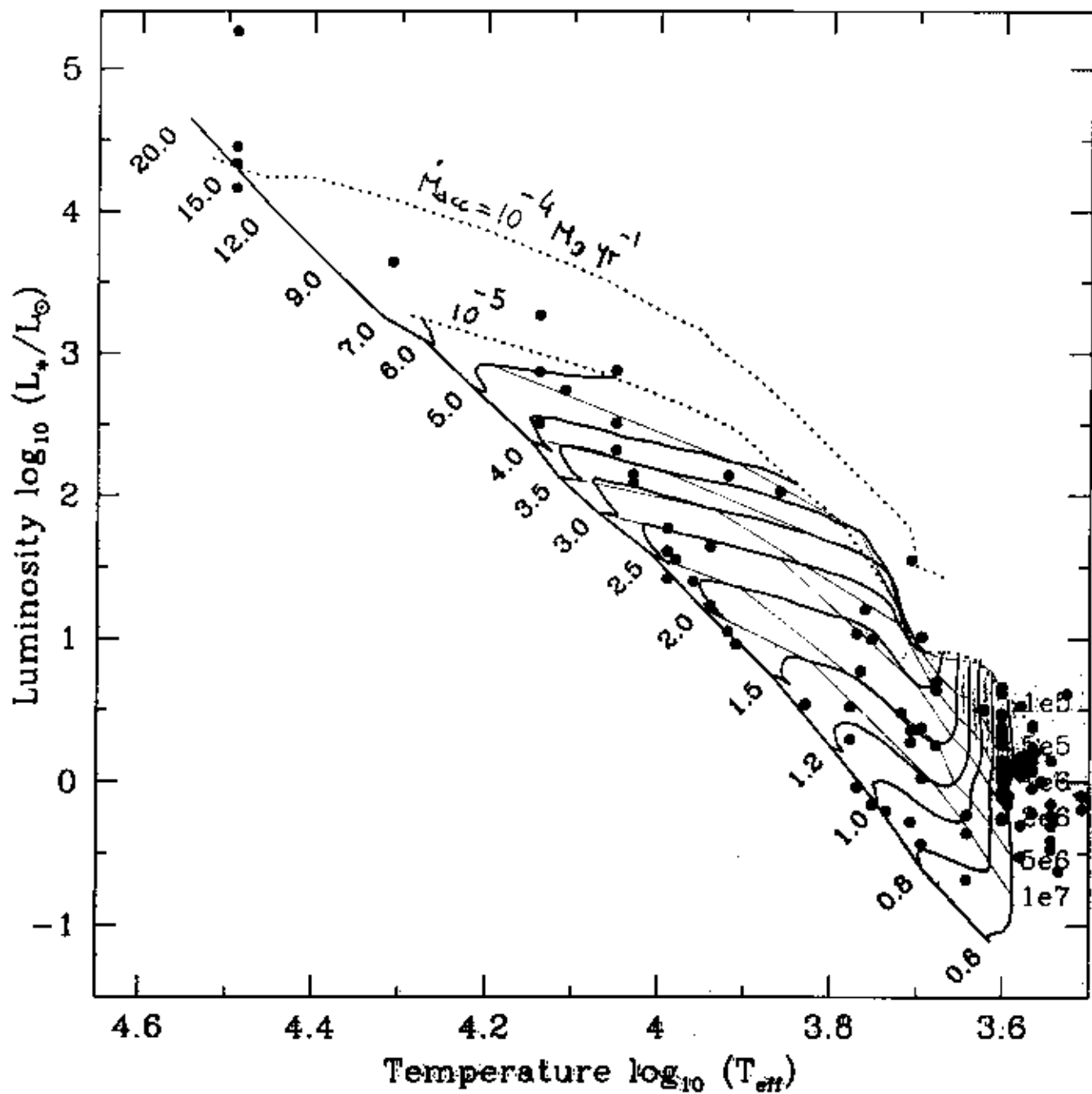


Herbig Ae/Be: PMS STARS OF INTERMEDIATE
MASS ($\sim 2 - 15 M_{\odot}$)

