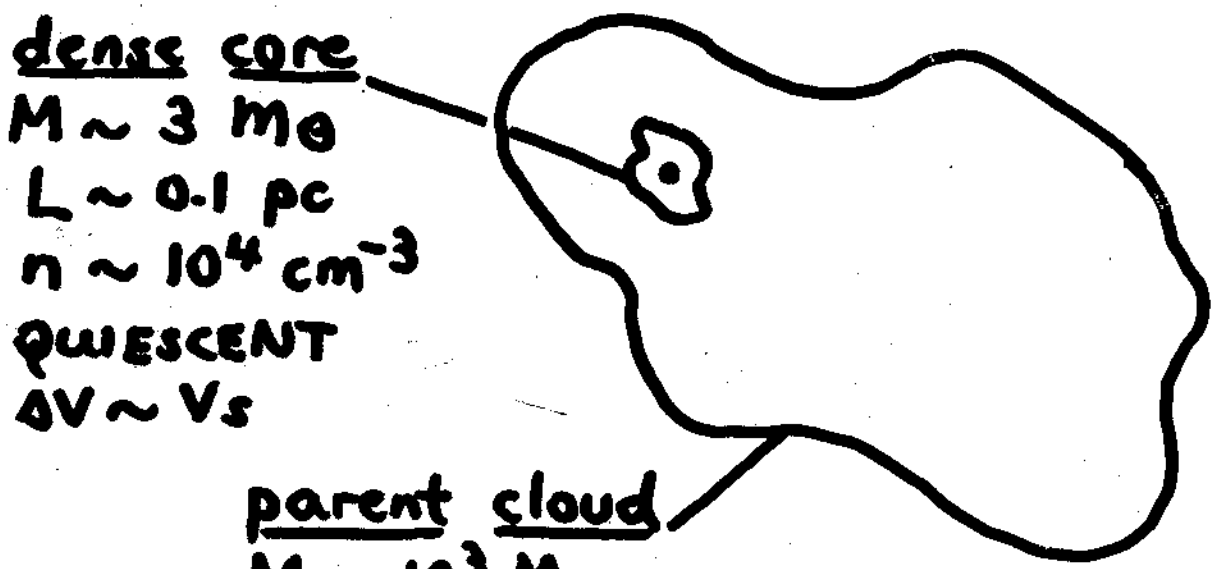
FORMATION of STELLAR GROUPS

- stars born in { OB associations unbound; T associations unbound; clusters bound }

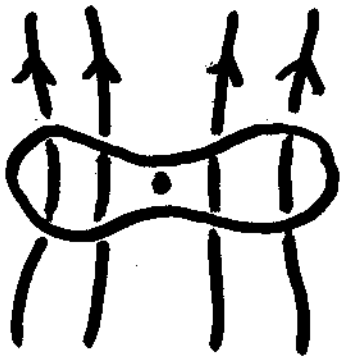
- $N(M_*) \sim$ <u>field-star IMF</u>
  - -interesting statistical implications
    (eg, L_{max} vs. N; N vs. M_{max})
  - -still need a physical account

- Basic Observations:



BASIC THEORY

- dense core → star



(1) ambipolar diffusion
10^7 yr

(2) dynamical collapse
10^5 yr

BUT observed cores are elongated...

- parent cloud → dense cores

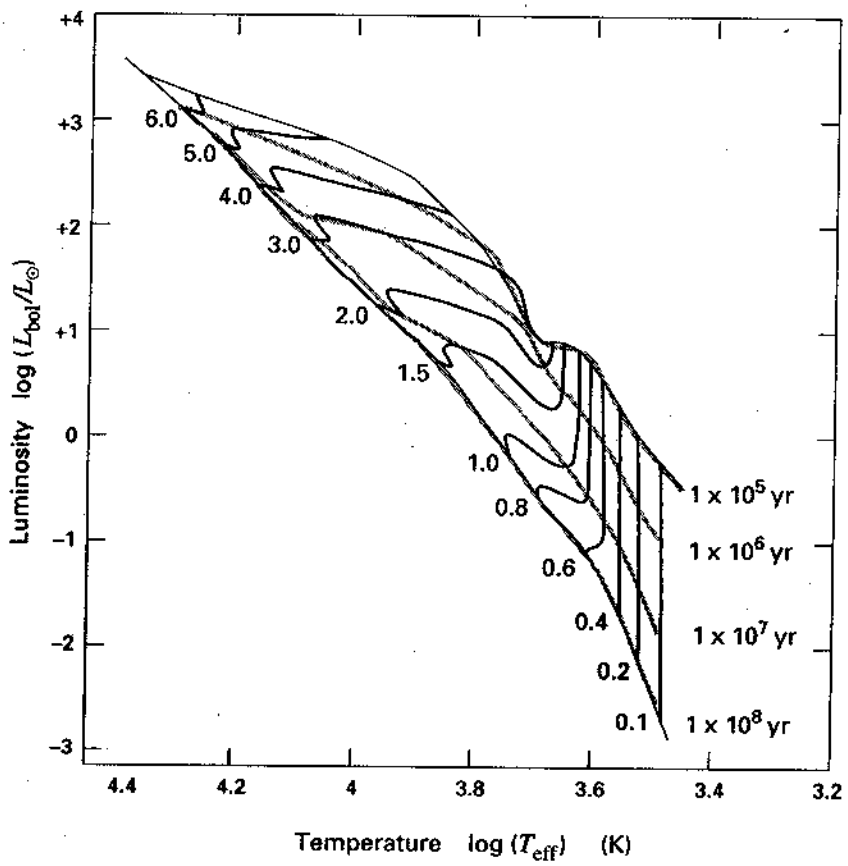
dynamical fragmentation:
collapse and breakup of
massive ($M \gg M_J$), quiescent clouds

