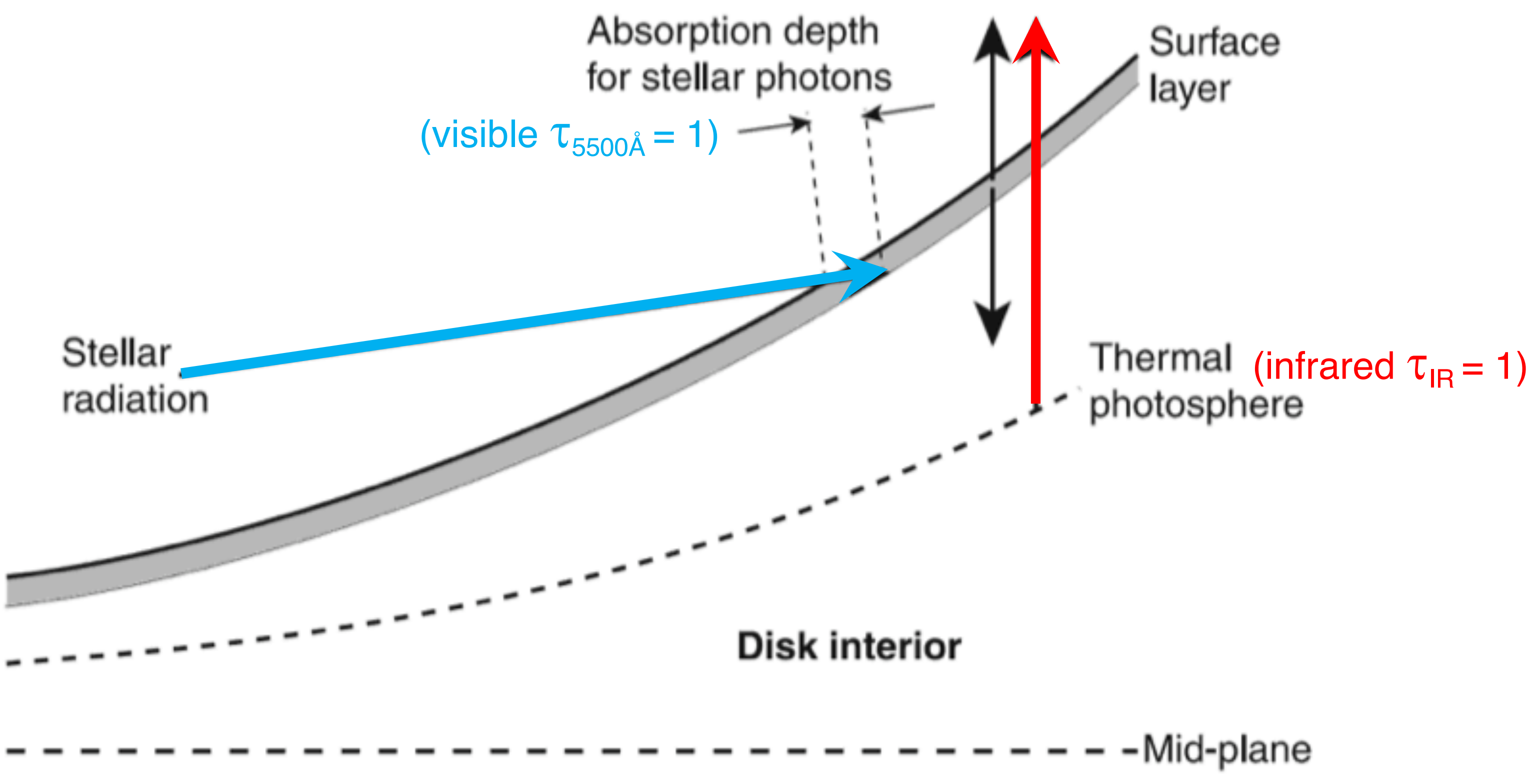
Radiative Equilibrium of Passive Disks



Chiang & Goldreich 1997

Radiative Equilibrium of Passive Disks

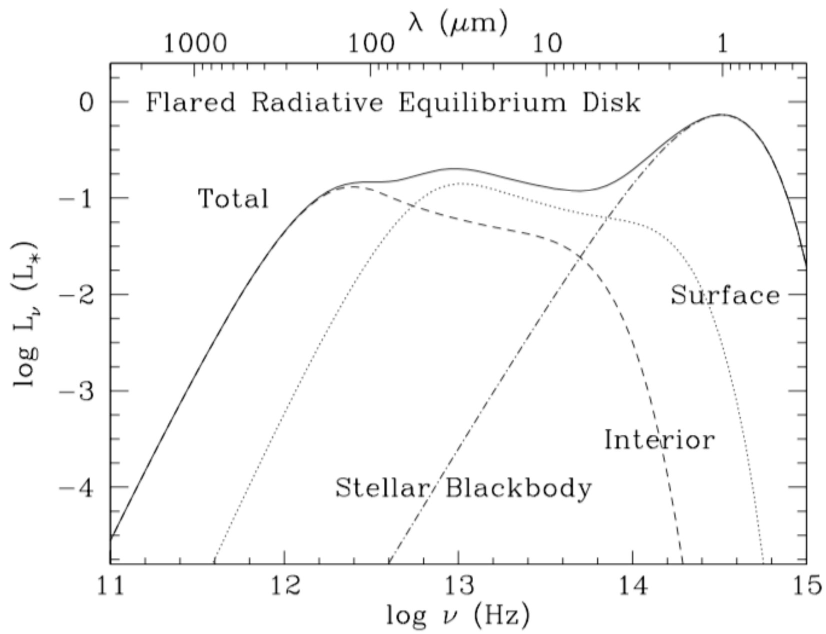


FIG. 6.—SED for the hydrostatic, radiative equilibrium disk. At mid-IR wavelengths, the superheated surface