$\sim 300 *$



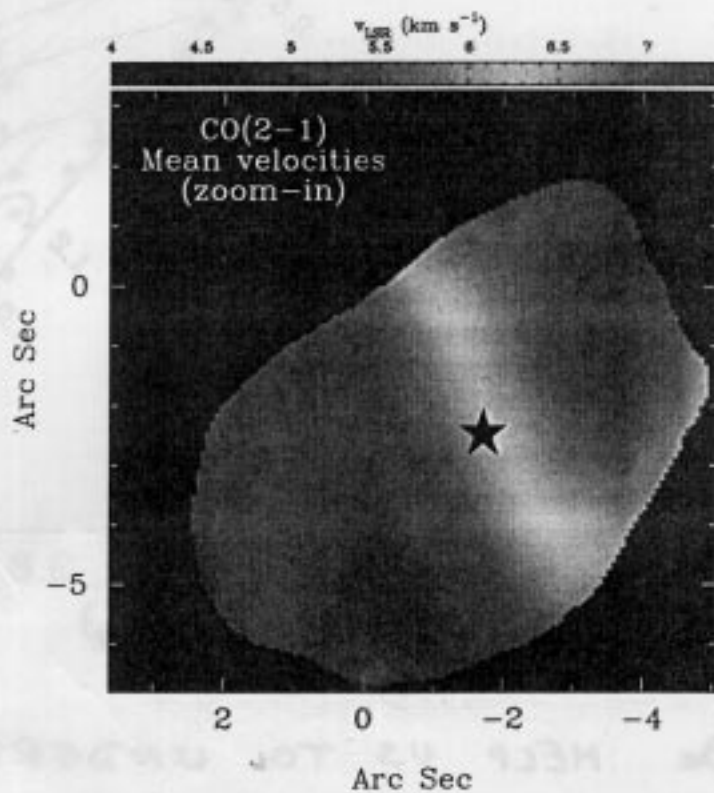
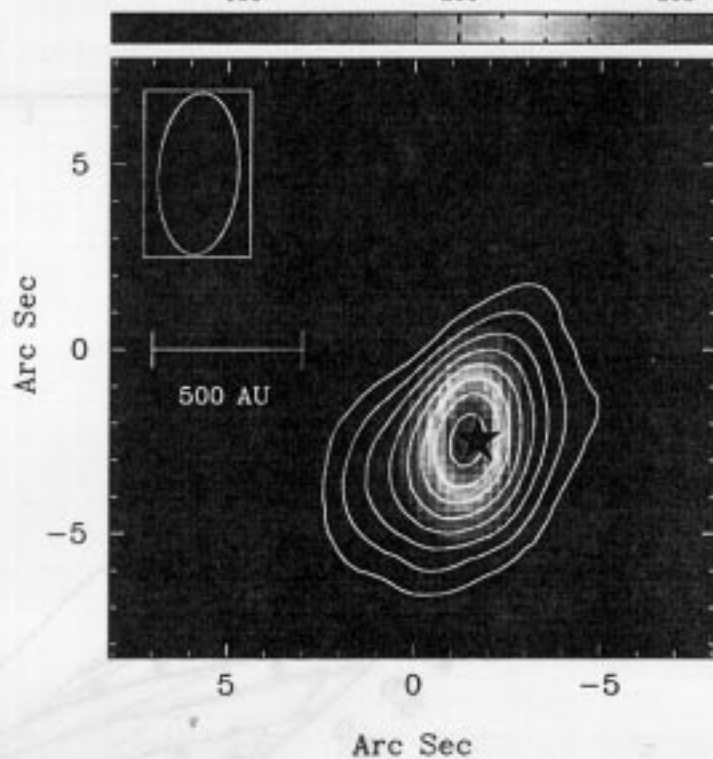
- DO HAeBe HELP US TO UNDERSTAND THE FORMATION OF MASSIVE STARS ?
- DO HAeBe HAVE (ACCRETION) DISKS ?

Dust and Gas around the Herbig Ae Star HD 163296

(Mannings & Sargent 1997 -- ApJ, 490, 792)

Contours: zeroth moment of CO(2-1) line emission.
Colors: continuum flux density (mJy) at $\lambda = 1.3$ mm.