BUT unlikely initial state $F_{tot} \neq 0$
too efficient $\Sigma M_{frag} = M_{tot}$

internal clumping:
collisions of streams in
turbulent, MHD environment

- EMPIRICAL APPROACH

STAR FORMATION HISTORY



complete pre-M.S. tracks

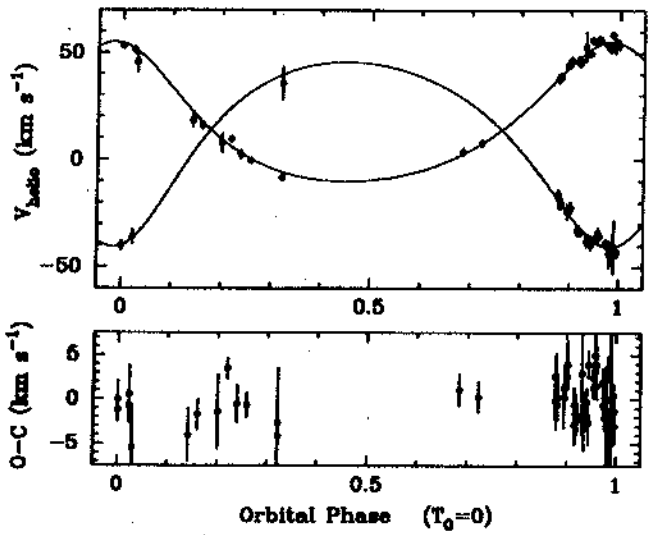
Palla & Stahler 1999

palla@arcetri.astro.it

TESTING the TRACKS

- ZAMS should match observed one.
- Pre-M.S. spectroscopic binaries:

> If double-lined, know M_1/M_2 from $V_r(t)$.



> From spectra, obtain L_1, L_2 and T_1, T_2.