radiates approximately 2–3 times more power than the interior. Longward of 300 μm, *n* gradually steepens from about 3 to 3 + β as the disk becomes increasingly optically thin.

Chiang & Goldreich 1997

Fit to GM Aur

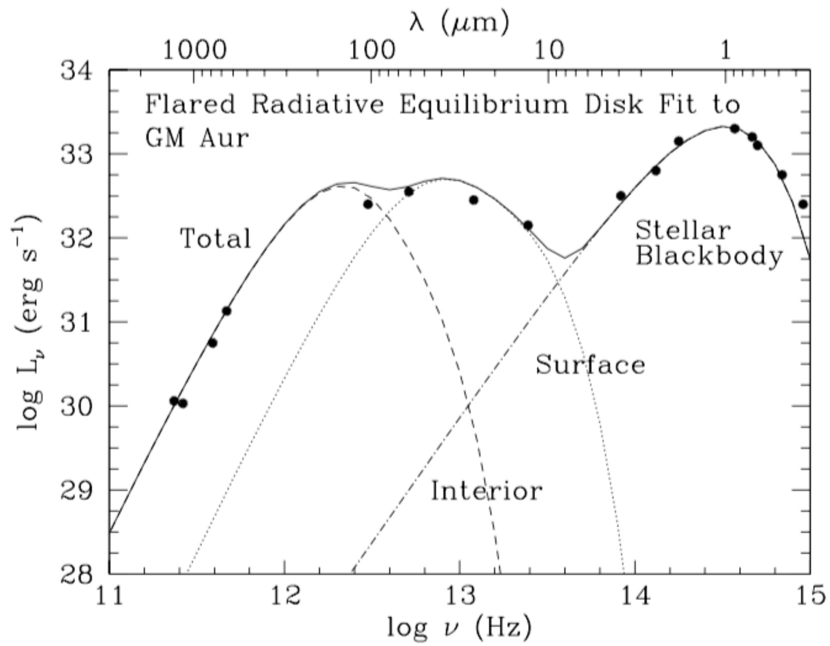
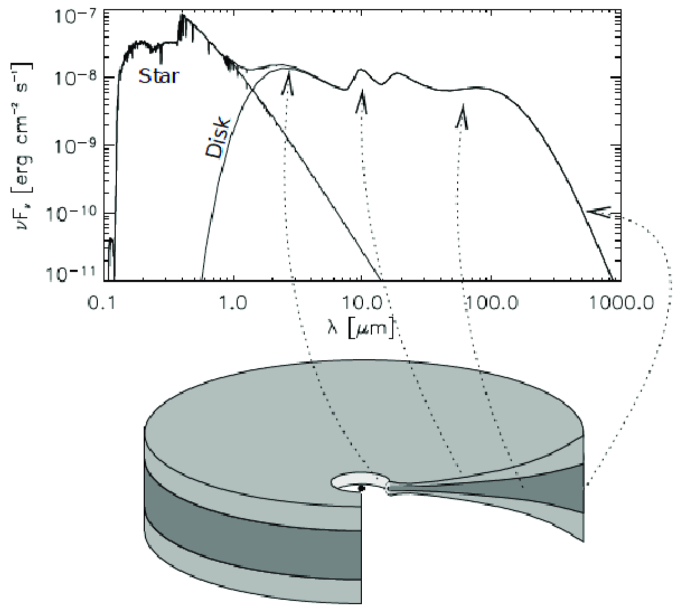