100 200 300



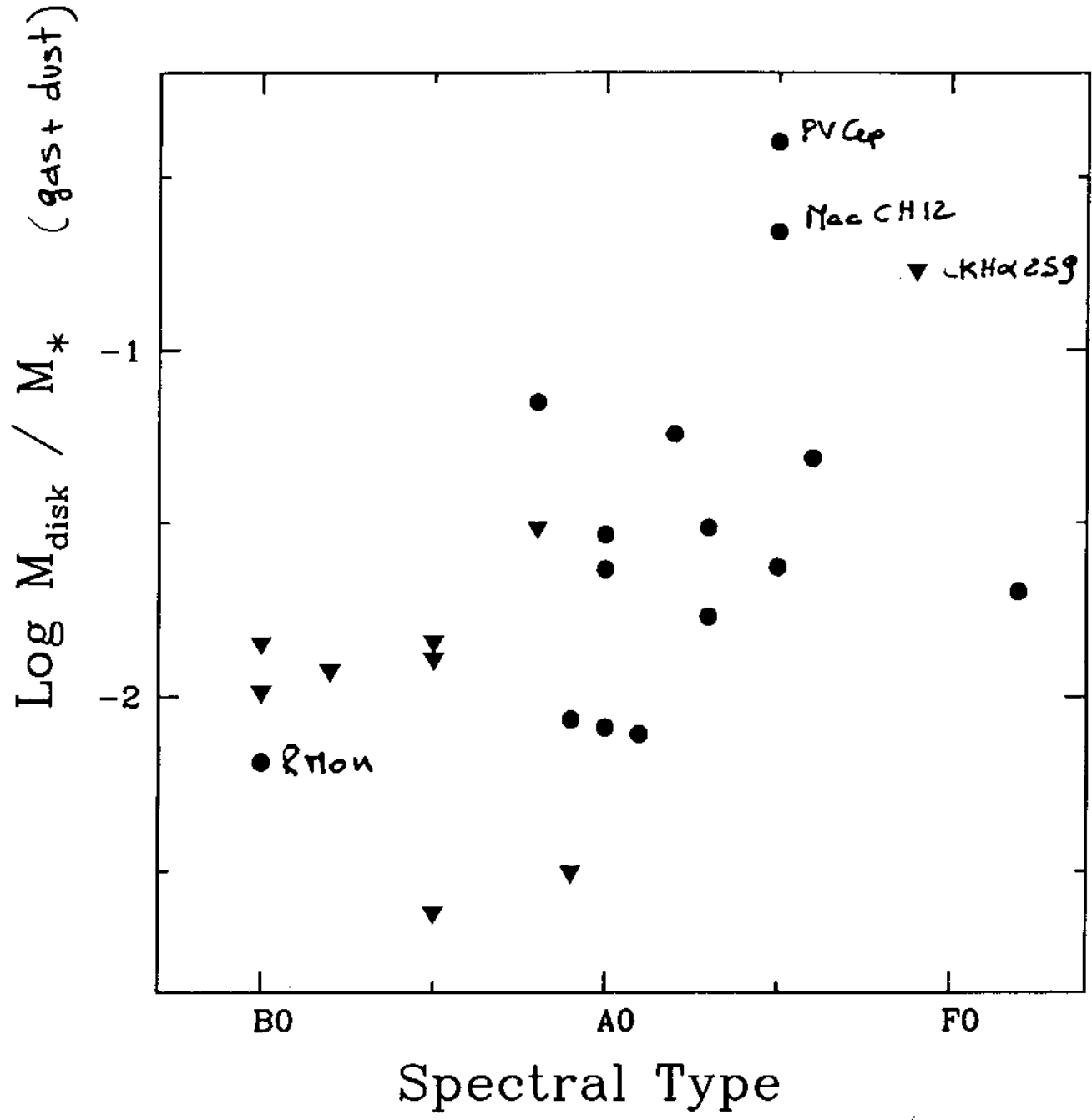
$\chi_{1.3\text{mm}} = 1 \text{ g cm}^{-2} \text{ gr}^{-1} \text{ of dust} ; \beta = 1$

