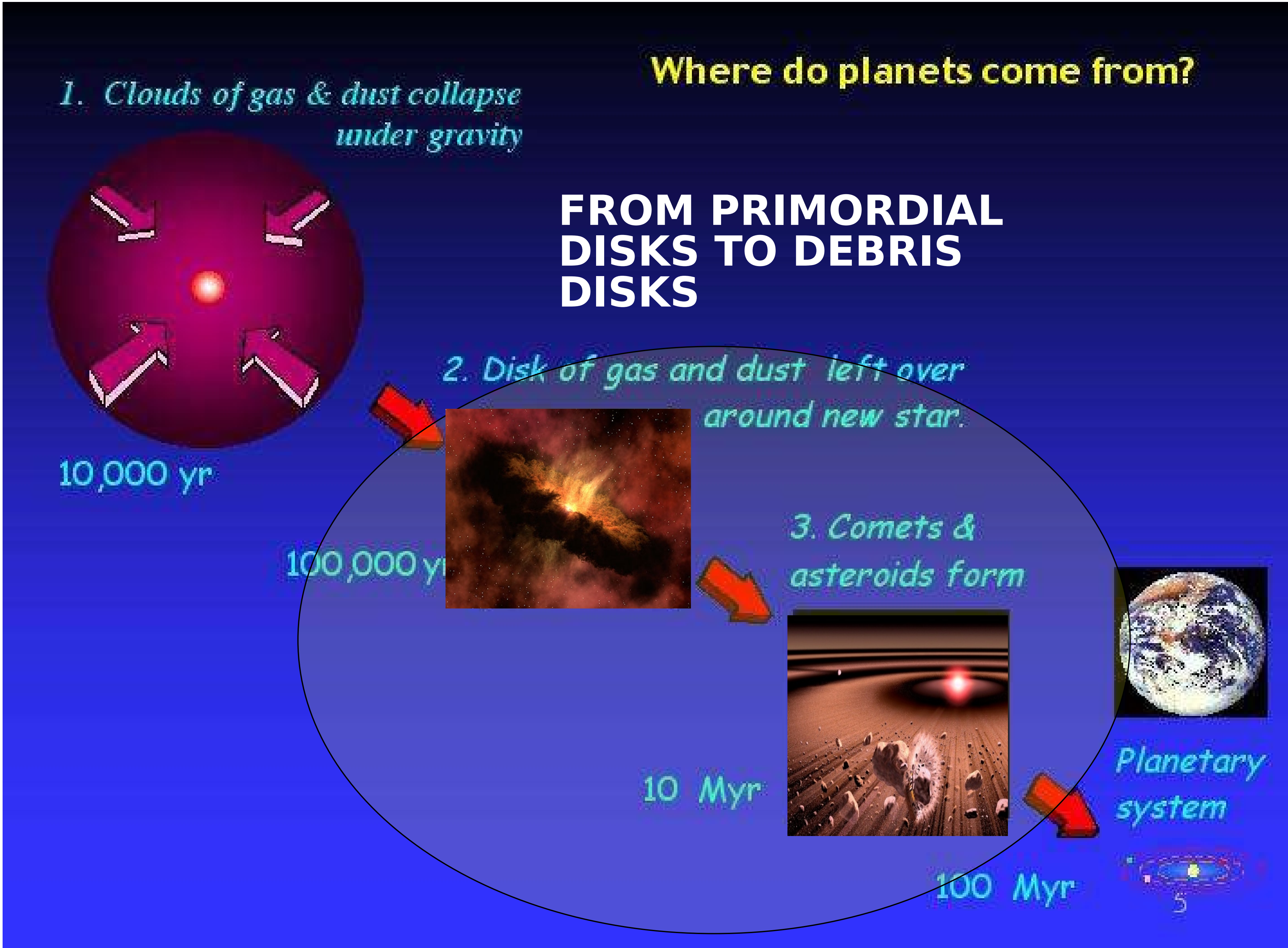
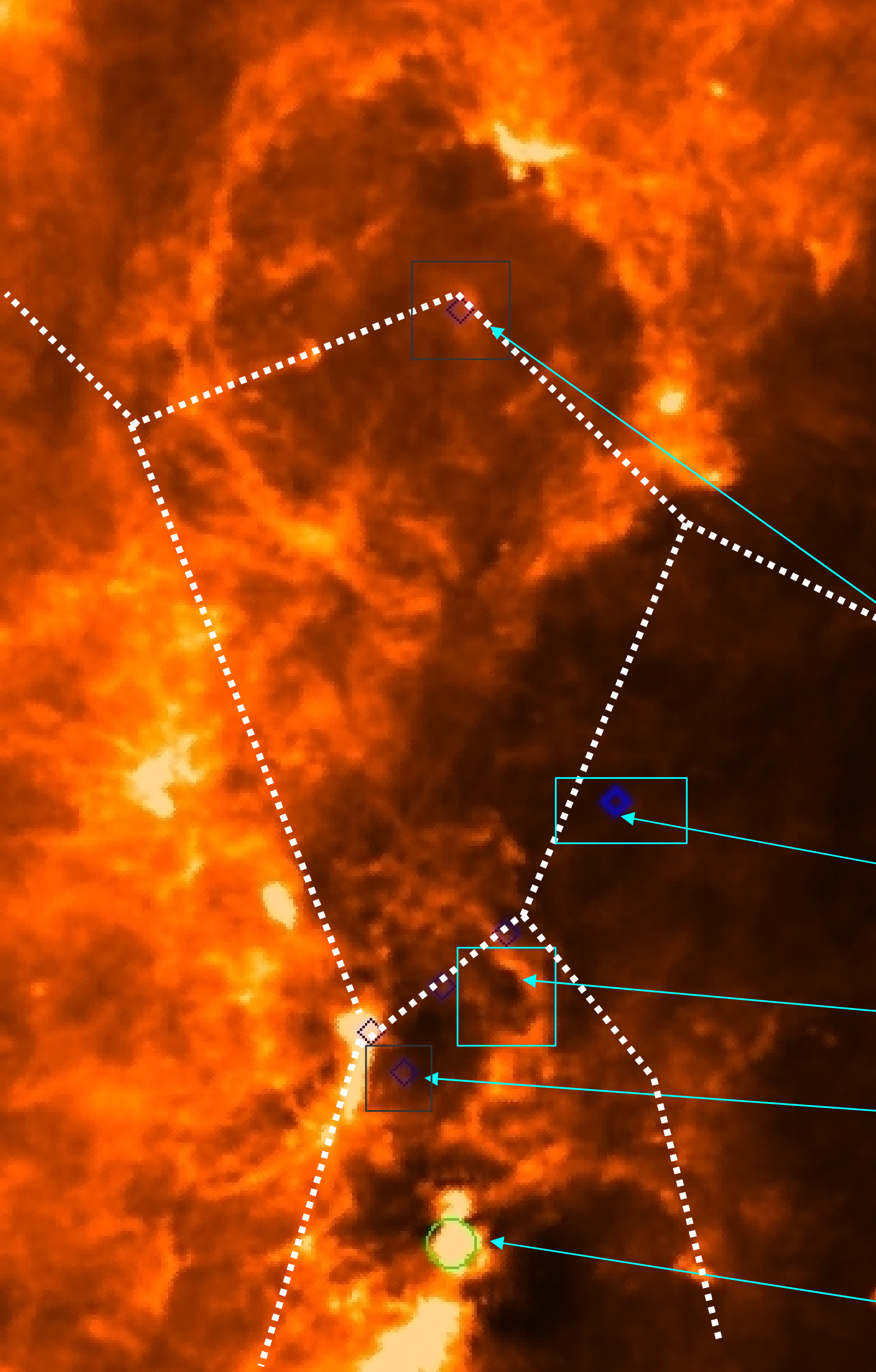
Backround : Orion OB1b subassociation (3.6μm,8.0μm , 24μm)