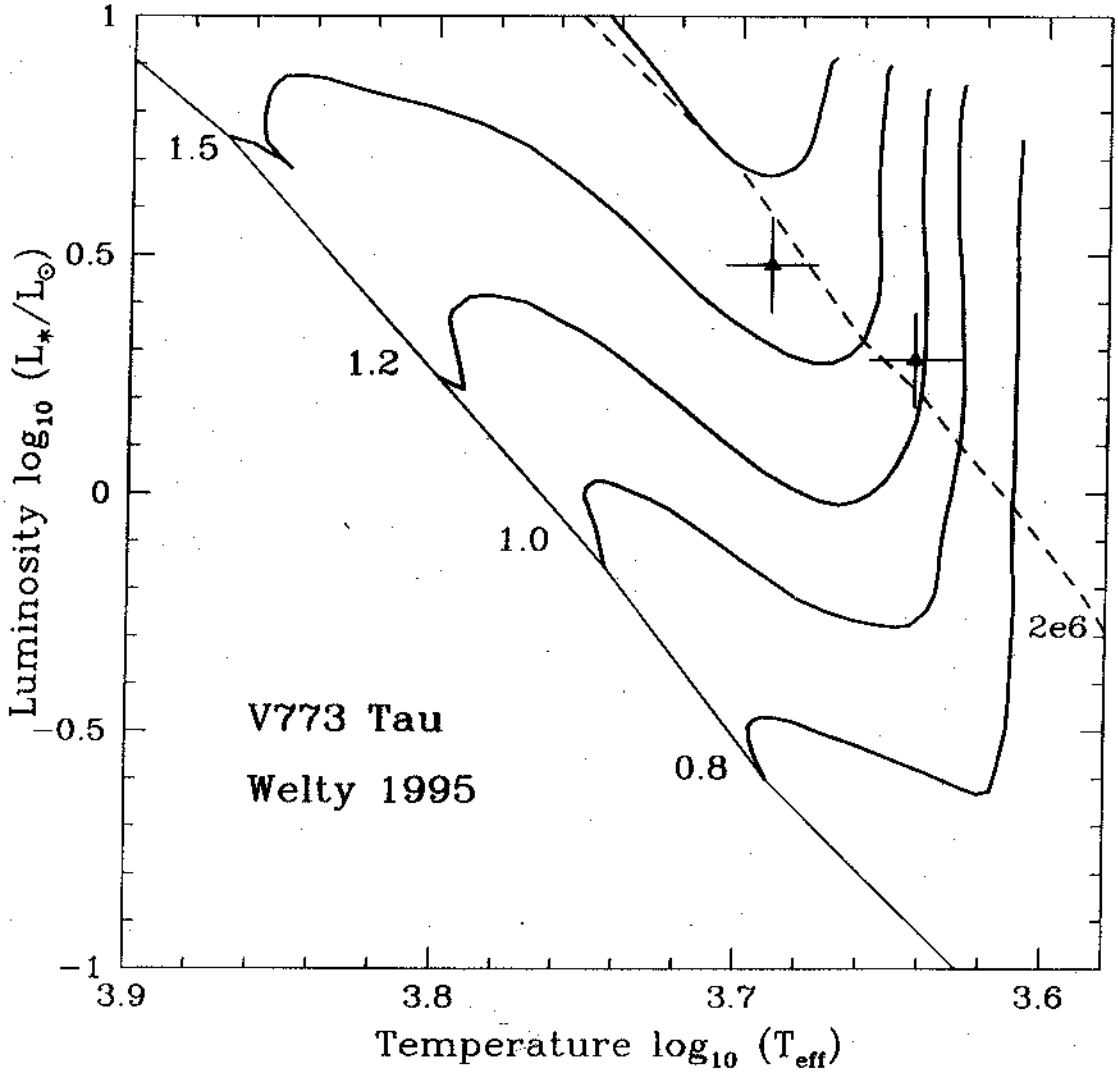
> Place stars in HR diagram.

Q: Is M_1/M_2 correct?

Q: Compare ages. Coeval?

example – V773 Tau

$\left(\frac{M_1}{M_2}\right)_{obs} = 1.32$ $\left(\frac{M_1}{M_2}\right)_{theor} = 1.37$

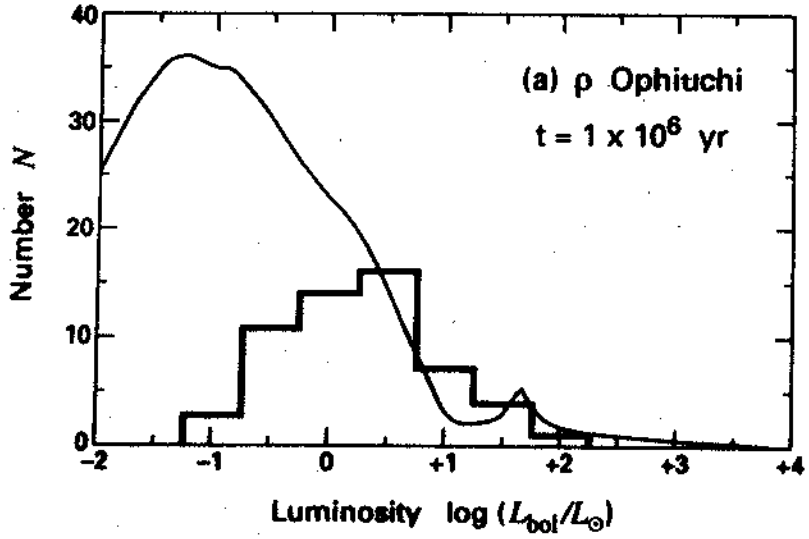


$t_1 \approx t_2 \approx 2 \times 10^6$ yr

APPLICATION to CLUSTERS:

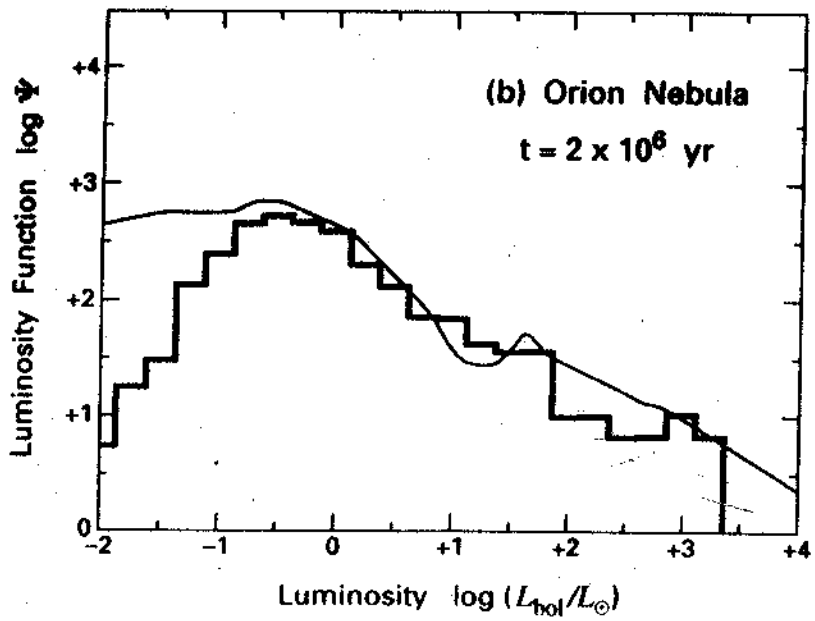
BOLOMETRIC LUMINOSITY FUNCTIONS

- use simple model plus tracks:



Fletcher + Stahler '94

Wilking et al 1989

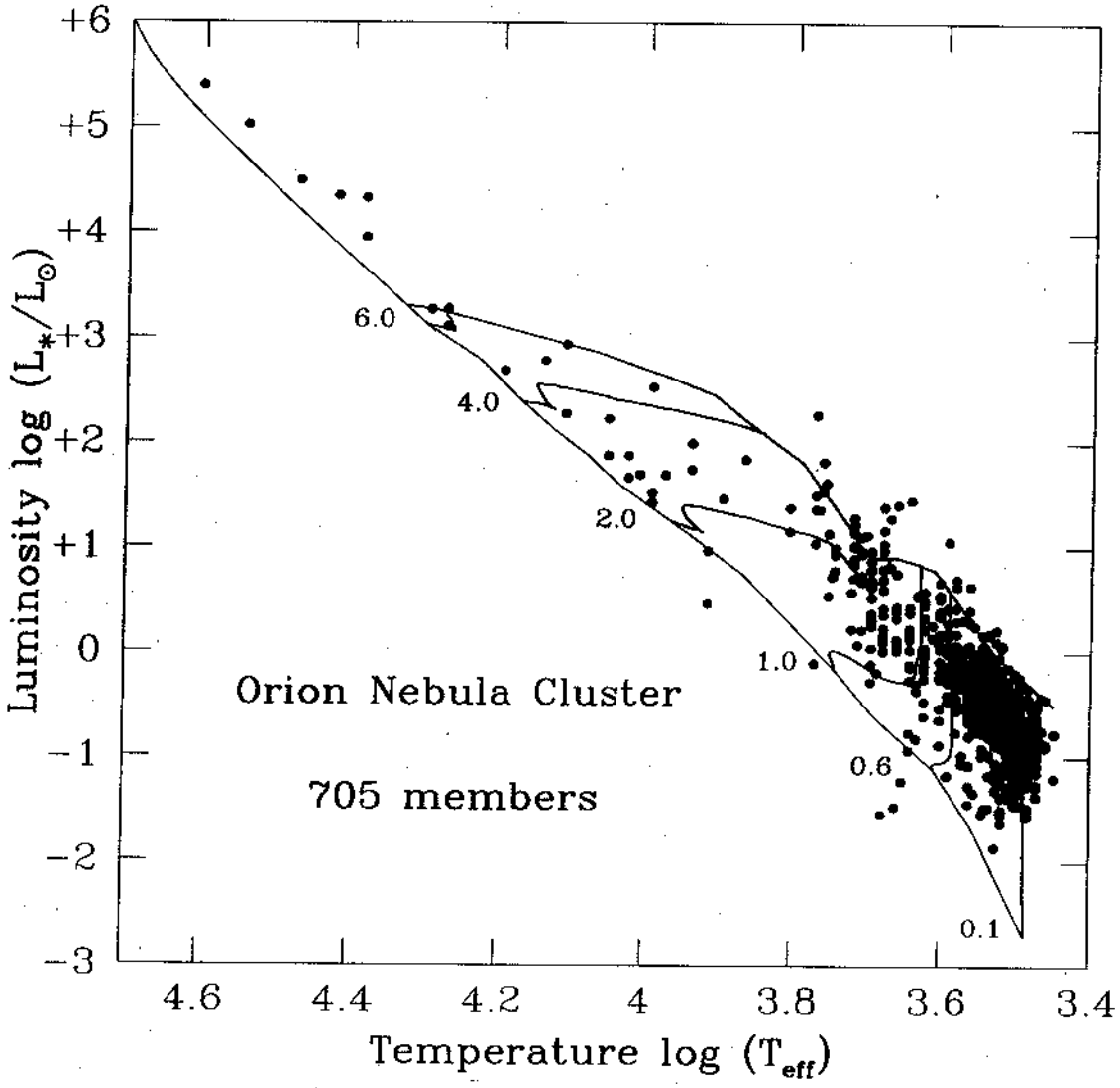


Palla + Stahler 1999

Hillenbrand 1997

model - continuous formation at fixed rate.