FIG. 8.—Observed SED of GM Aur (*filled circles*) and accompanying hydrostatic, radiative equilibrium (face-on) disk model. Fit parameters are as follows: $\Sigma = 3 \times 10^3 a_{\rm AU}^{-3/2}$ g cm^{-2}, $\beta = 1.4$, $r_p = 0.3$ μm, $a_o = 390$ AU, and $a_i = 6.8$ AU. The derived inner cutoff radius is likely an artifact of fitting a face-on model to a disk observed at substantial inclination (see the text for a discussion).

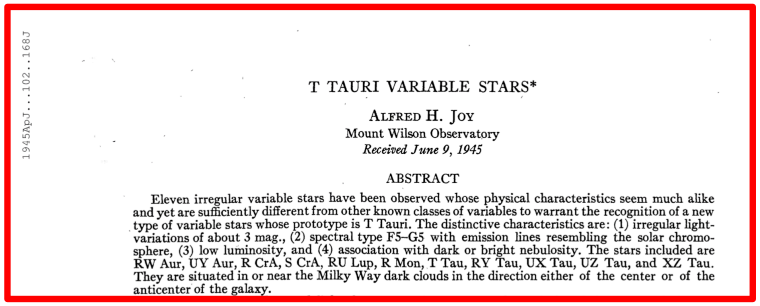
Chiang & Goldreich 1997

Disks are optically thick in infrared
and optically thin in millimeter



To witness planet formation we must observe in millimeter

T Tauri



1945ApJ...102..168J

T TAURI VARIABLE STARS*

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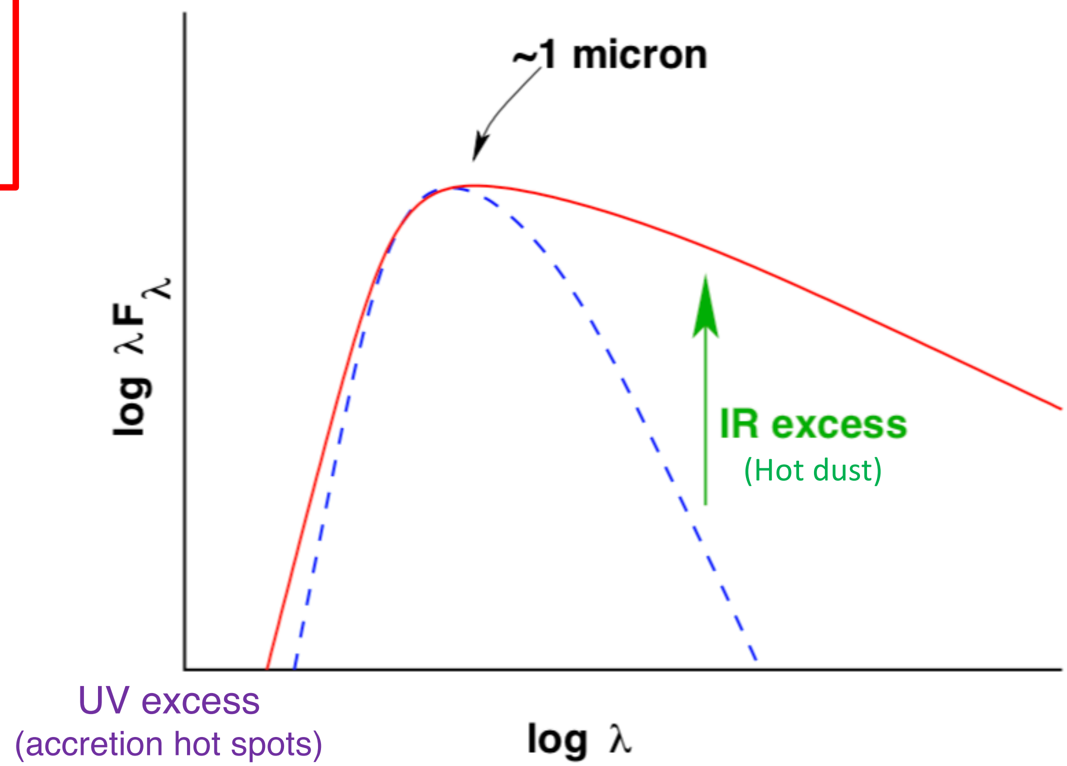
