

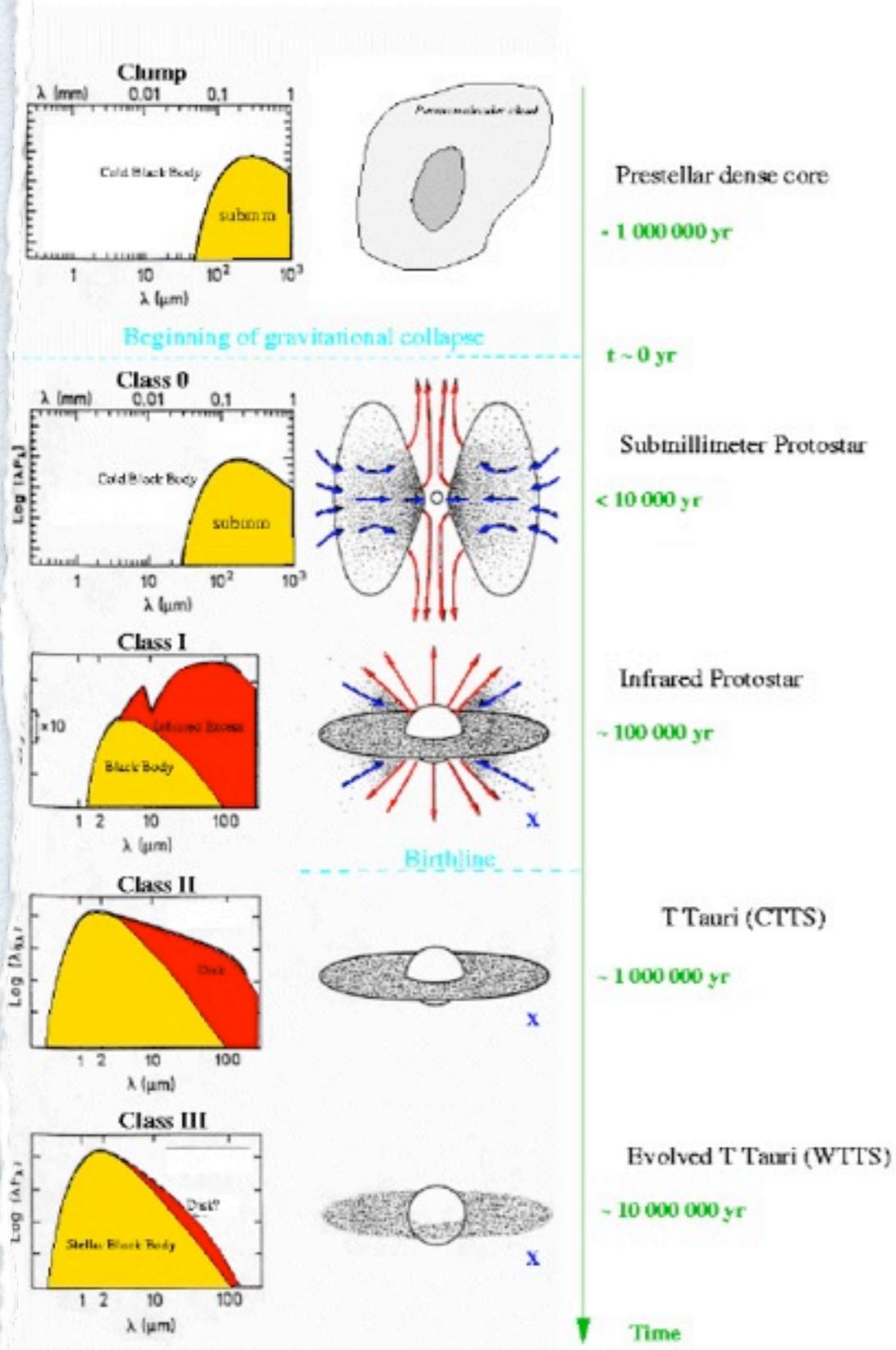




OH MY GOD, IT'S FULL OF
STARS

Infrared/Submillimeter Young Stellar Object Classification

(Lada 1987 + André, Ward-Thompson, Barsony 1993)



T Tauri phase

\sim Myrs

WTTS phase

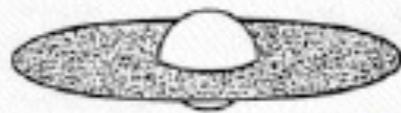
10-100 Myrs

T. LADA, BOSTON UNIVERSITY

T Tauri phase

T Tauri (CTTS)

~ 1 000 000 yr



Evolved T Tauri (WTTS)