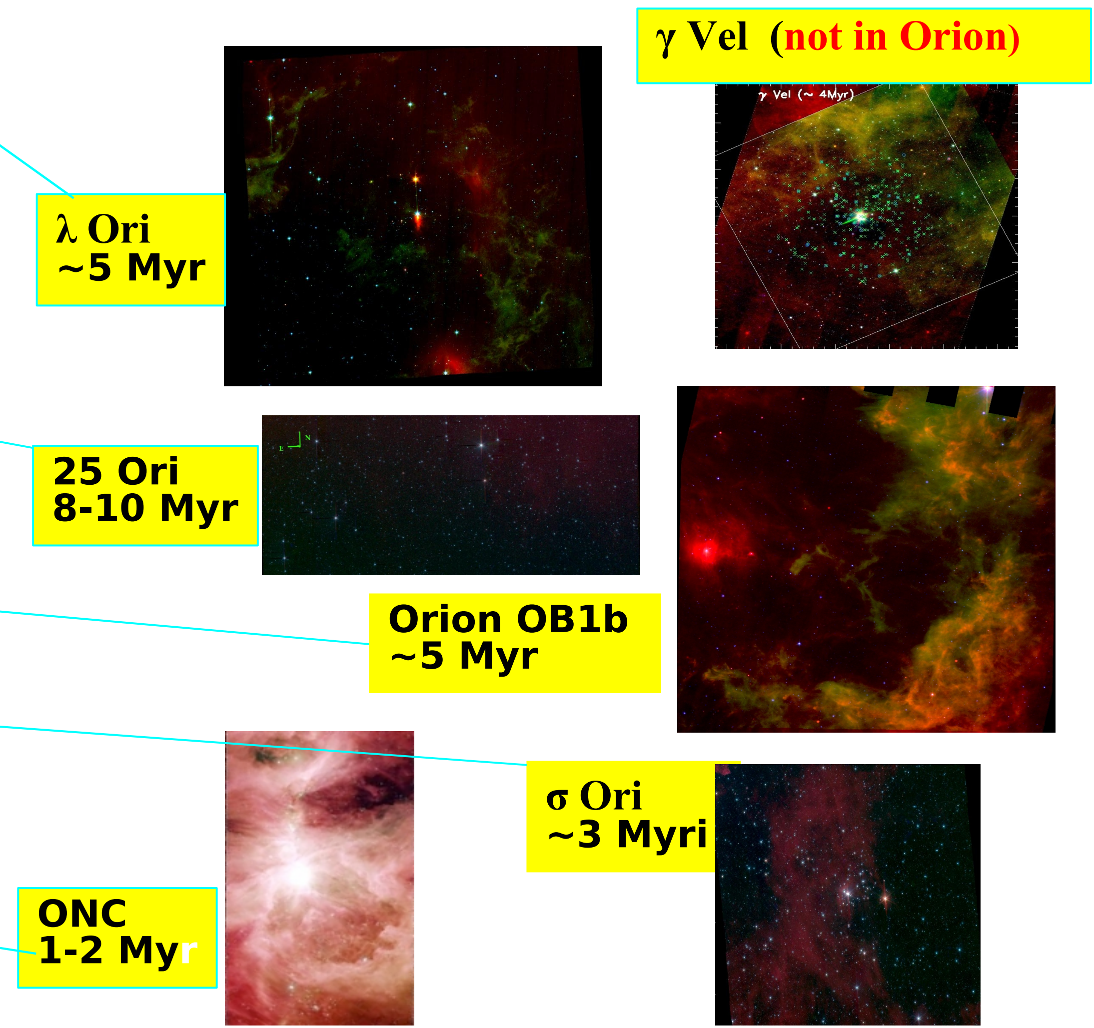
FROM PRIMORDIAL DISKS TO DEBRIS DISKS



DISK CENSUS:

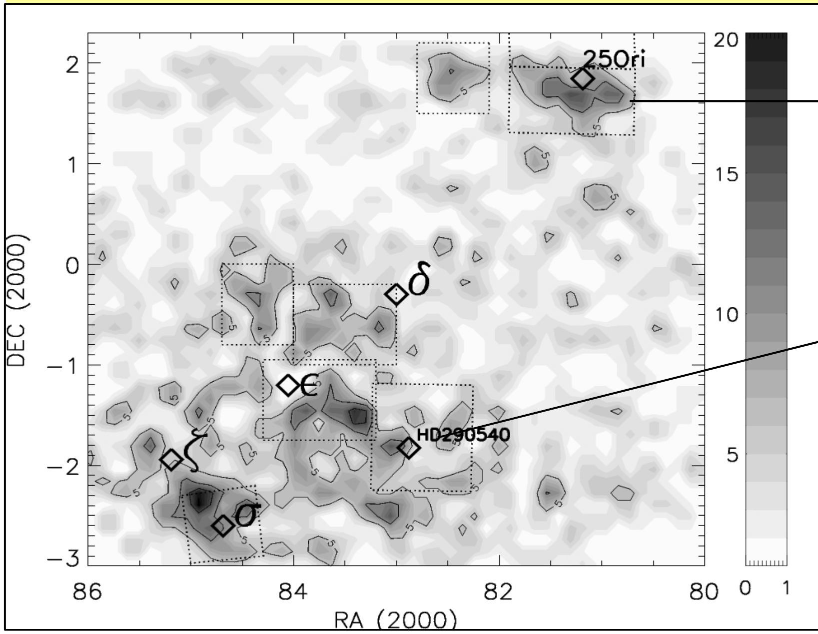
Region Name	References (Hernandez et al)	Age Myr	Distance pc
ONC	in prep.	~1-2	400
σ Ori	2007a	~3	440
λ Ori	in prep.	~5	400
Orion OB1b	2006,2007b	~5	440
γ Vel	2008	~6	350
25 Ori	2006,2007b	~8-10	330