$T_d = 28 \text{ K (A0)}$

gas : dust = 100 : 1

OVRO : Mannings & Sargent, 93, 99

PdB: Di Francesco et al, 97
Natta et al, 99

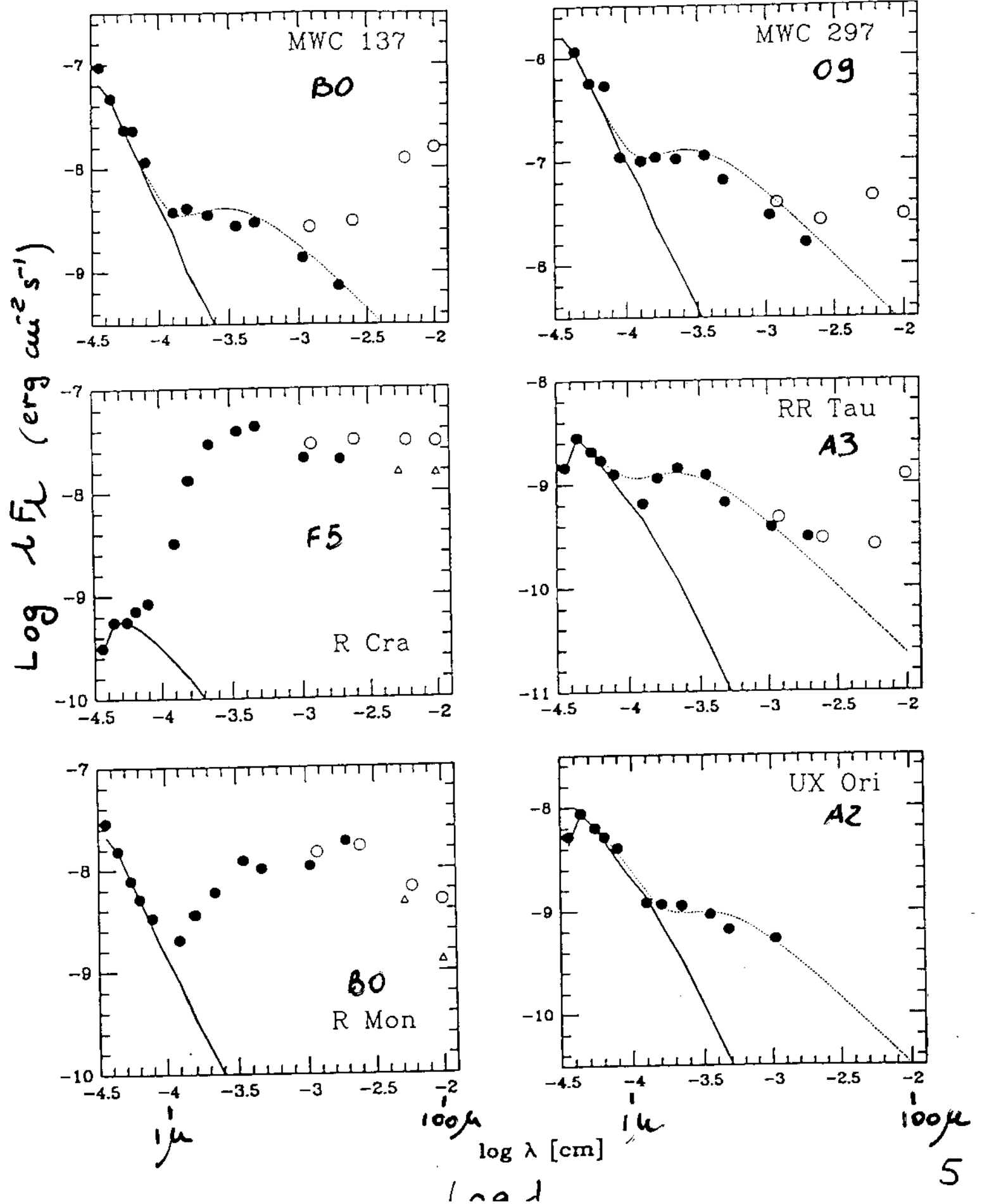


EARLY B STARS HAVE "LIGHT" DISKS (IF ANY)

LATE B AND A STARS HAVE "NORMAL" (i.e., ~ AS TTS) DISKS

- FROM MM INTERFEROMETRY, MASS & SIZE