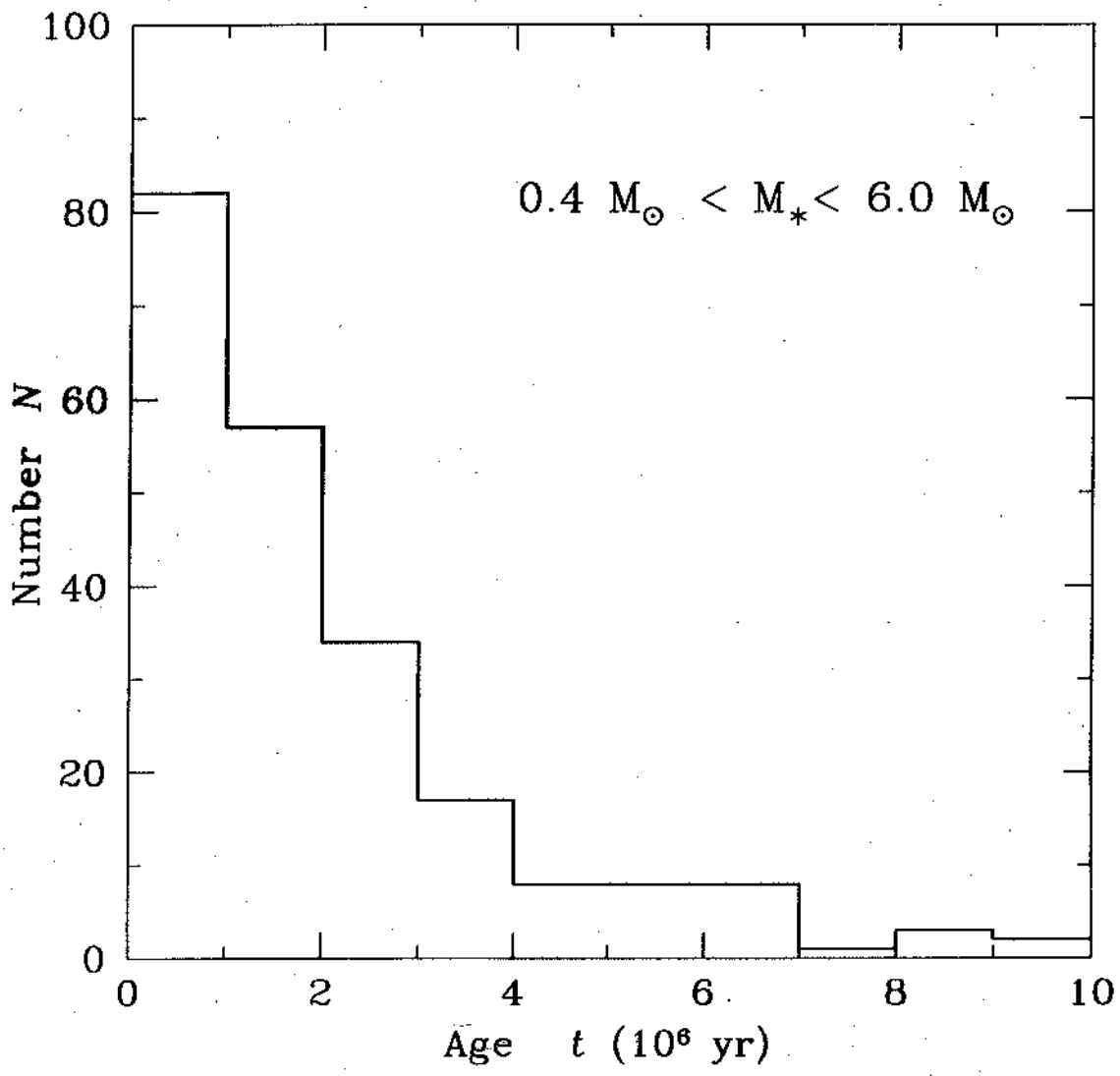
ORION NEBULA CLUSTER



Hillenbrand 1997

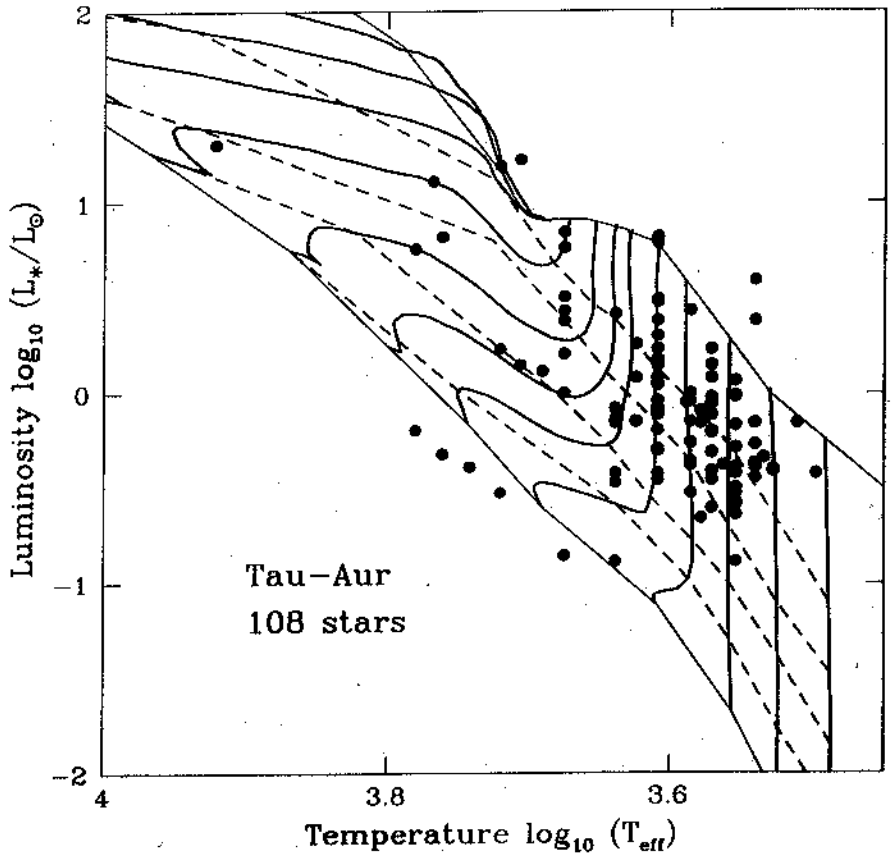
ORION NEBULA CLUSTER:

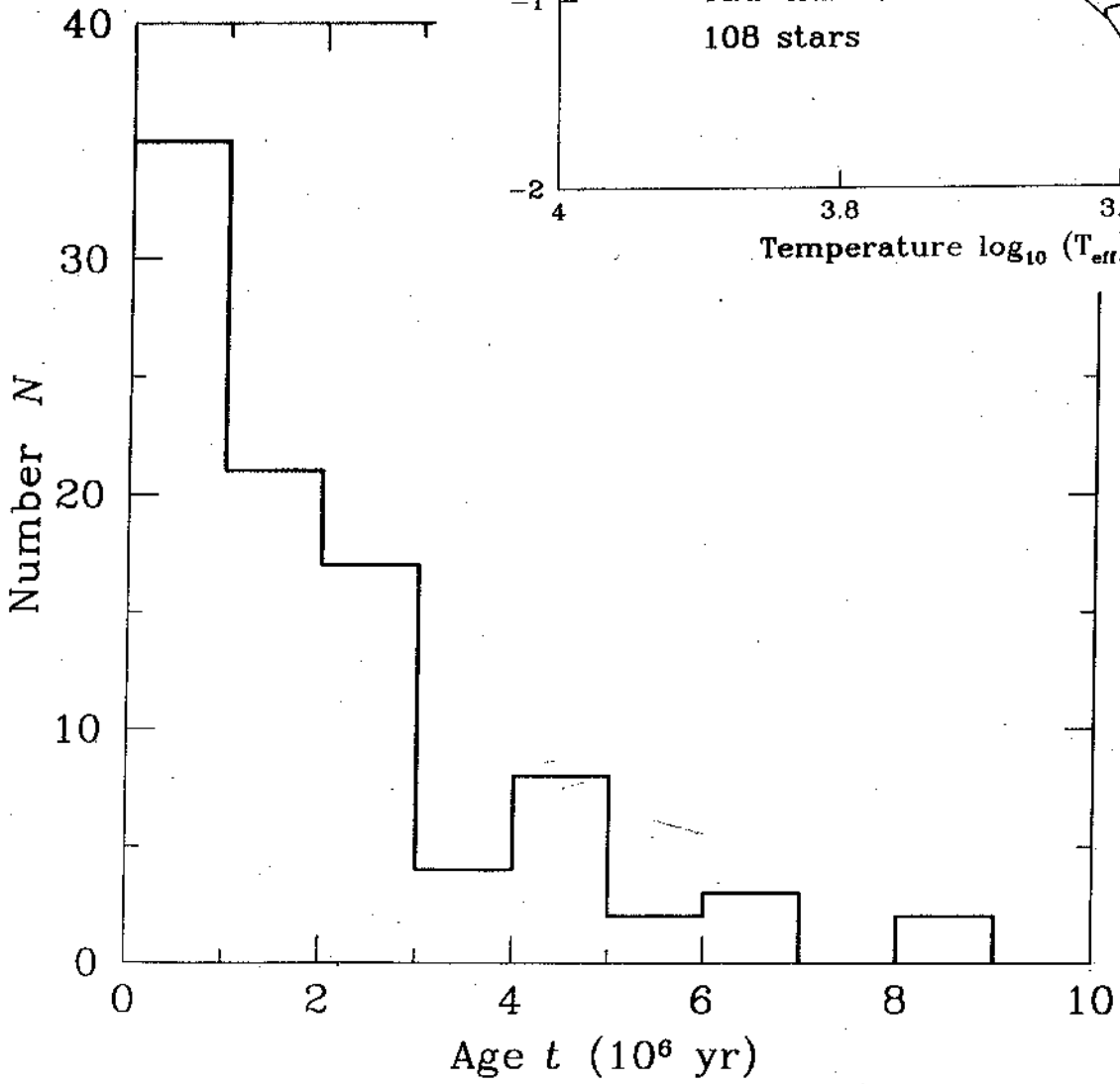
AGE HISTOGRAM



rate of star formation has accelerated.