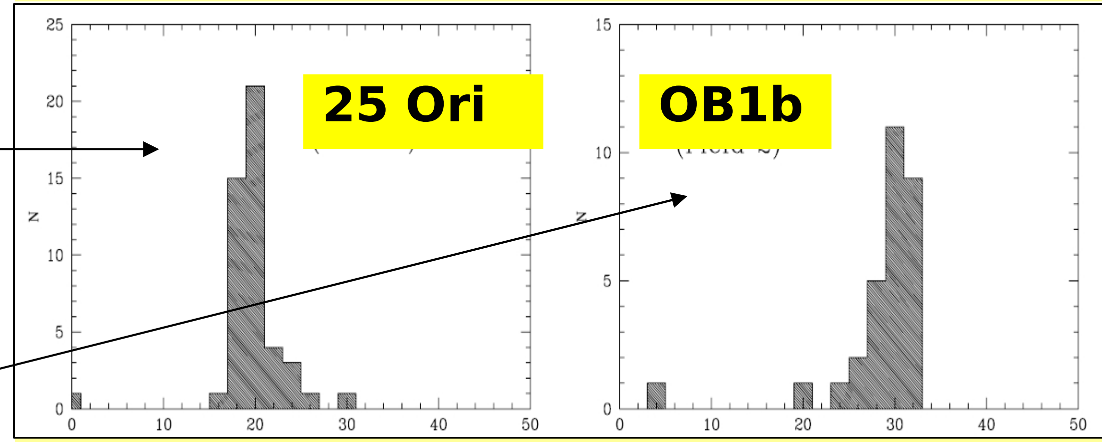


MEMBERS ?

Density map of variable stars:
Young stars are variables and form groups in the star forming regions

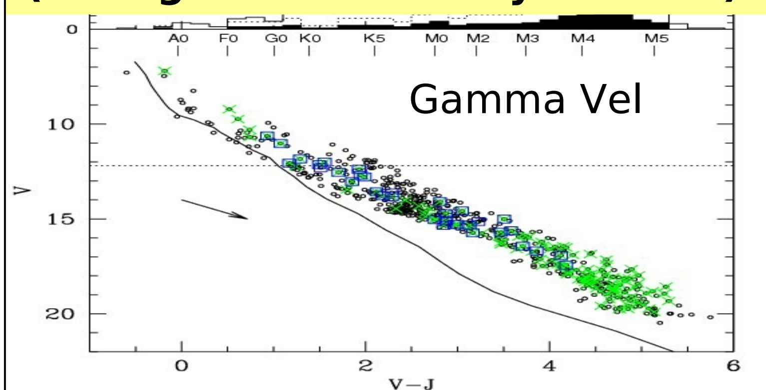


MEMBERS SHARE KINEMATIC PROPERTIES
(Briceno et al 2007)

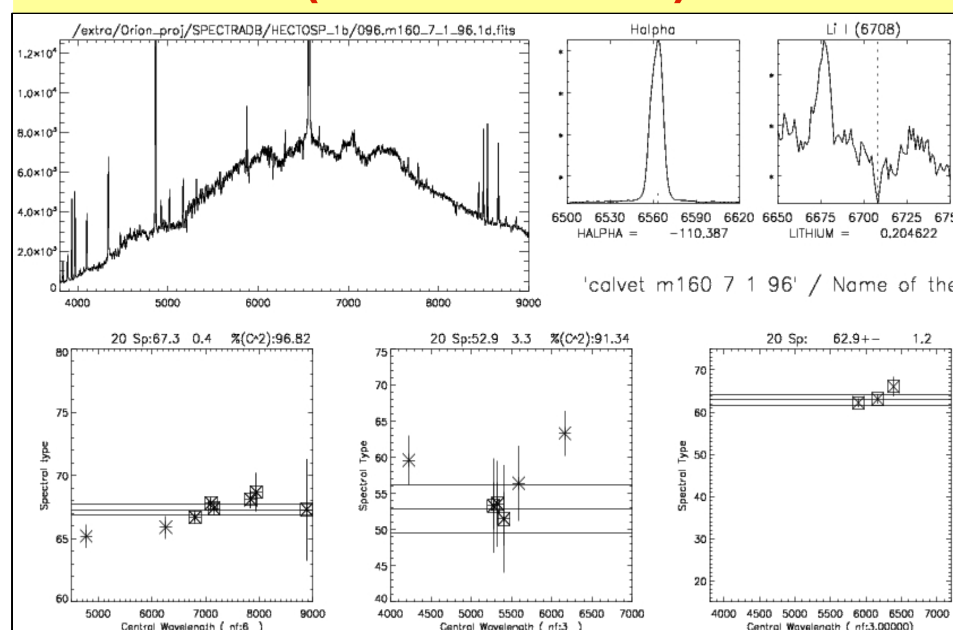


Radial velocity distribution of two stellar groups.