~ 10 000 000 yr



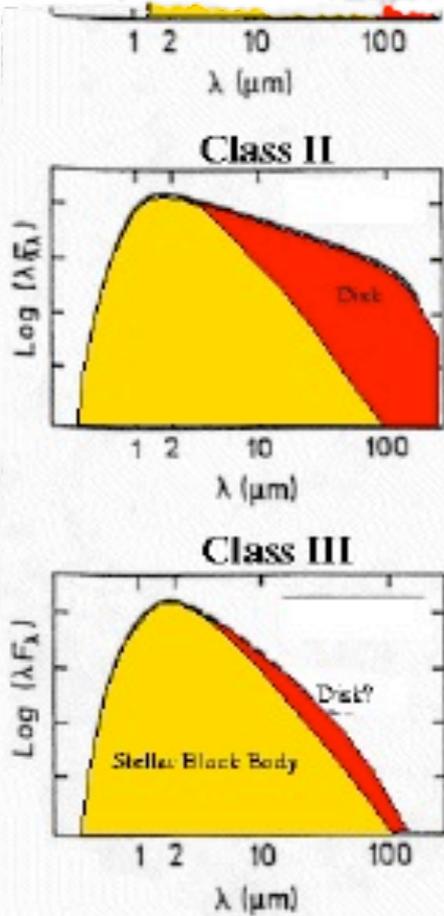
~ Myrs

WTTS phase

10-100 Myrs



ZAMS





In 1978,
Herbig
postulated the
existence of
Post-Tauri
population



Ramiro de la Reza

Carlos Torres

Germano Quast

Licio da Silva

In 1987, a list of **isolated T-Tauri** stars is published.



Ramiro de la Reza

Carlos Torres

Germano Quast

Licio da Silva

In 1987, a list of **isolated T-Tauri** stars is published.

Michael Sterzik



**Claudio
Melo**

Nuria Huelamo

**Ramiro de la
Reza**

Amelia Bayo



Isolated T-Tauri

V4046 Sgr
AS218
FK Ser
AB Dor
TWHya
CoD -27 11363

Post-T Tauri

V773 Tau
V410 Tau
HV Tau
FK Ser
AK Sco
...
TW Hya
CoD -27 11363
AS218
V4046 Sgr

TWHYA IS AN ASSOCIATION

THE ASTRONOMICAL JOURNAL

VOLUME 103, NUMBER 2

FEBRUARY 1992

A SEARCH FOR T TAURI STARS BASED ON THE *IRAS* POINT SOURCE CATALOG. I.

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Received 28 June 1991; revised 24 September 1991

ABSTRACT

One of the main interests of an unbiased survey over a large part of the sky like this one lies in the possibility of finding TTS outside the known sites of star formation. In this respect, we have revealed the probable TTS nature of Hen 1 (No. 1), which would be the TTS with the highest galactic latitude ($b = 59^\circ$) known, situated far from any molecular cloud. Other new relatively isolated TTS are No. 70 (Cod-40 8434) and No. 101 (BZ Sgr). On the other hand, we have found several TTS around TW Hya, which was considered as the prototype of isolated TTS. The cases of Cod-298887 (No. 45) and Hen 600 (Nos. 50a and 50b) have already been discussed by de la Reza *et al.* (1989). The new TTS in this region are HD 98800 (No. 54) and Cod-337795 (No. 55). With the exception of HD 98800, which is distant about 10° from TW Hya, the other stars are situated within about 6° . This result seems to exclude the hypothesis of TW Hya being a "runaway" star, and indicates that a T associ-

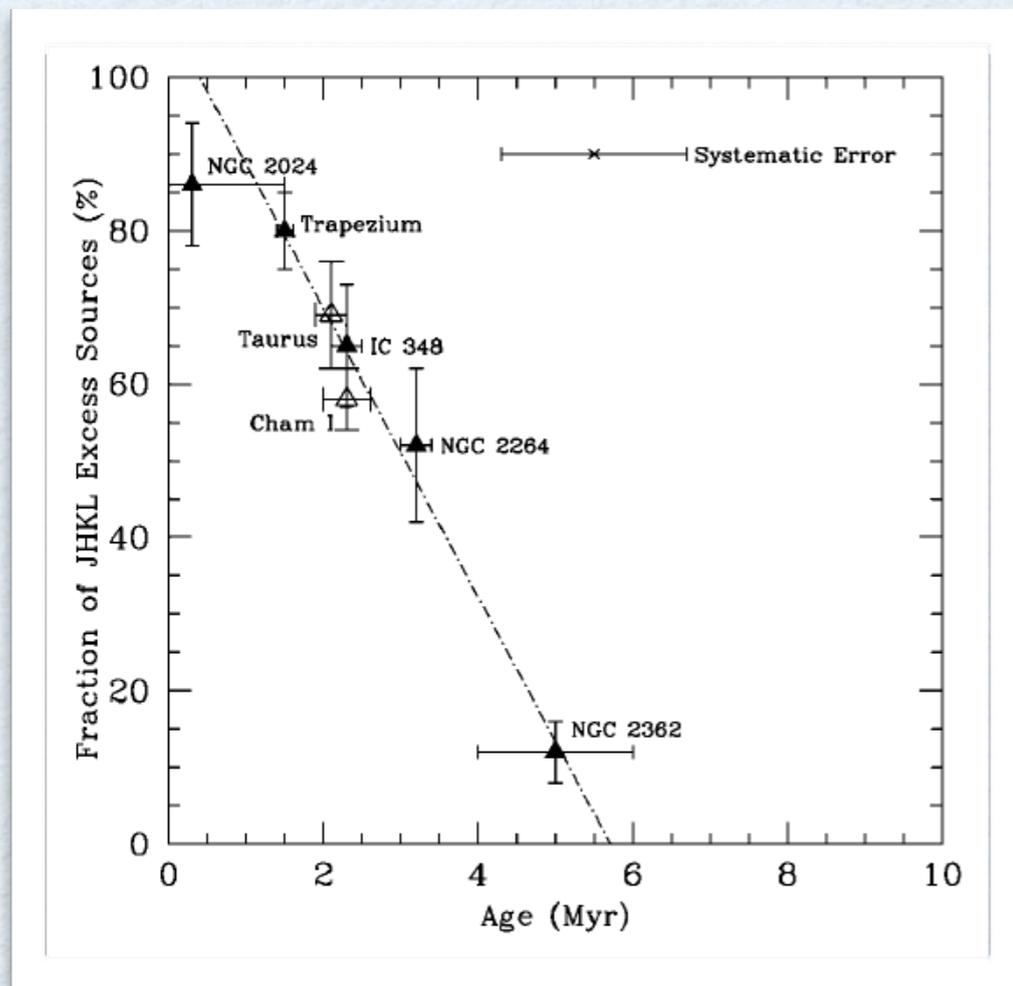
ation probably existed in that direction and is now being dissipated; the remnants of the parent molecular cloud have possibly been dispersed in the form of diffuse clouds, which are difficult to observe.