- WHAT ARE THE OTHER DISK PROPERTIES (ACCRETION, $T(R)$ etc.)?
- WHAT HAPPENS IN THE EARLY-B STARS?
 - ALL HA_cBe HAVE LARGE IR EXCESSES

Hillenbrand et al. 1992 : DISKS WITH VERY HIGH \dot{M}_{ac}



- K A O -

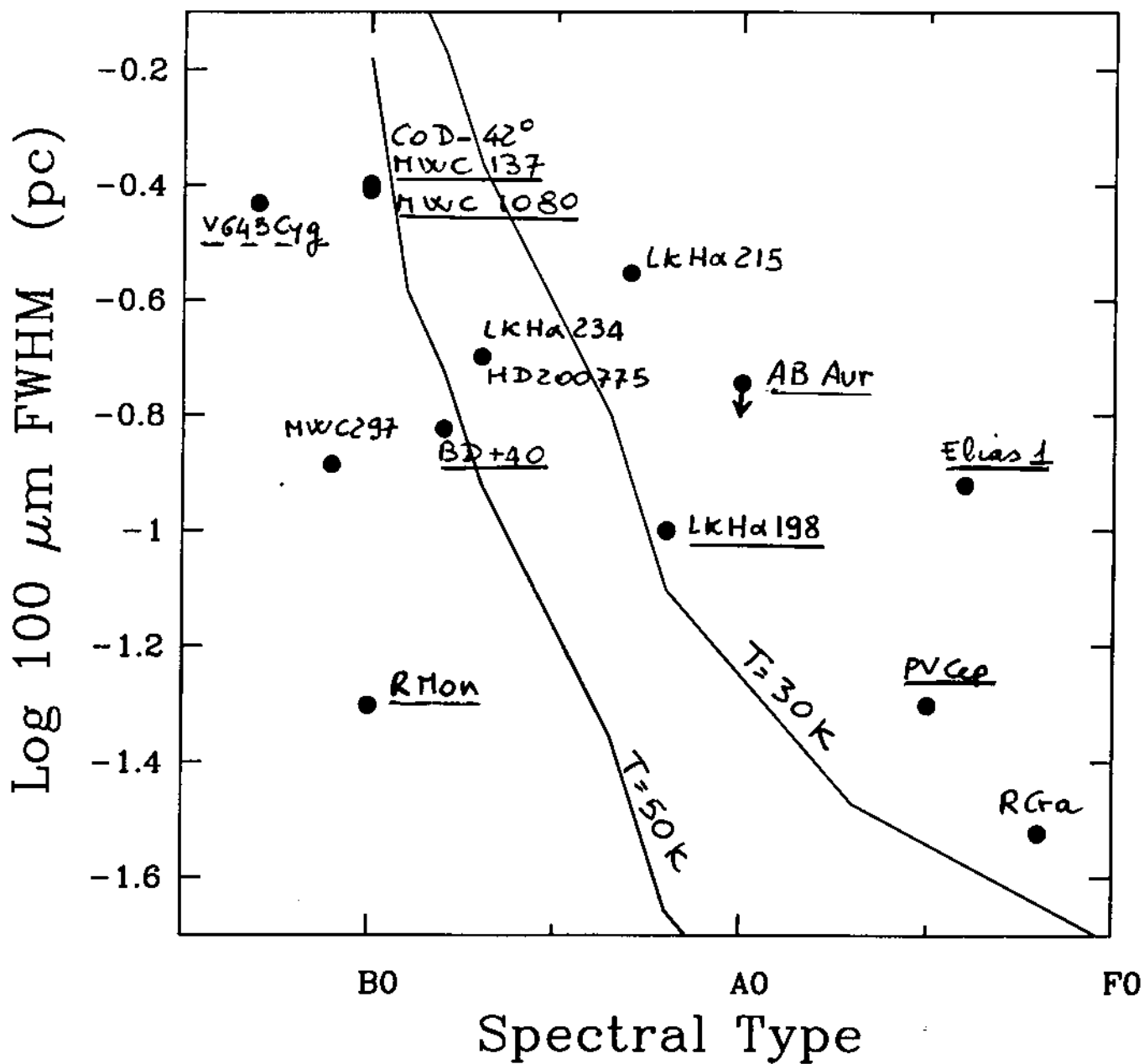
HIGH SPATIAL RESOLUTION OBSERVATIONS
OF YSOs AT 50 AND 100 μm
(MID-80s \rightarrow).