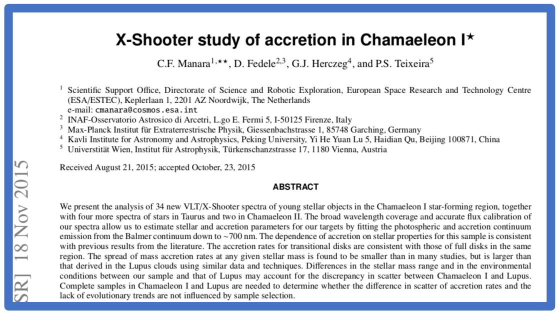
Received June 9, 1945

ABSTRACT

Eleven irregular variable stars have been observed whose physical characteristics seem much alike and yet are sufficiently different from other known classes of variables to warrant the recognition of a new type of variable stars whose prototype is T Tauri. The distinctive characteristics are: (1) irregular light-variations of about 3 mag., (2) spectral type F5–G5 with emission lines resembling the solar chromosphere, (3) low luminosity, and (4) association with dark or bright nebulosity. The stars included are RW Aur, UY Aur, R CrA, S CrA, RU Lup, R Mon, T Tau, RY Tau, UX Tau, UZ Tau, and XZ Tau. They are situated in or near the Milky Way dark clouds in the direction either of the center or of the anticenter of the galaxy.