In addition to the TTS, we have identified with high probability 24 new Herbig Ae/Be stars. Although the presence of $H\alpha$ emission was known for many of them, their pre-main sequence nature is indicated by their *IRAS* colors, which are different from those of classical Be stars. This result is consistent with the fact that the Herbig Ae/Be stars constitute the extension of the TTS class to early types. Since the catalog of Herbig Ae/Be stars and Herbig Ae/Be star candidates of Finkenzeller & Mundt (1984) contains 57 objects, if our results are confirmed this would represent a substantial increase of this number.

Concerning the by-products of our search, we remark that serendipitously we have detected, with a relatively high effi-

PDS - Pico dos dias SURVEY

First trial to find associations around isolated T Tauri stars based on IRAS fluxes



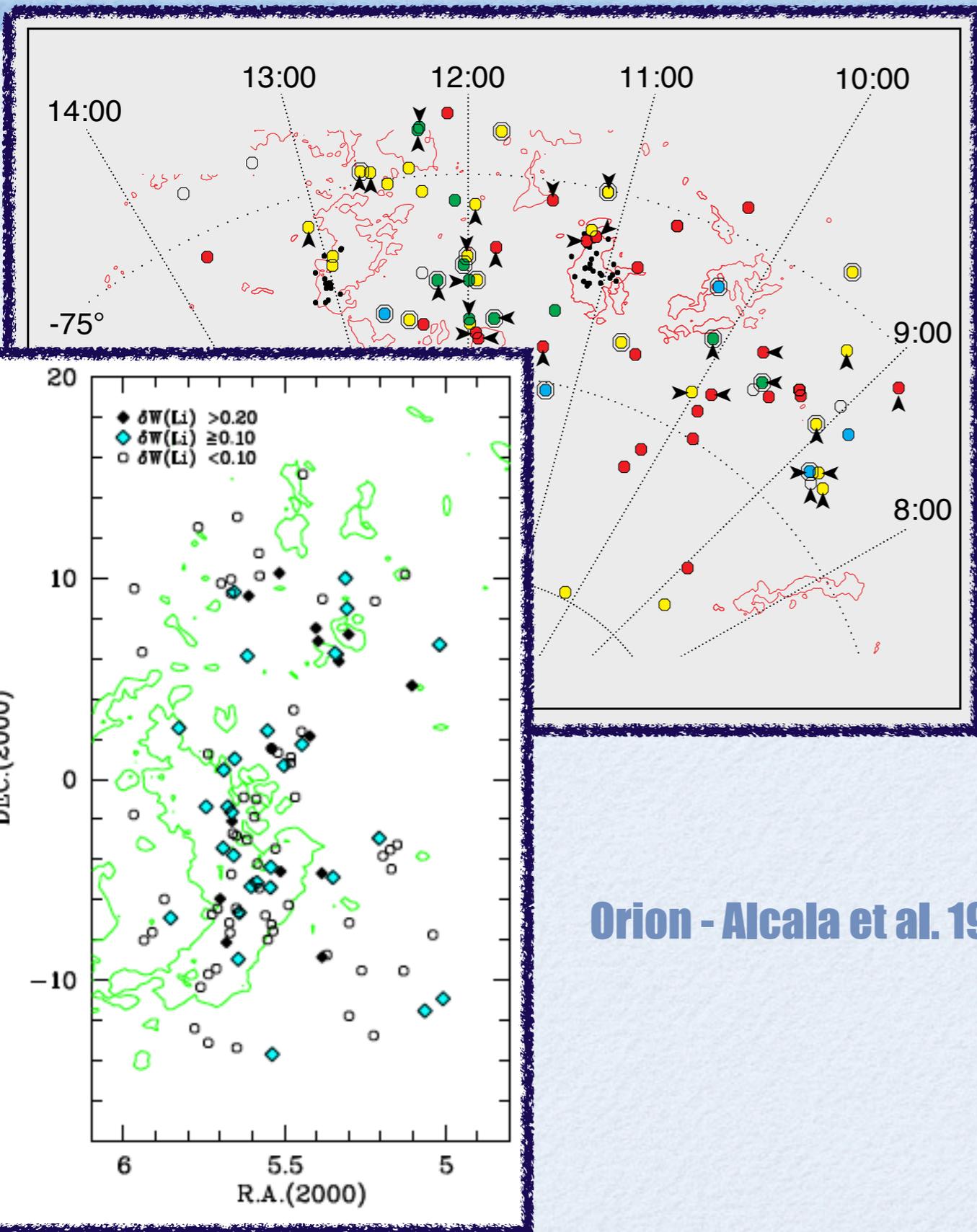
Disks are **short-lived**.