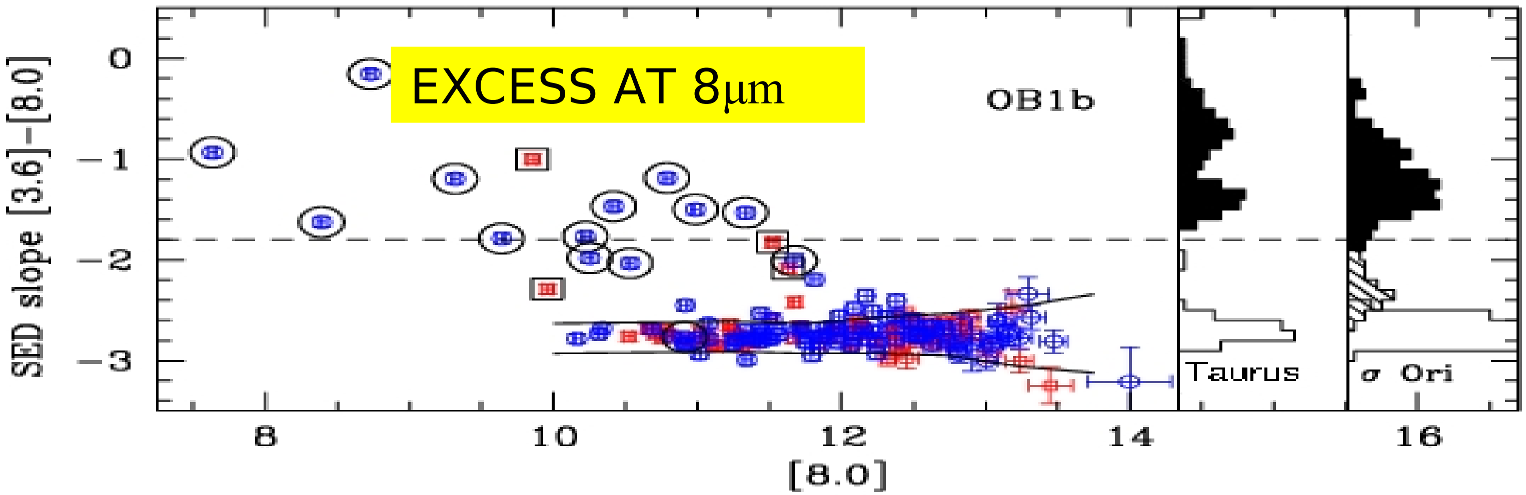
SIMILAR LOCATION ON CMDs
(Young stars are X-ray sources)



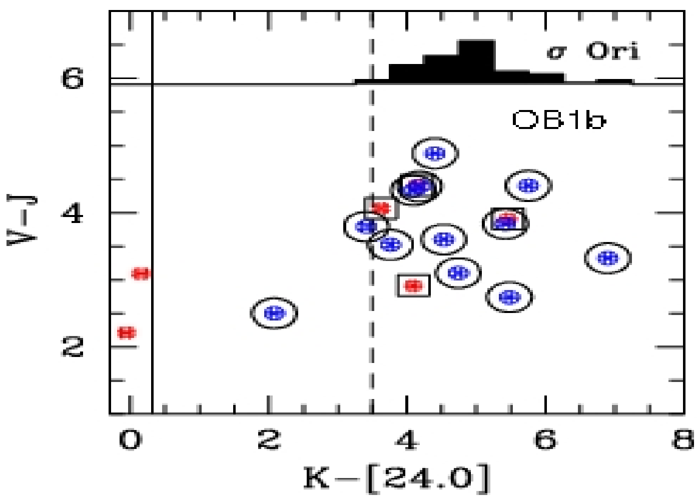
SPECTRAL FEATURES
(SPTCLASS code)



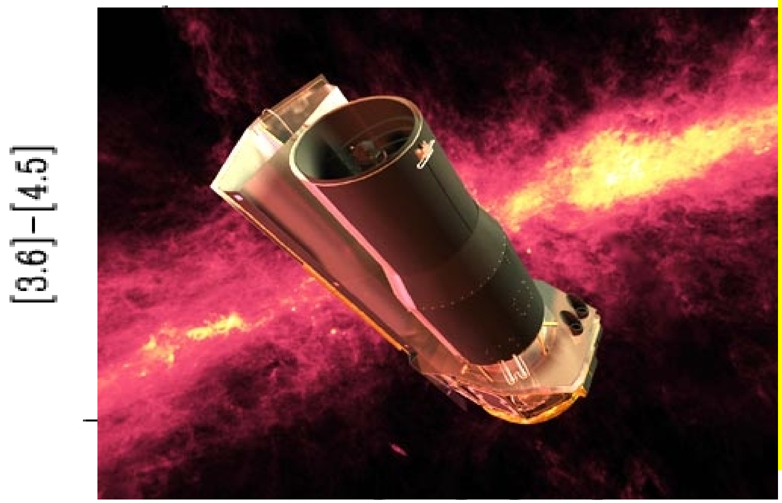
LMS in the Orion OB1b sub-association (**Hernandez et al 2007b**)