UV Excess
Accretion Luminosity and Mass Accretion Rate



X-Shooter study of accretion in Chamaeleon I★

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ABSTRACT

We present the analysis of 34 new VLT/X-Shooter spectra of young stellar objects in the Chamaeleon I star-forming region, together with four more spectra of stars in Taurus and two in Chamaeleon II. The broad wavelength coverage and accurate flux calibration of our spectra allow us to estimate stellar and accretion parameters for our targets by fitting the photospheric and accretion continuum emission from the Balmer continuum down to ~700 nm. The dependence of accretion on stellar properties for this sample is consistent with previous results from the literature. The accretion rates for transitional disks are consistent with those of full disks in the same region. The spread of mass accretion rates at any given stellar mass is found to be smaller than in many studies, but is larger than that derived in the Lupus clouds using similar data and techniques. Differences in the stellar mass range and in the environmental conditions between our sample and that of Lupus may account for the discrepancy in scatter between Chamaeleon I and Lupus. Complete samples in Chamaeleon I and Lupus are needed to determine whether the difference in scatter of accretion rates and the lack of evolutionary trends are not influenced by sample selection.

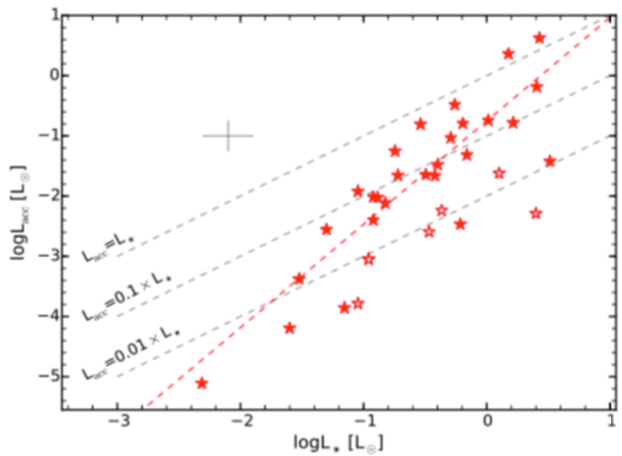


Fig. 4: Accretion luminosity as a function of stellar luminosity for the whole Chamaeleon I sample discussed here (*red stars*). Empty symbols denote non-accreting objects. Dashed lines are for different $L_{acc}/L_{\star}$ ratios in decreasing steps from 1, to 0.1, to 0.01, as labeled. The best-fit relation from Eq. (2) is overplotted with a dashed red line. Typical uncertainties are shown in the upper left corner of the plot.

$$\log L_{acc} = (1.72 \pm 0.18) \cdot \log L_{\star} - (0.75 \pm 0.16)$$

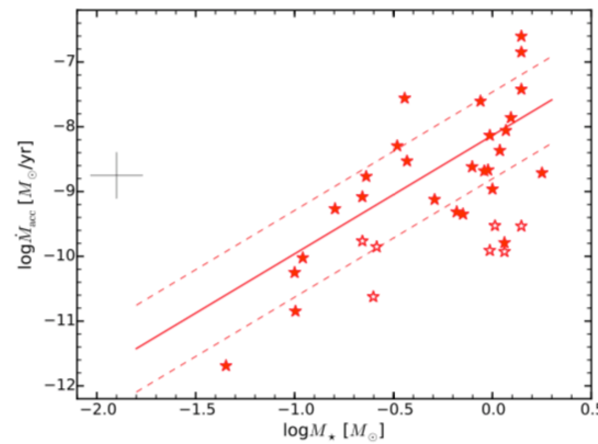
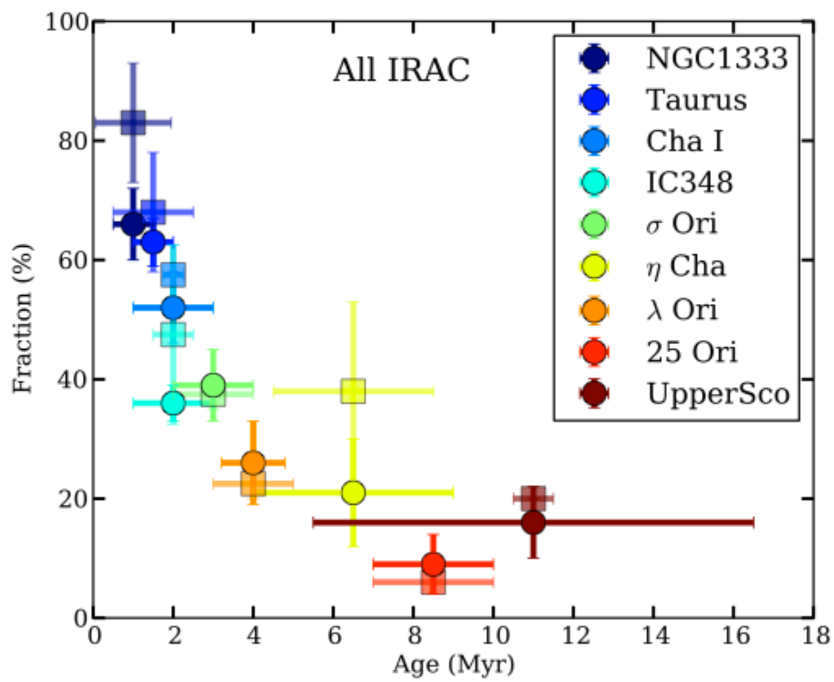