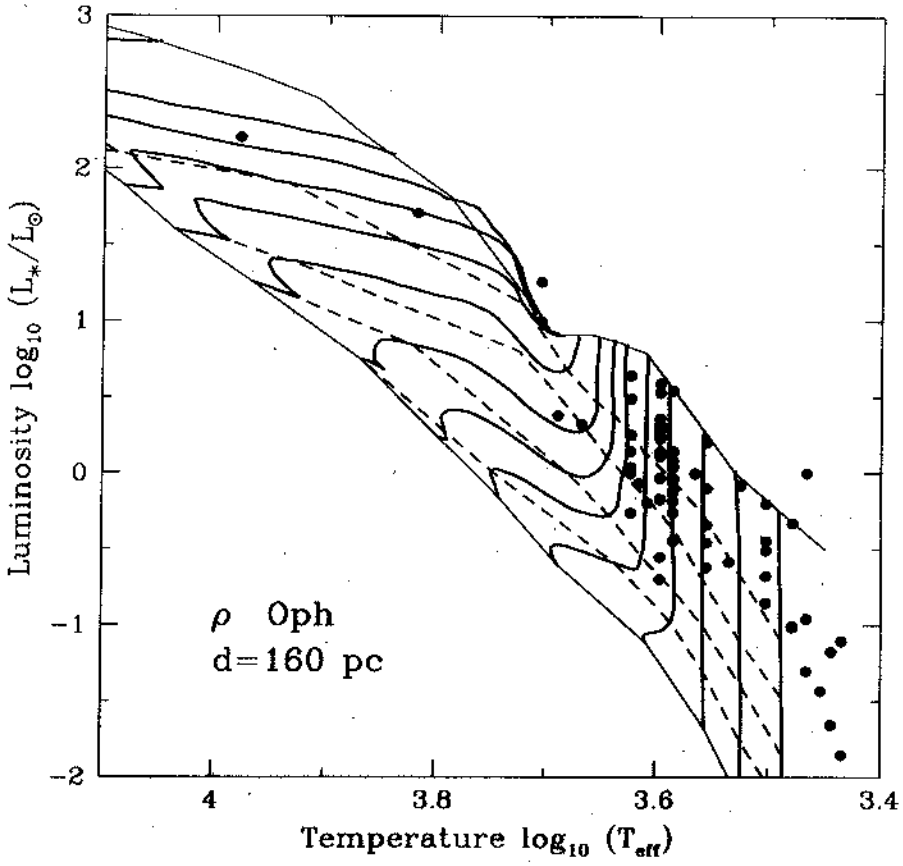
TAURUS-AURIGA

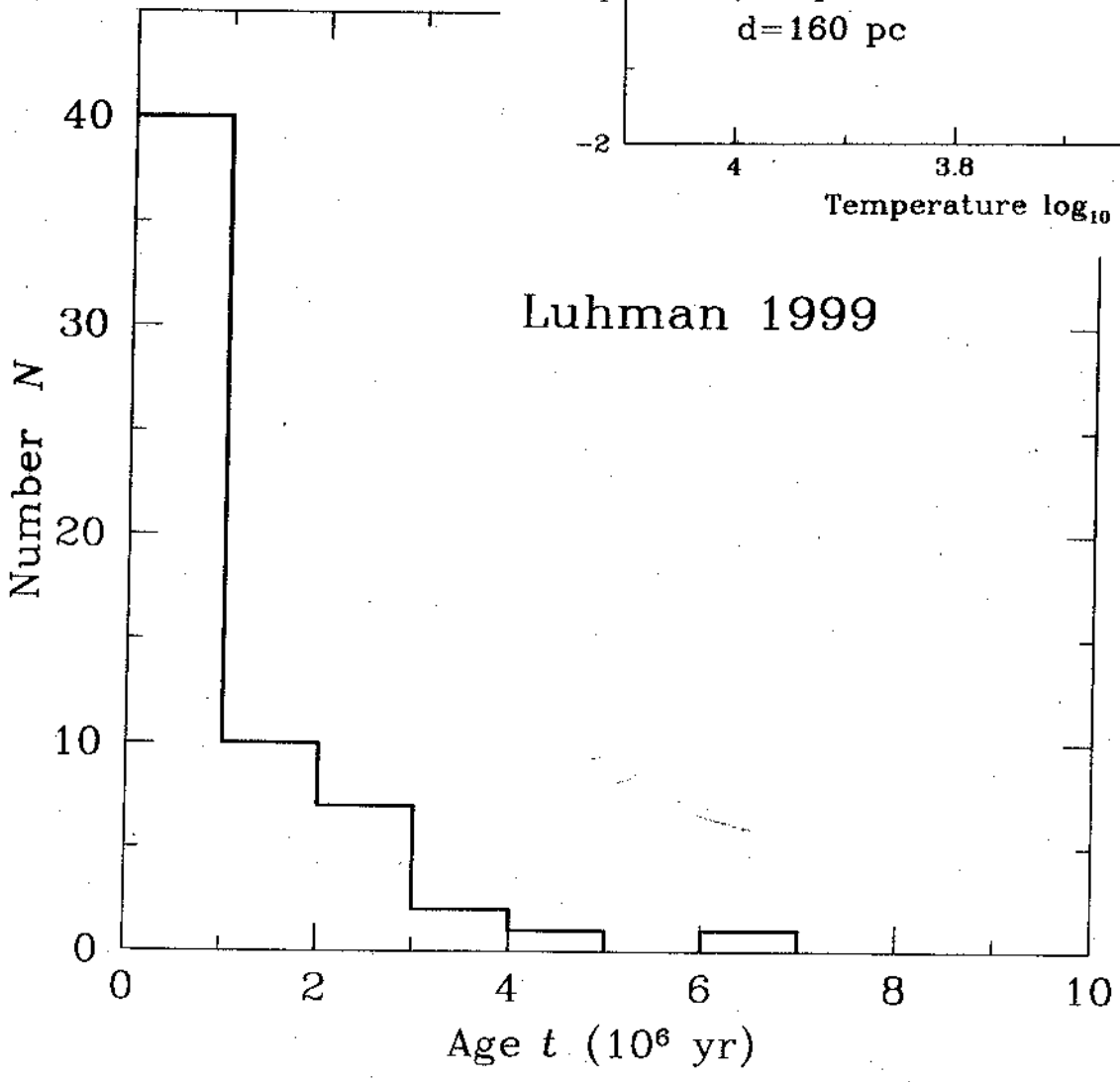




Kenyon + Hartmann 1995

ρ OPHIUCHI





Luhman + Ricke 1999

FORMATION of GROUPS II

- There must be a "deceleration."
  - > relatively rapid
  - > coincides with cloud dispersal
- Acceleration does not fit independent contraction of cores
  - > no likely core-core interaction
- **Cores must arise through global evolution of parent cloud.**
  - > quasi-static contraction
  - > driven by energy dissipation
- The agenda:
  - > observe "deceleration"
  - > study contraction of parent cloud
  - > revisit core formation