

CONSTRAINTS ON ACCRETION DISK LIFETIMES

Lynne A. Hillenbrand (*California Institute of Technology*)
Michael R. Meyer (*Steward Observatory, University of Arizona*)

It is common belief that circumstellar disks appear near-ubiquitously around stars at birth. These disks are the sites of planetary formation, and with detection of extra-solar planets now occurring routinely, understanding of the evolutionary link between young circumstellar disks and planets is more critical than ever. Diminution of accretion disk activity and transition from optically thick accretion disks to optically thin post-planet-building disks occurs during the early pre-main sequence phase. **Observationally, we have yet to place solid quantitative constraints on accretion disk lifetimes as a function of stellar mass.**

It has been clear for some time (Strom et al., 1989; Skrutskie et al., 1990; Beckwith et al., 1990; Wolk & Walter, 1996; Allen, 1996) that there are rather young (<1 Myr) stars which already have lost their disks, and also rather old (~ 10 Myr) stars which still retain their disks. It also has been clear for some time that stars of the same age and/or mass have large ranges in accretion rate (Valenti et al., 1993; Hartigan et al., 1995; Gullbring et al., 1998; Hartmann et al., 1999).

We have attempted to constrain disk lifetimes by compiling and combining measurements of **infrared excesses and stellar ages and masses** for a large sample ($N > 2500$) of young stellar objects.

Our analysis of near-infrared excess trends with stellar age and stellar mass supports a conclusion of large dispersions in disk accretion rates and disk lifetimes.

Nevertheless, a generally declining trend of disk fraction with age is suggested.

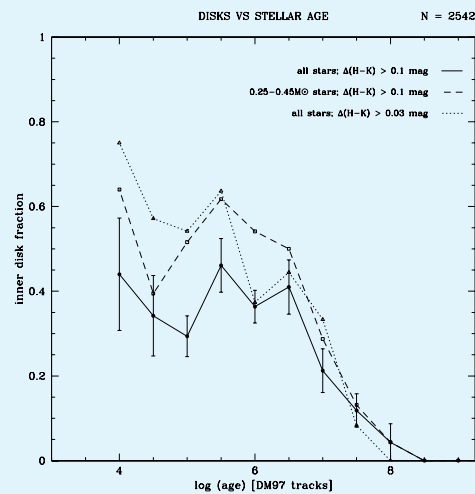


Fig. 1.— Inner disk fraction vs stellar age for all stars in near-by star-forming regions located on the HR diagram and having H-K photometry. The dashed line uses a cut of $\Delta(H-K) > 0.03$ mag to define a disk while the solid line uses $\Delta(H-K) > 0.1$ mag. Dotted line indicates a restricted range of masses around the peak of the mass function.

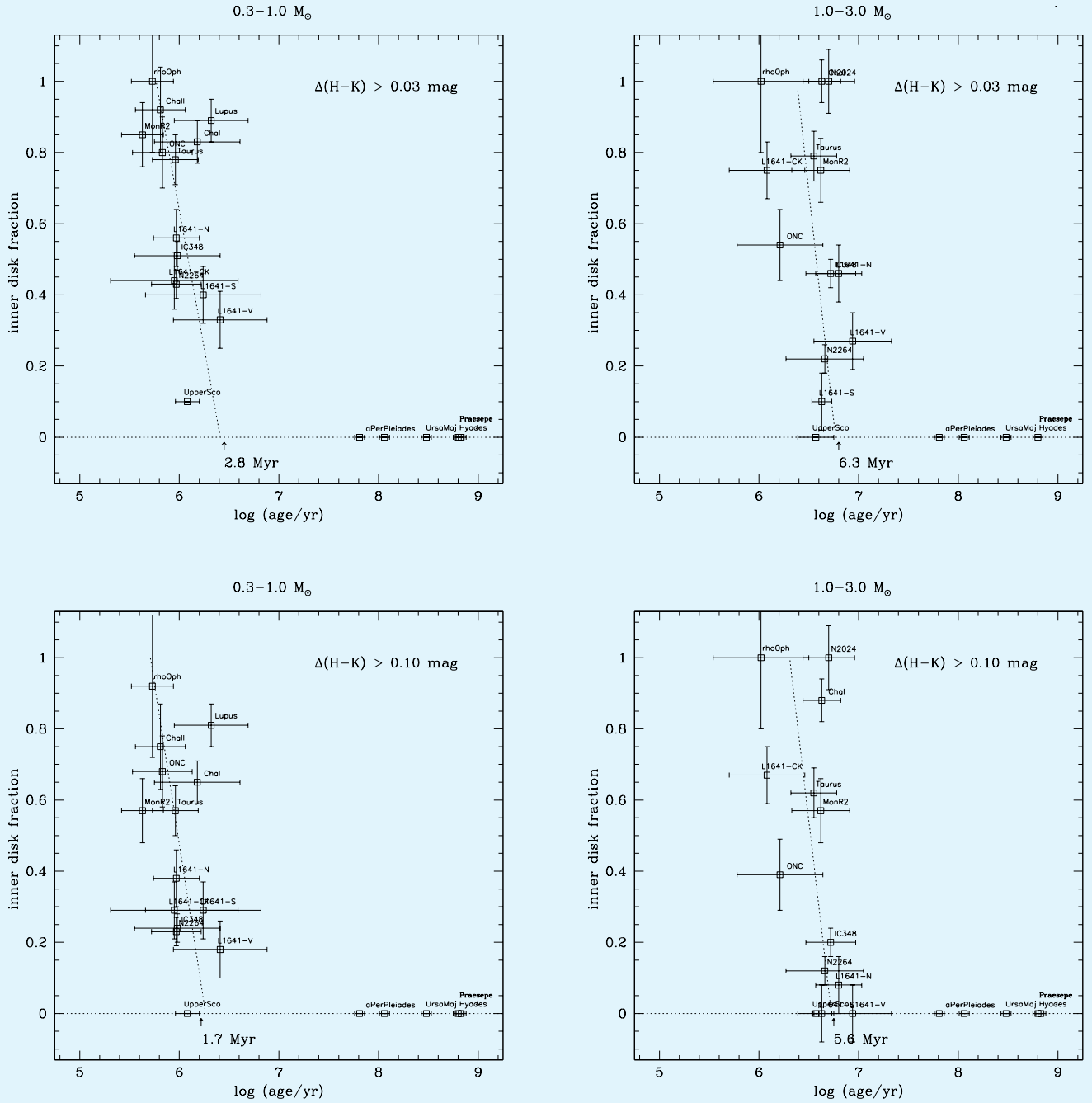


Fig. 2.— Fraction of stars in each cluster showing disks, as a function of cluster age. Top panels use a cut of $\Delta(H-K) > 0.03$ mag to define a disk while bottom panels use $\Delta(H-K) > 0.1$ mag. Left panels show stars $0.3-1.0M_{\odot}$; right panels show stars $1.0-3.0M_{\odot}$. The apparently longer disk lifetimes for higher mass stars probably reflects the fact that the tracks used in this analysis (D’Antona & Mazzitelli, 1997/1998) have not been corrected for the effects of the stellar birthline (Palla & Stahler, 1993). Note that different tracks (e.g. Baraffe et al. 1998, Burrows et al. 1997) may give different ages; thus the absolute ages are considered highly uncertain. **Nevertheless, for low-mass stars disks appear to last no longer than a few Myr in the mean.**