THEN ROSAT CAME...



THEN ROSAT CAME...

Lupus - Alcala et al. 1997



Thousands of X-rays
sources

mixed ages

Not connected to
SFRs

Orion - Alcala et al. 1998

The first association

TUC-HOR

THE ASTRONOMICAL JOURNAL, 120: 1410–1425, 2000 September

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A NEW ASSOCIATION OF POST-T TAURI STARS NEAR THE SUN¹

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Received 1999 November 12; accepted 2000 May 18

ABSTRACT

Observing *ROSAT* sources in an area $20^\circ \times 25^\circ$ centered at the high-latitude ($b = -59^\circ$) active star ER Eri, we found evidences for a nearby association, that we call the Horologium association (HorA), formed by at least 10 very young stars, some of them being bona fide post-T Tauri stars. We suggest

THE ASTROPHYSICAL JOURNAL, 535:959–964, 2000 June 1

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IDENTIFICATION OF A NEARBY STELLAR ASSOCIATION IN THE *HIPPARCOS* CATALOG: IMPLICATIONS FOR RECENT, LOCAL STAR FORMATION

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Received 1999 July 6; accepted 2000 January 20

ABSTRACT

The TW Hydrae Association (~ 55 pc from Earth) is the nearest known region of recent star formation. Based primarily on the *Hipparcos* catalog, we have identified a group of nine or 10 comoving star systems at a common distance (~ 45 pc) from Earth that appear to comprise another somewhat older