EXCESS AT 8μm

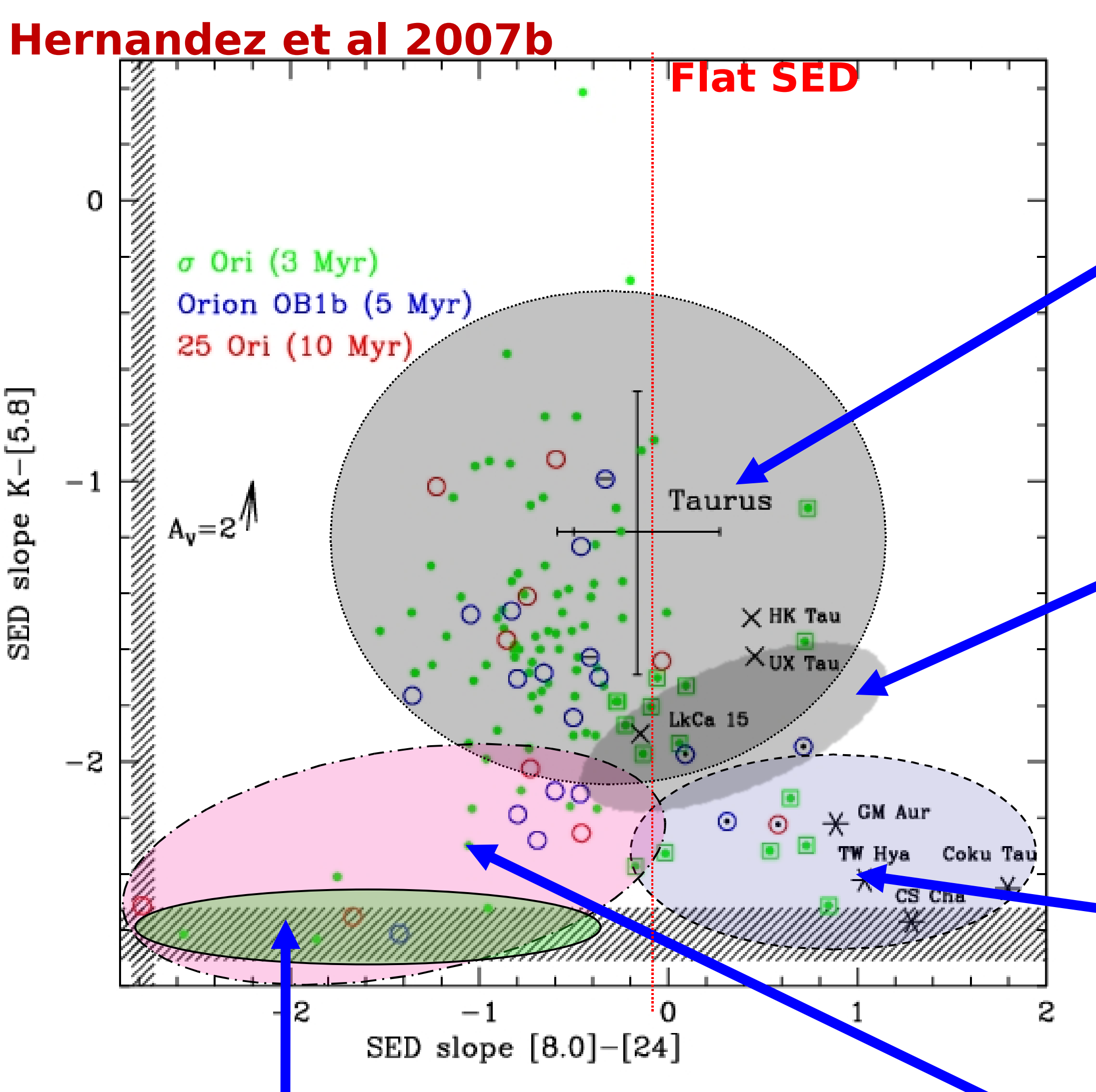


EXCESS AT 24μm

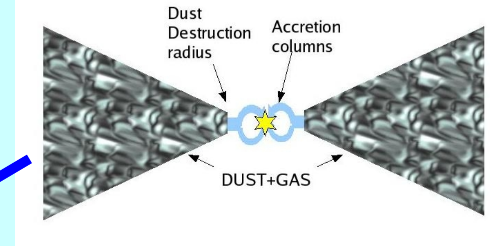


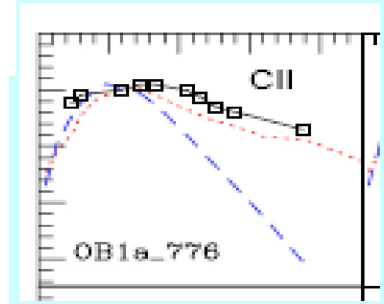
IRAC:
3.6 μm
4.5 μm
5.8 μm
8.0 μm
MIPS:
24μm