Fig. 6: Mass accretion rate as a function of the stellar mass for the whole Chamaeleon I sample discussed here (*red stars*). Empty symbols are used for non-accreting objects. The best-fit relation from Eq. (5) is overplotted with a red line, and the standard deviation from the best fit is shown with dashed lines. Typical uncertainties are shown in the upper left corner.

$$\log \dot{M}_{acc} = (1.83 \pm 0.35) \cdot \log M_{\star} - (8.13 \pm 0.16)$$

Disk lifetime



(Ribas et al. 2014)

Disks dissipate within ~10Myr

A static description cannot be the full picture: **disks must evolve in time.**

Evolution summary (Spitzer Core to Disk Legacy)


The Astrophysical Journal Supplement Series, 181:321–350, 2009 April doi:10.1088/0067-0049/181/2/321

THE *SPITZER* c2d LEGACY RESULTS: STAR-FORMATION RATES AND EFFICIENCIES; EVOLUTION AND LIFETIMES

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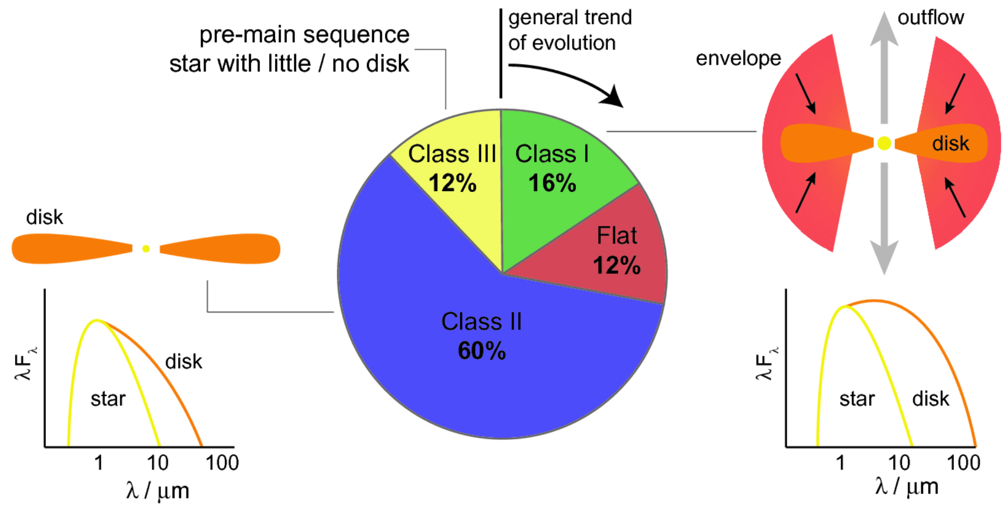

Class II is the (main) epoch of planet formation