FAR-IR MULTICHANNEL SCANNING
PHOTOMETER (PAUL HARVEY, U. TEXAS).

THE SYSTEM COMPARED A STABLE,
WELL KNOWN POINT-SOURCE PROFILE
WITH A SCAN ACROSS THE SOURCE.
IT WAS POSSIBLE TO RESOLVE OBJECTS
WITH FWHM $\geq 10-15$ ARCSEC.

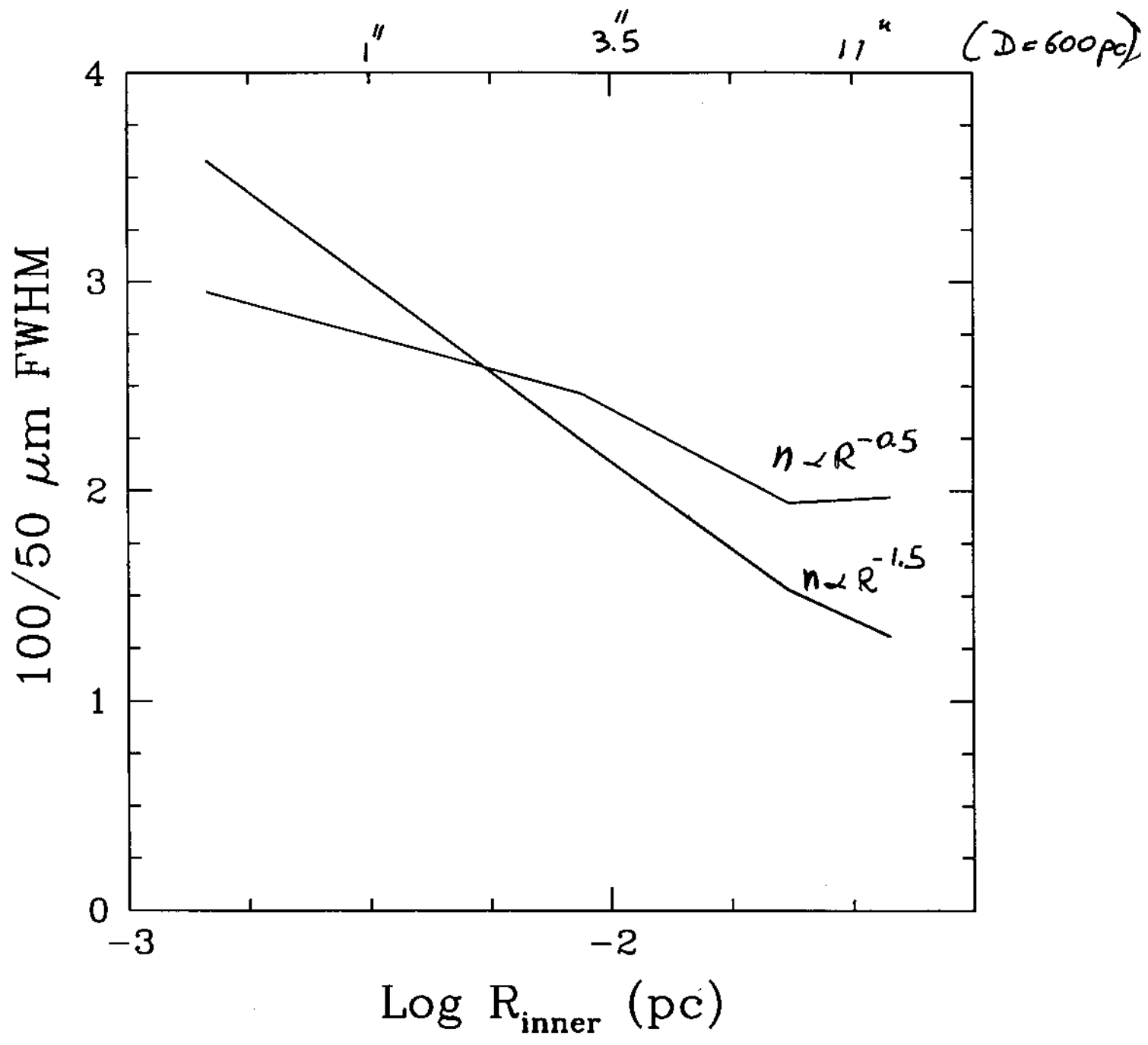
H A e / B e : Natta et al., 1993
Di Francesco et al., 1994, 1998