DISK DIAGNOSTICS

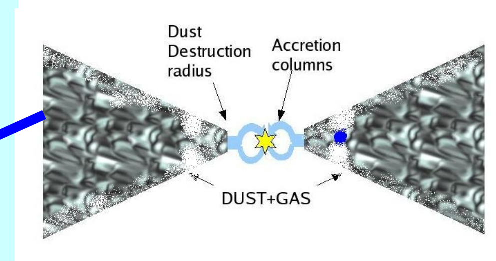


Optically thick flared

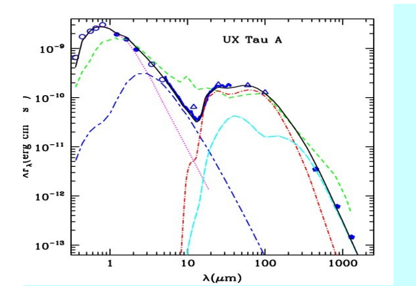




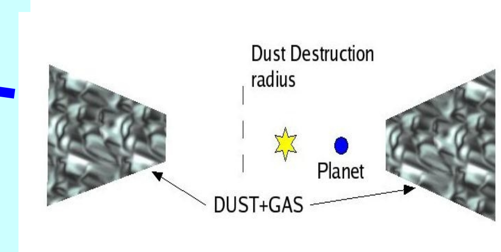
Pre-Transitional

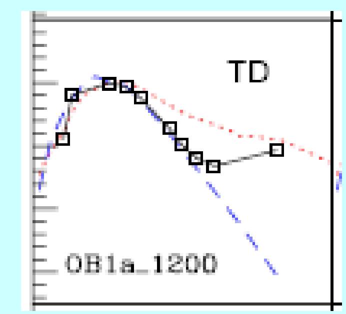


Espaillat et al 2007

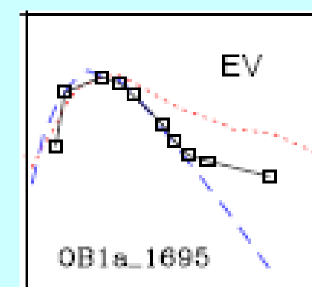


Transitional

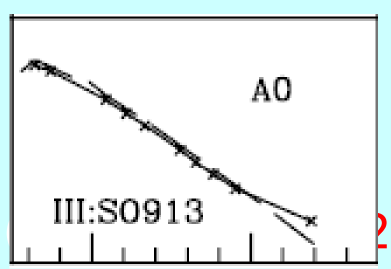




Evolved

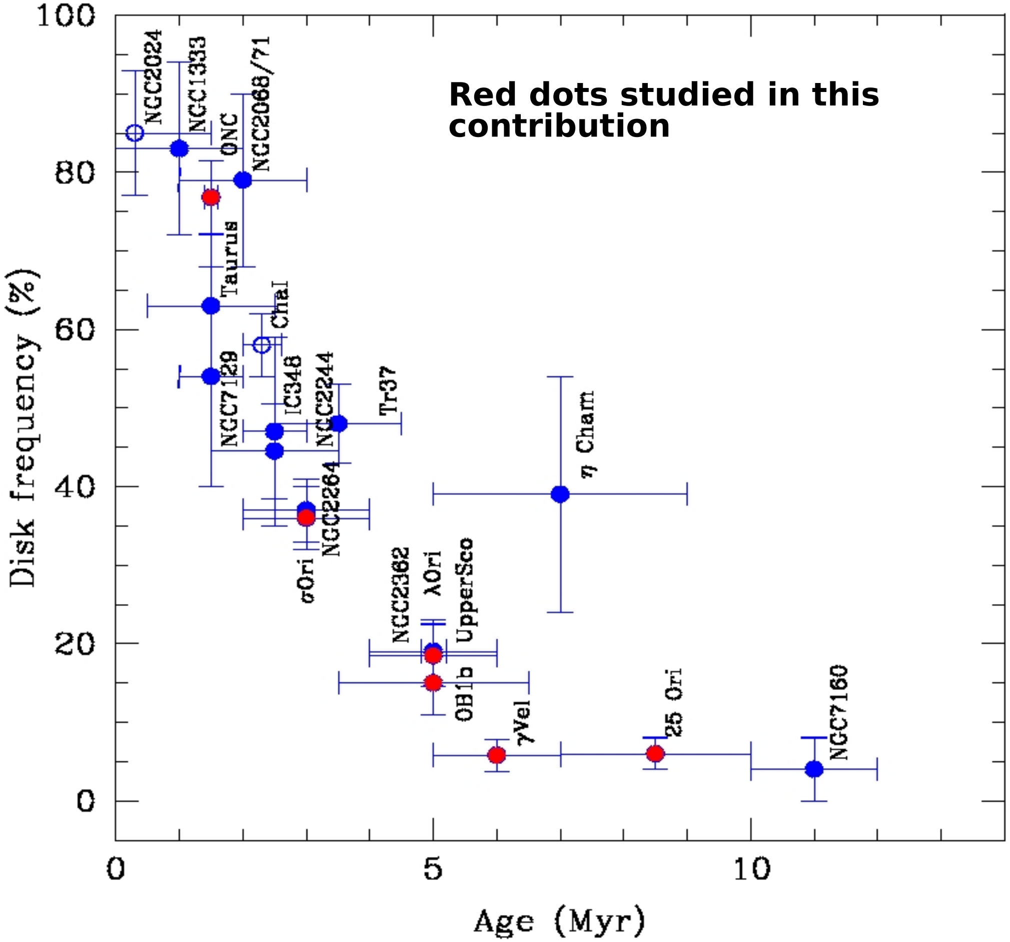


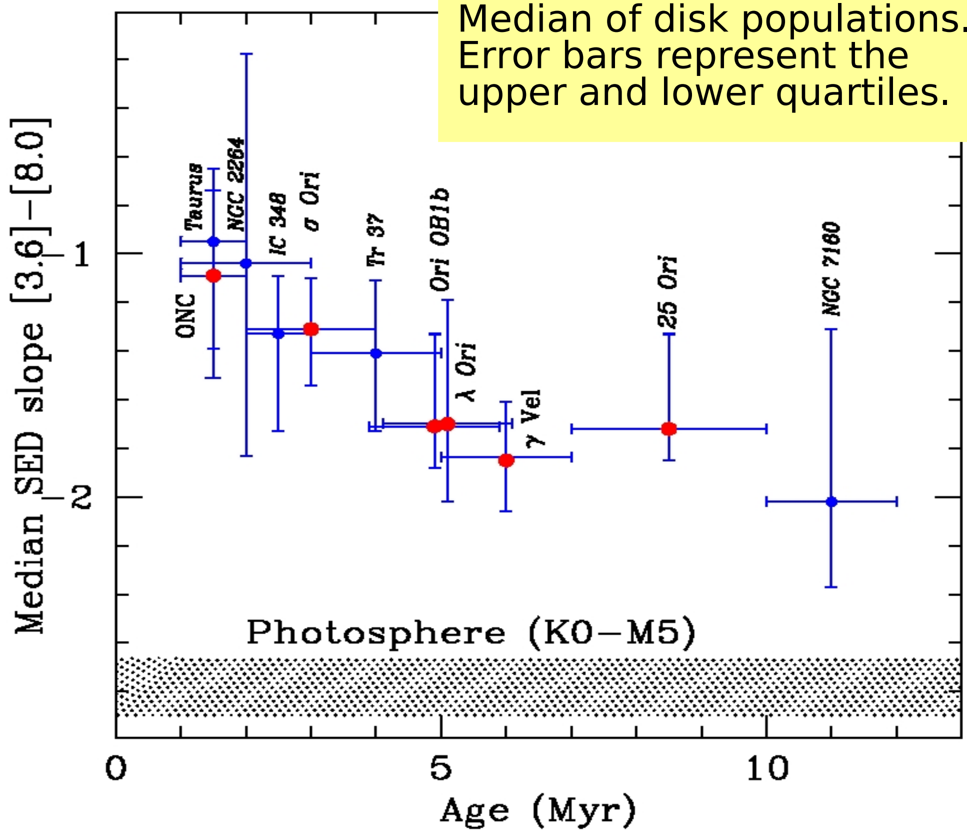
Debris



Backround : gamma Vel ... 24μm)

DISK EVOLUTION (LMS: K & M)



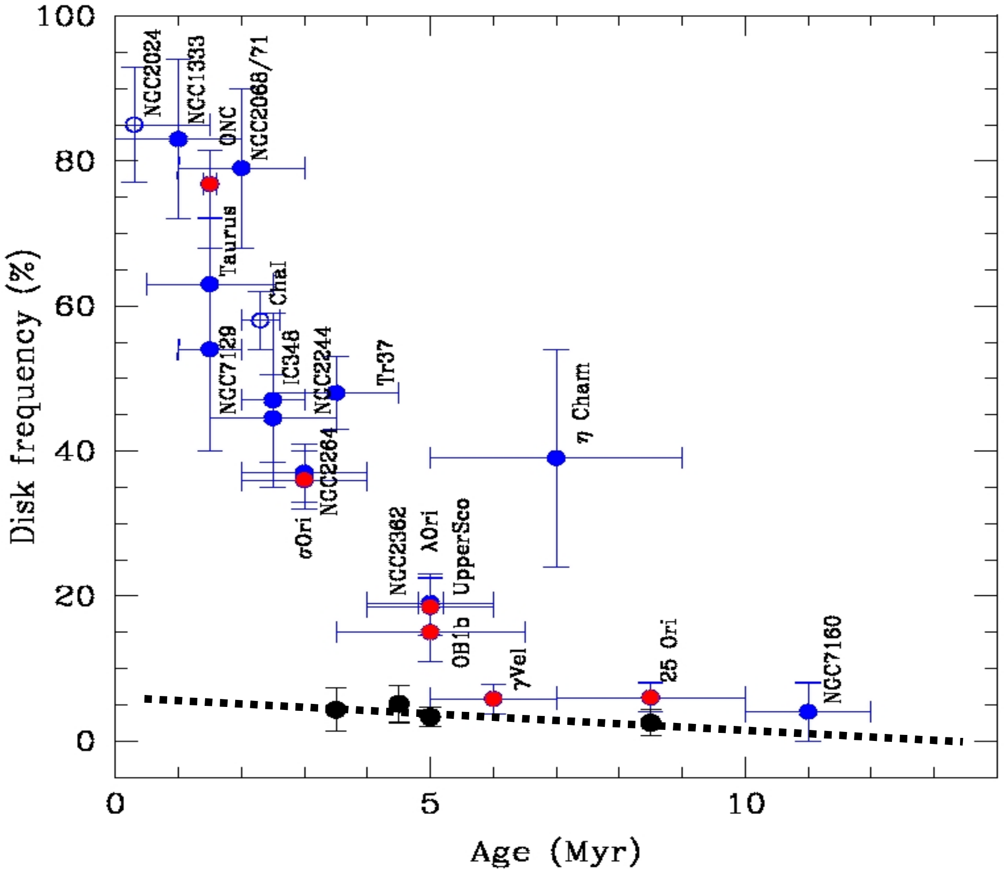


Median of disk populations.
Error bars represent the upper and lower quartiles.