F i n d i n g

A s s o c i a t i o n s



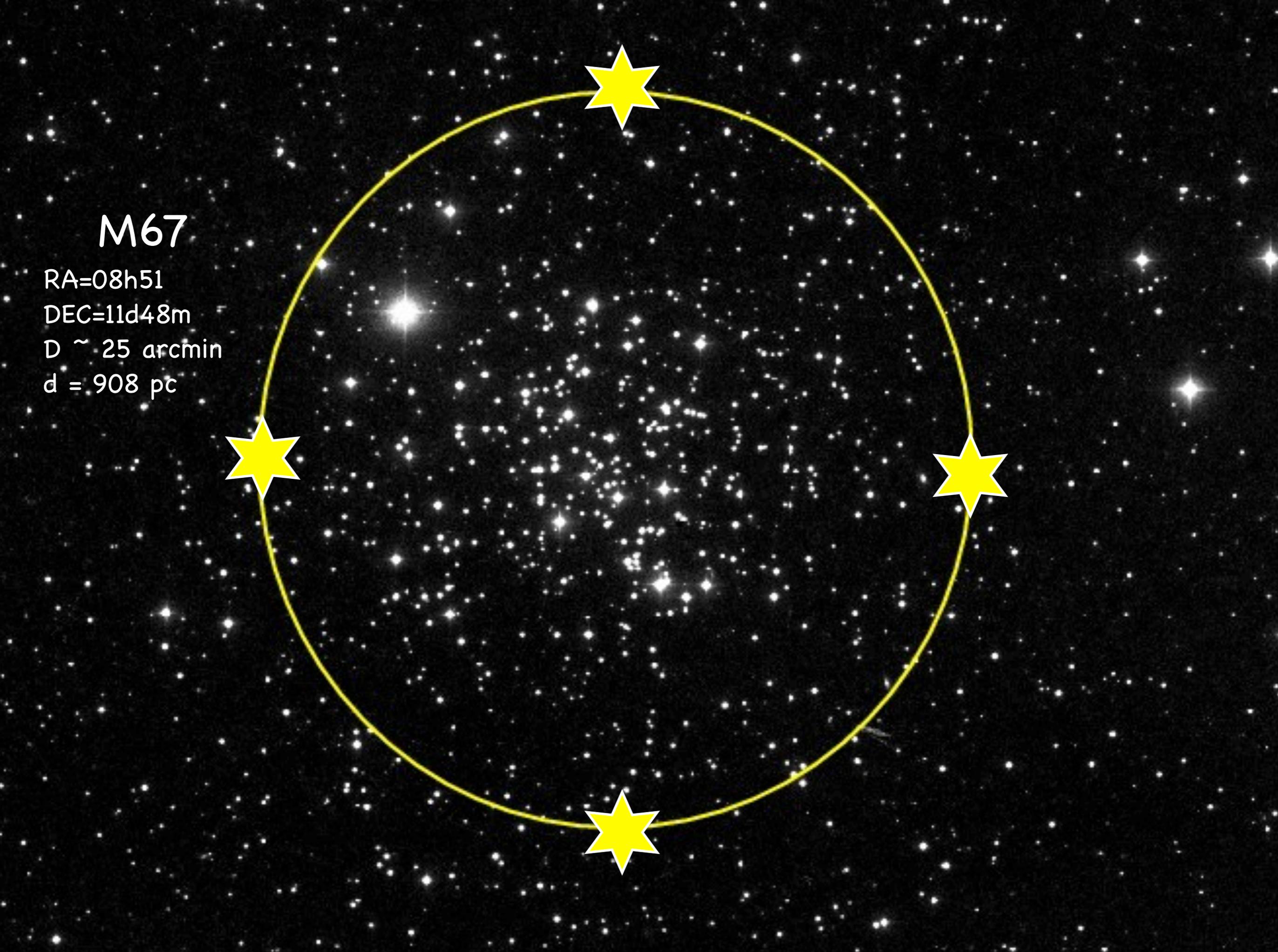
M67

RA=08h51

DEC=11d48m

D ~ 25 arcmin

d = 908 pc



What's the key then?

- The visual sensation of clustering (on-sky) is lost (proximity)
- But they do cluster in kinematics & spatially (UVW;XYZ-space) and evolutionary state (age)