KAO SIZES [Natta et al. 1993; Di Francesco et al. 1994, 1998]

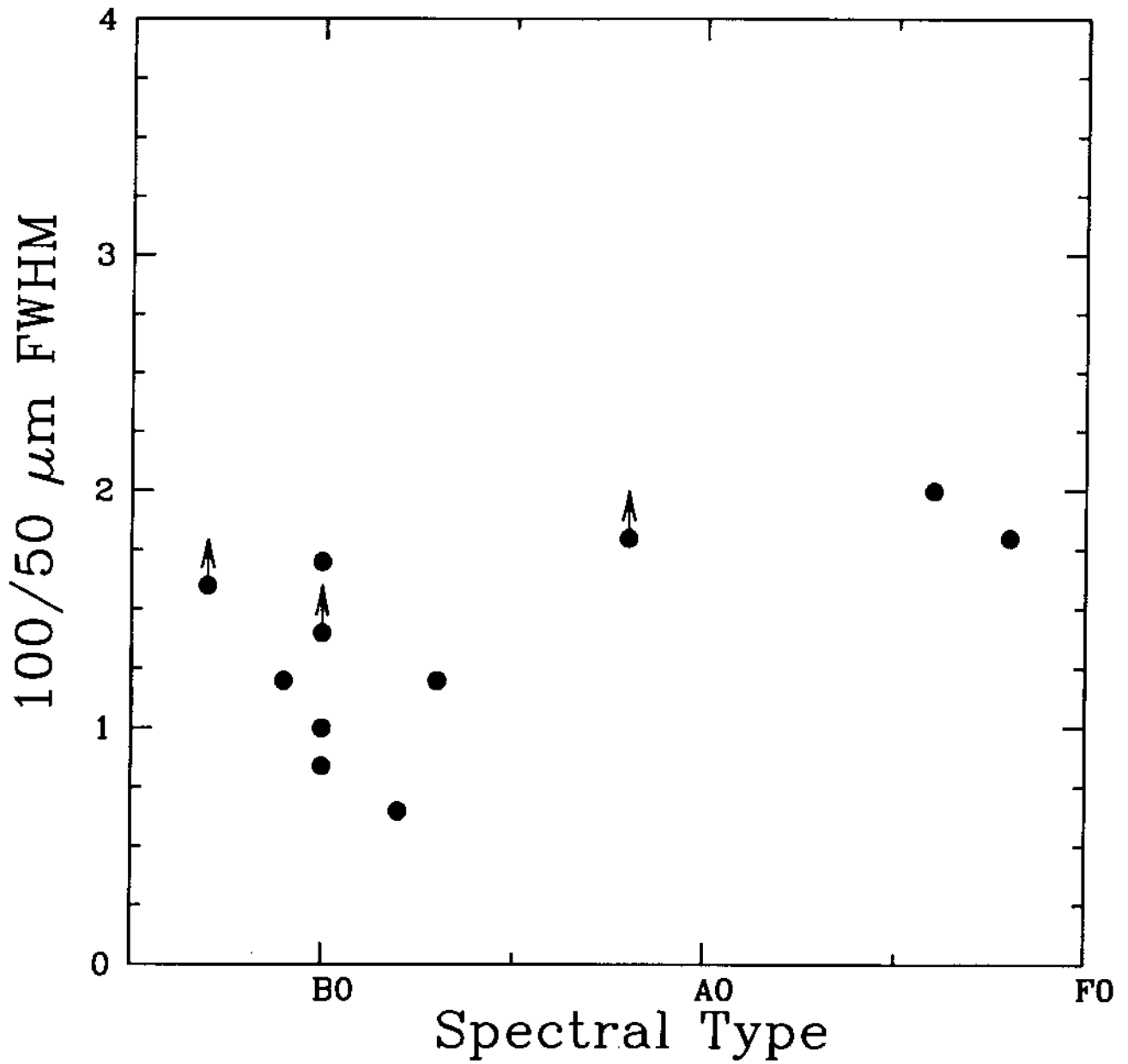


— DETECTED WITH MM INTERFEROMETERS
 - - - NON DETECTED WITH MM INTERFEROMETERS

FIR SIZES FROM RADIATION TRANSFER MODELS



FIR SIZES FROM KAO



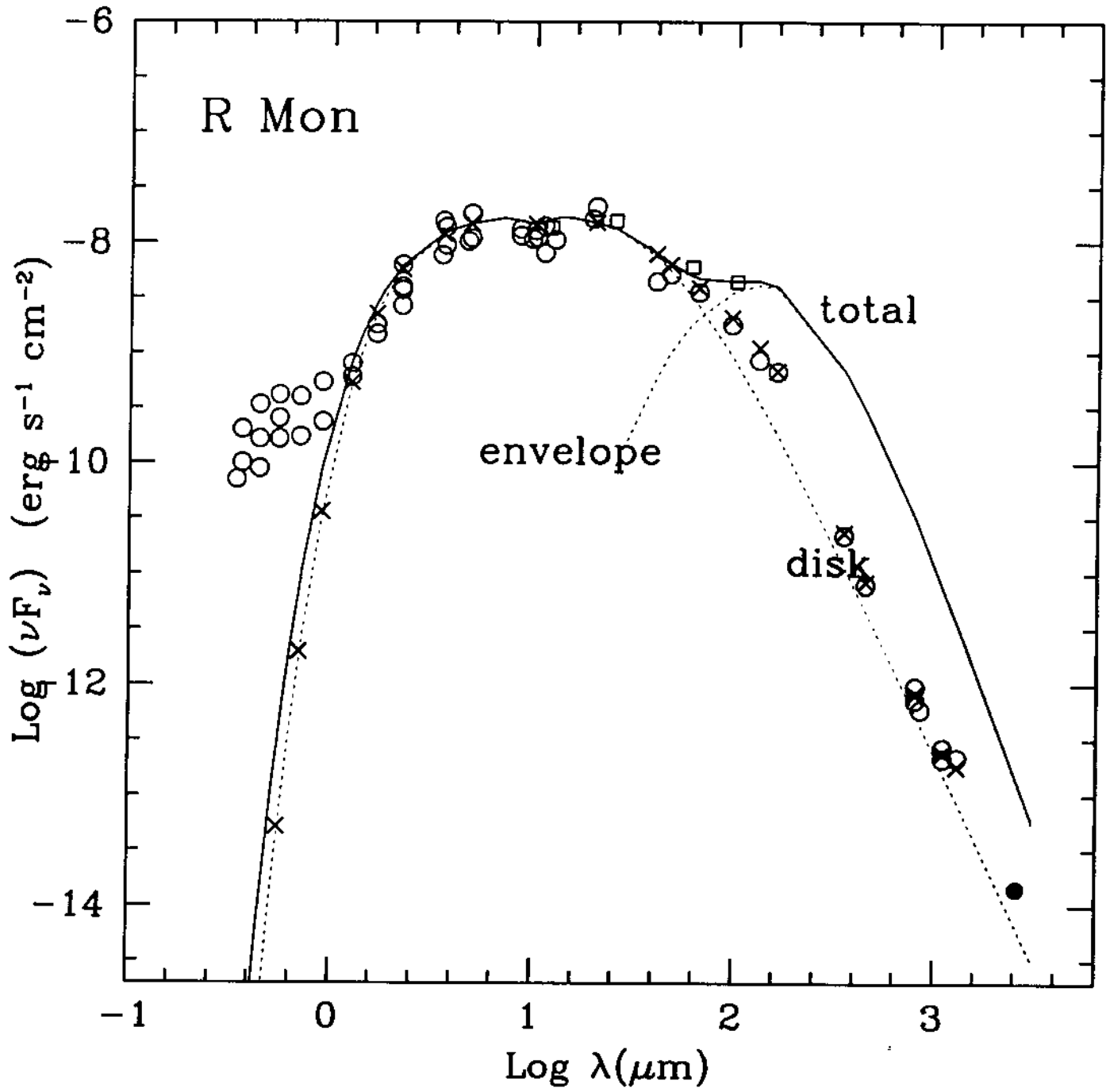
FROM KAO WORK, WE CONCLUDED
THAT MOST HA₂/Be ARE