The disk fraction decreases with age suggesting a timescale for primordial disk dissipation around LMS of 5-7Myr (Hernandez et al 2008).

The amount of infrared emission also decreases with the age indicating a reduction of the height of the disk photosphere (Hernandez et al 2007b).

DISK EVOLUTION (IMS: B,A,F)



However, the timescale for primordial disk dissipation around IMS is less thank 3 Myr (Hernandez et al 2006).

Disk population around IMS

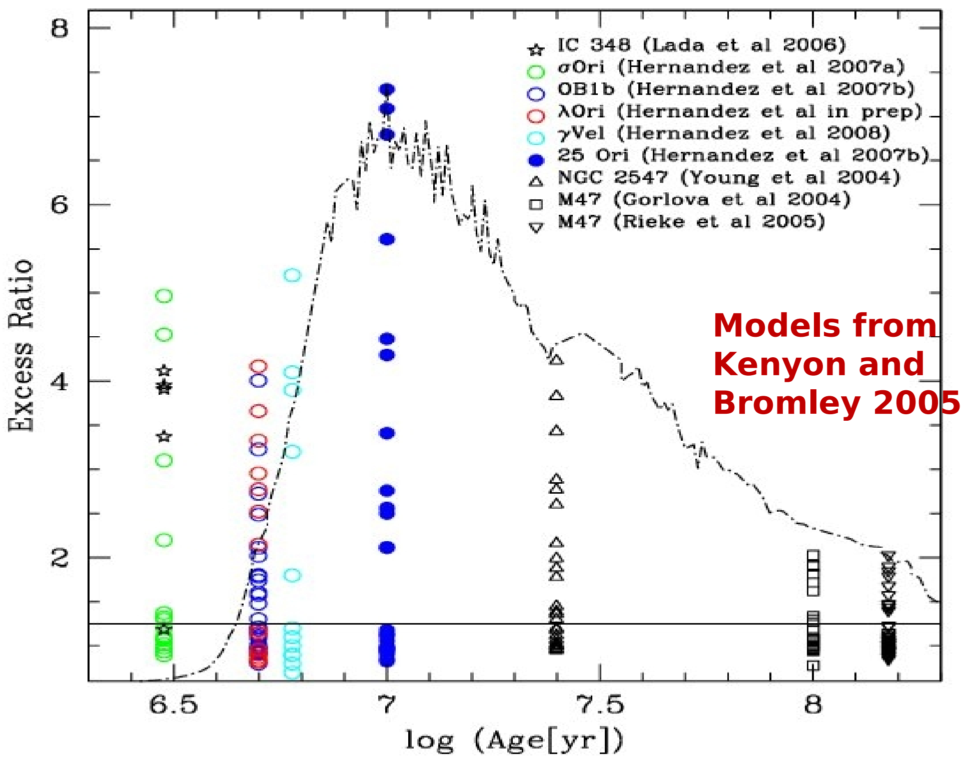
- Since IMS evolve faster than LMS, second generation disks appear sooner around IMS.

- Since IMS are more luminous, the circumstellar dust is hot and more detectable.

DISKS IN INTERMEDIATE MASS STARS

Debris disks are more frequent and have larger 24mic excess at 10 Myr
[Hernandez et al 2006, Currie et al 2008]

Adapted from Hernandez et al 2006



- Primodial disks dissipate in few Myr,
- planetesimals bodies (1000-2000Km) are created,

.- the smallest bodies are stirred up and collisional cascade takes place.

The time scale for this process is ~10Myr for intermediate mass stars

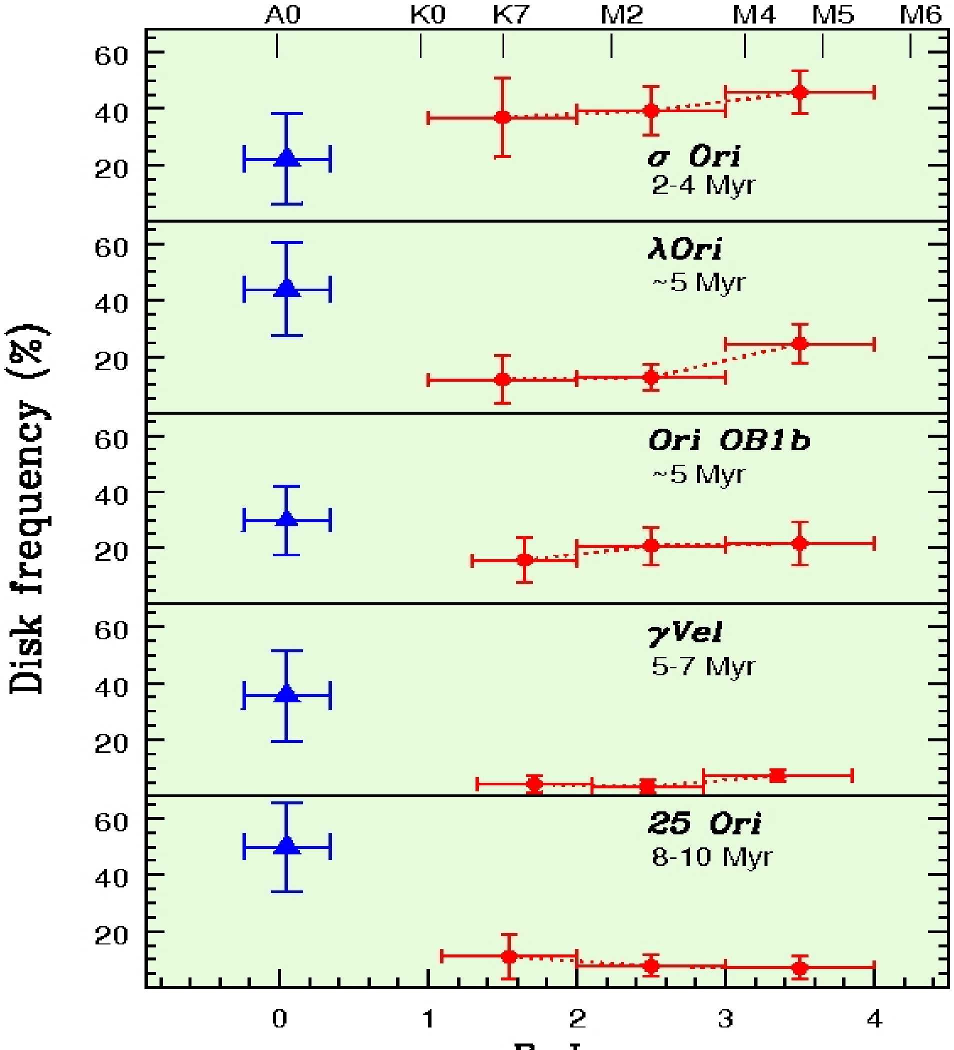
After 10 Myr the infrared excess decreases as the debris reservoir diminishes.