SPACE MOTIONS

We need

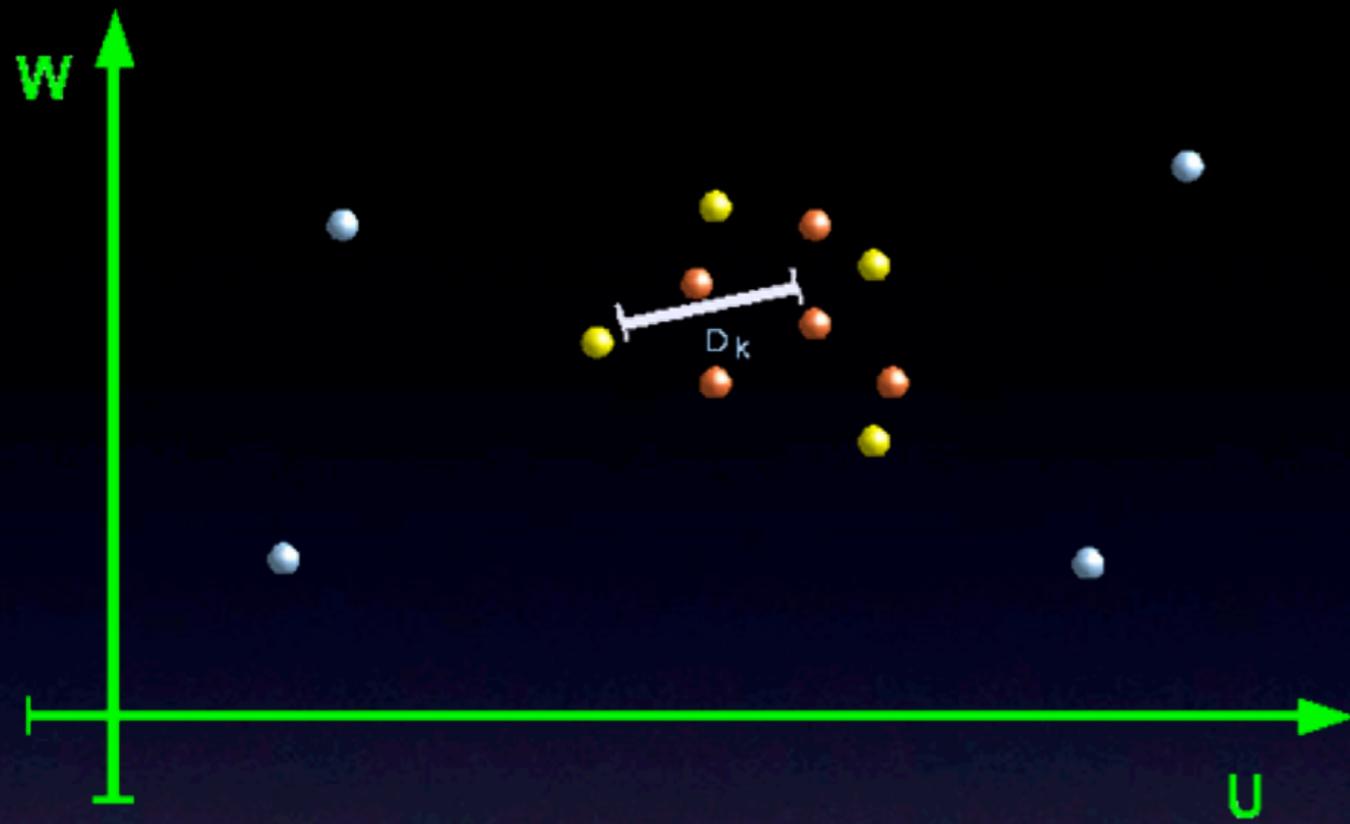
Proper Motions

Radial Velocities

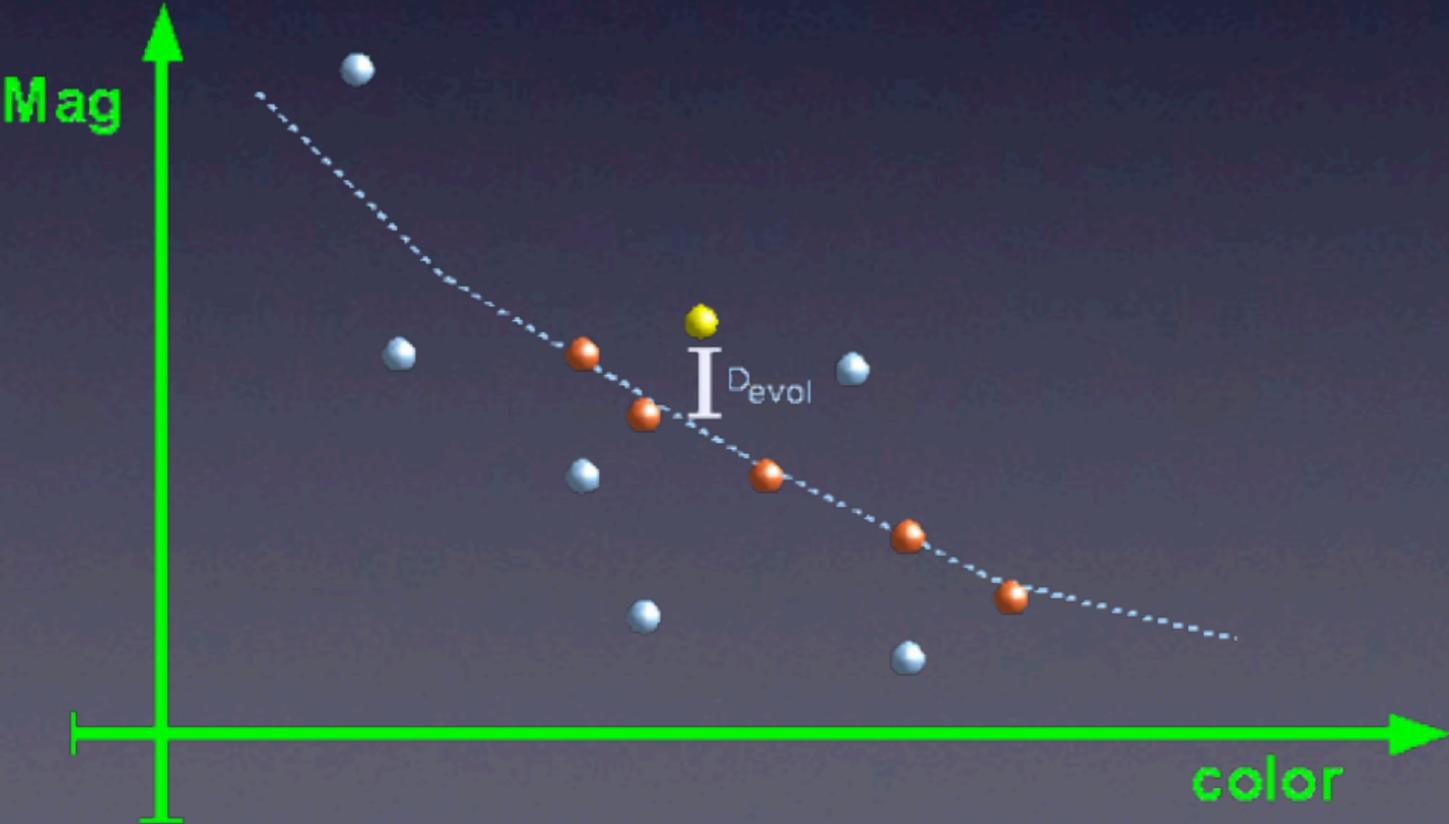
Distances







Look for the distance that minimizes the dispersion velocity...