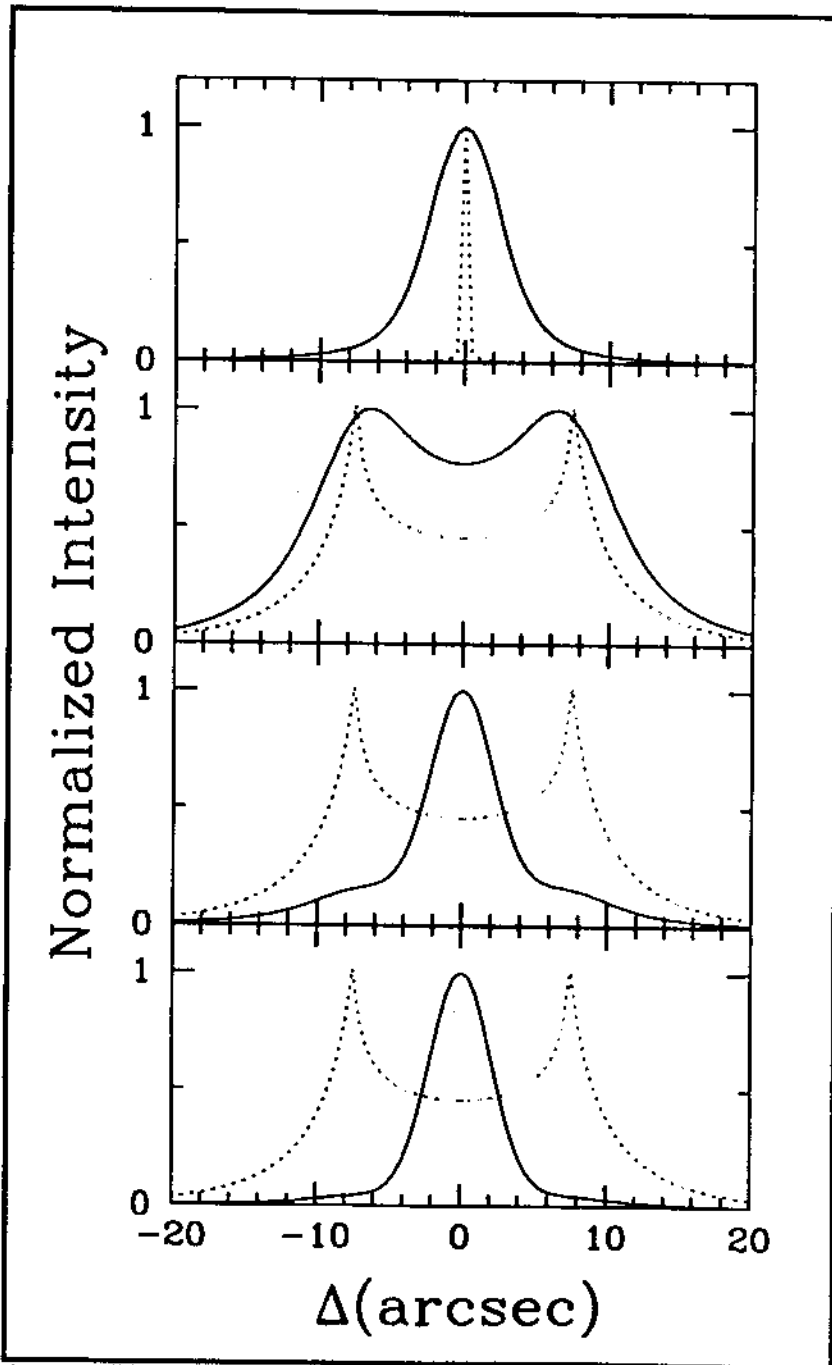
STAR + DISK + ENVELOPE

SYSTEMS.

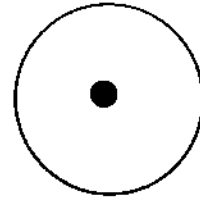
HOWEVER :

- THE KAO SAMPLE INCLUDED ONLY FEW (STRANGE) A STARS
- IT WAS DIFFICULT TO SEPARATE DISK AND ENVELOPE CONTRIBUTION IN THE MID & FAR IR.

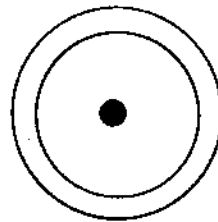




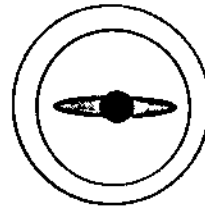
50 microns



The envelope extends to $R_{\text{sublimation}}$

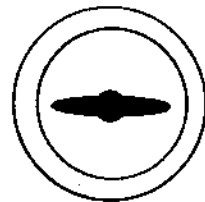


$R_{\text{in}} = 7.5''$



+ Disk:

$$F_{\nu}(\text{disk}) = \frac{1}{2} F_{\nu}(\text{envelope})$$



+ Disk

$$F_{\nu}(\text{disk}) = 2 F_{\nu}(\text{envelope})$$

$$L_* = 5000 L_{\odot}$$

$$n \propto R^{-1.5}$$