DISKS IN INTERMEDIATE MASS STARS

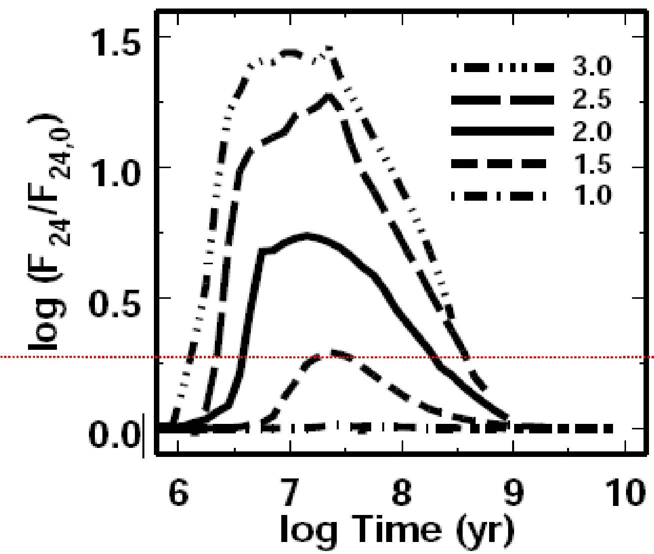
Primordial
+
Debris

Primordial disks

Kenyon and Bromley, 2008



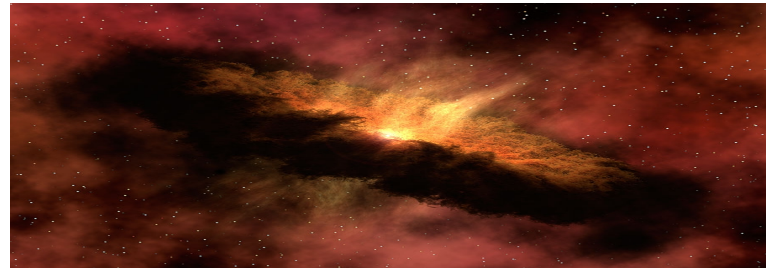
Hernandez et al in prep.



Second generation disks (debris disk) start to dominate the disk population at 5Myr, reaching a maximum in frequency and intensity at 10-15 Myr

(Hernandez et al 2006, Currie et al 2008)

SUMMARY

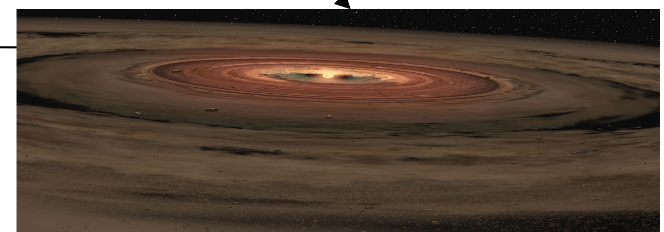


OPTICALLY THICK FLARED DISKS

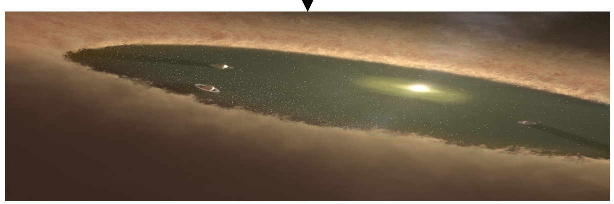
PRE-TRANSITIONAL DISKS

?

EVOLVED DISKS



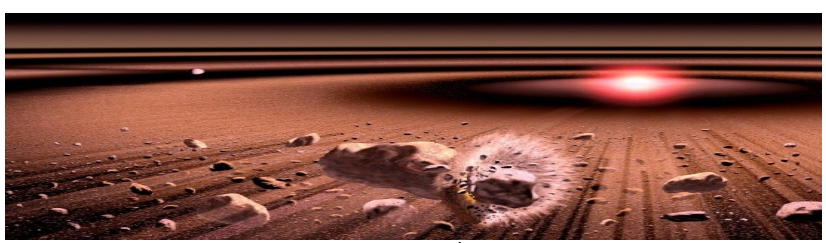
TRANSITIONAL DISKS



The timescale for primordial disks dissipation:
5-7 Myr for LMS; <3Myr for IMS.

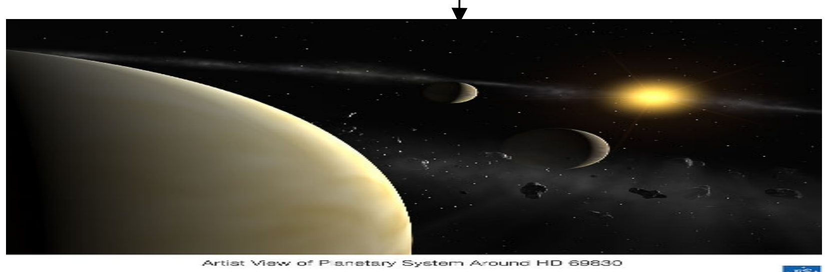
Grains grow and planetesimal bodies (1000-2000Km) are built

DEBRIS DISKS



For IMS, the debris disk phenomenon start to dominate at 5 Myr and is stronger around 10-15 Myr

PLANETARY SYSTEMS



Debris disks emission decreases with age from ~10 Myr to few Gyr (Rieke et al 2005)

Summary and conclusions

- The timescale for primordial disks dissipation is 5-7 Myr for LMS and <3 Myr for IMS
- Disks dissipate faster with higher stellar mass
- The amount of infrared emission also decreases with the age indicating a reduction of the height of the disk photosphere in the inner regions (grains are growing and the disk is settling)
- Optically thick primordial disks evolve to transitional disks and/or evolved disks (settled disks).
- Transitional disks represent ~10% of the disks bearing stars at ages from ~3 to 10 Myr.. The frequency of evolved disks increase with the age
- Debris disks around IMS start to dominate at 5 Myr and are more frequent and the excess are stronger at ~10 Myr. This timescale agrees with predictions of models of evolution of solids, where large icy objects (1000 km) begin to form at 10Myr initiating a collisional cascade between the smaller particles.

Backround : ONC (3.6μm,5.8μm , 8μm)