...and gives the "right" age



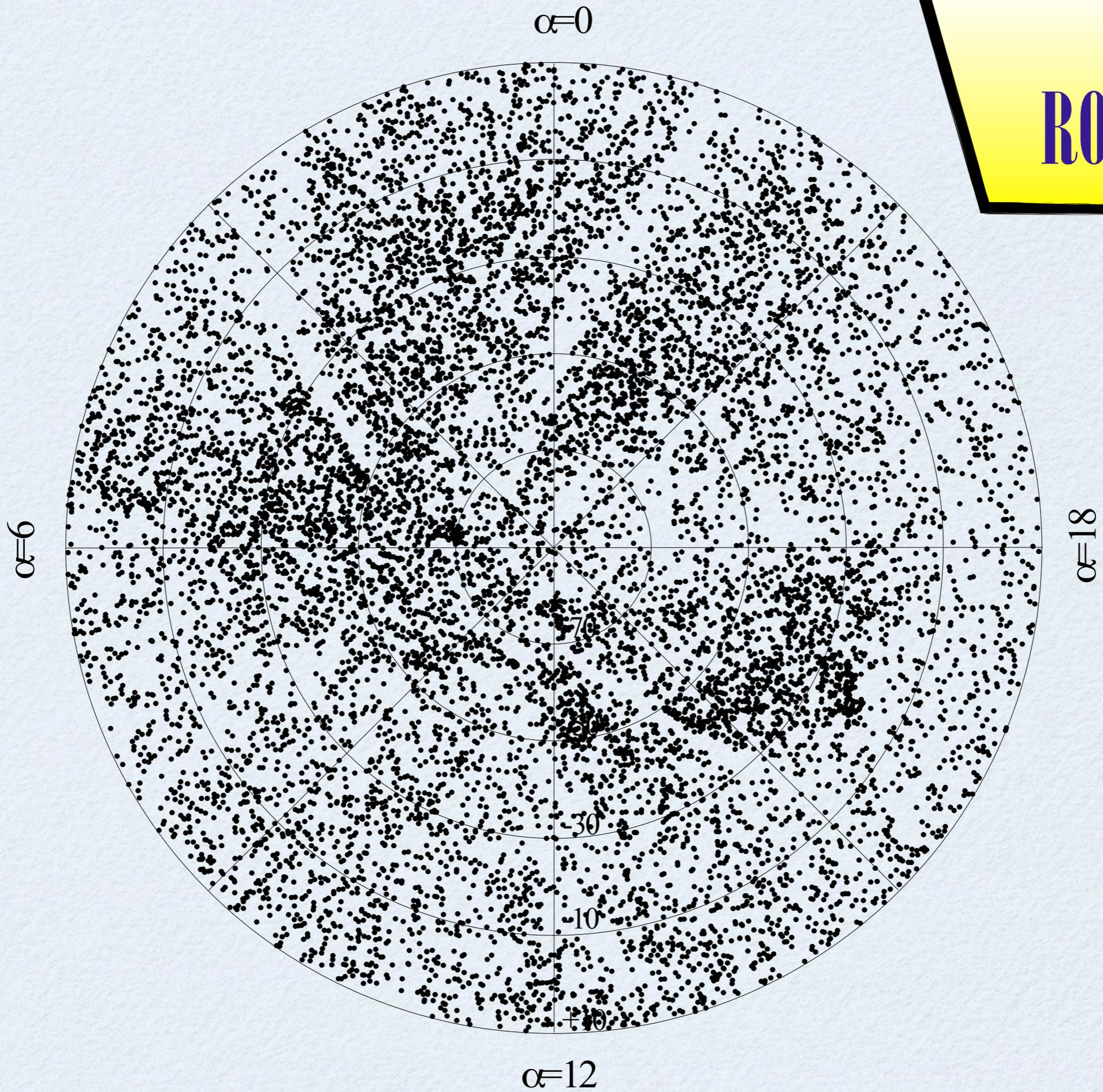


I'm sorry Dave. I'm afraid I can't do that.

Southern

ROSAT sources

9574



Giants	151	
Dwarfs	1802	
Young stars	631	55%
Pleiades age	394	19%
Old stars	777	0.4%

SACY

[Hip + TYC & (B-V) \geq 0.6

results

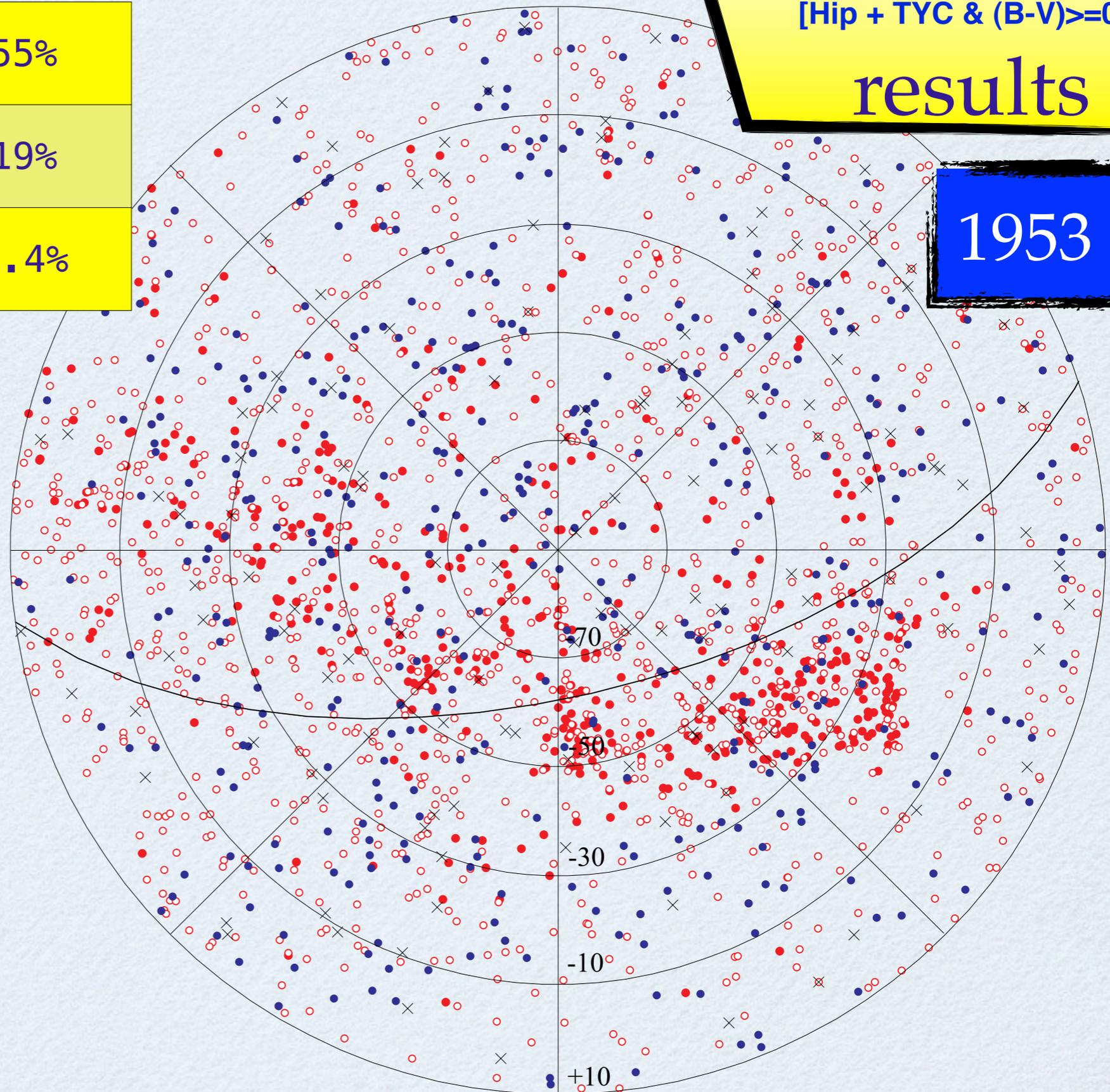
1953

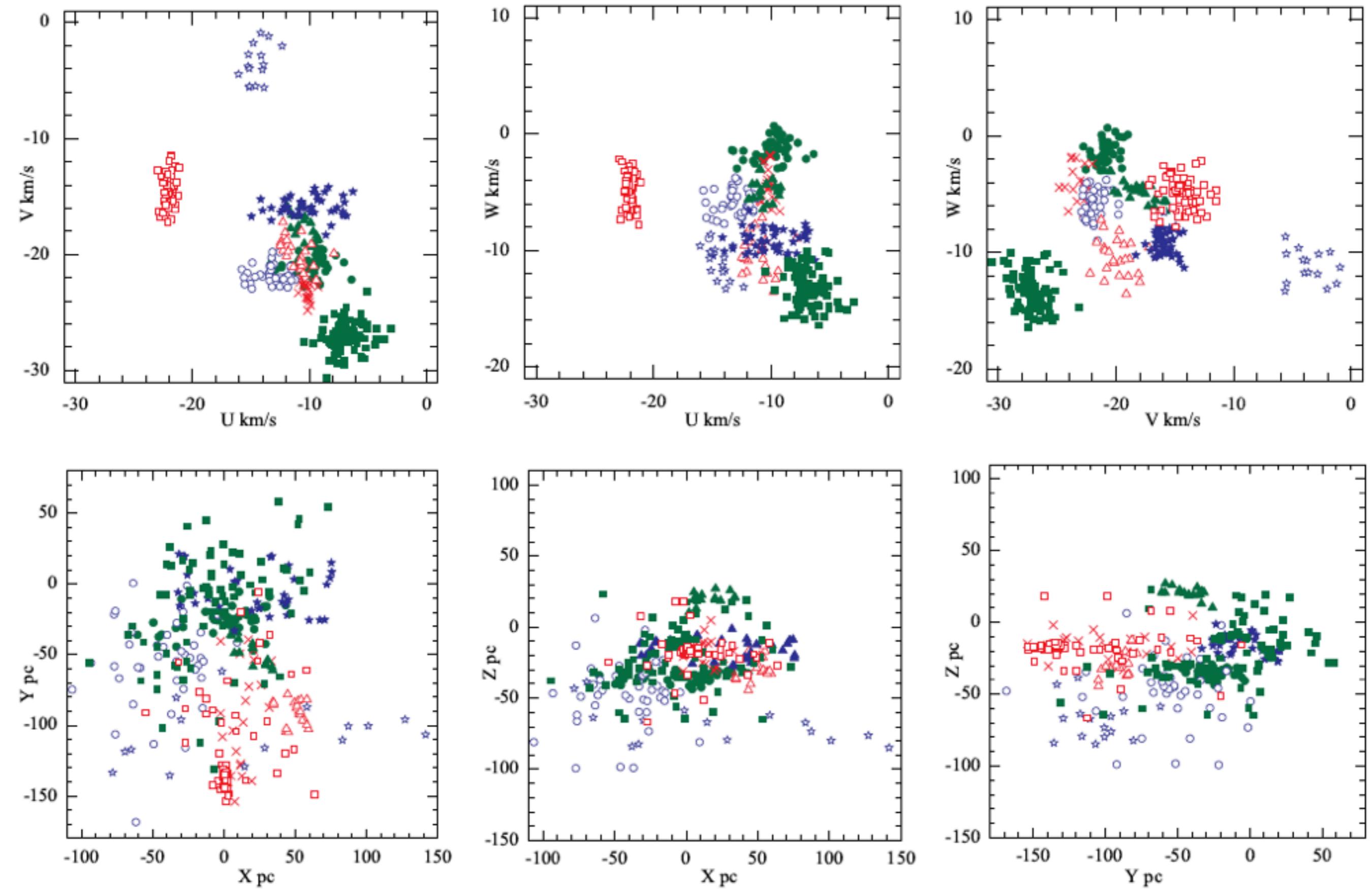
- Stars in Assoc
- Other young stars
- Old dwarfs
- × Giants

$\alpha=6$

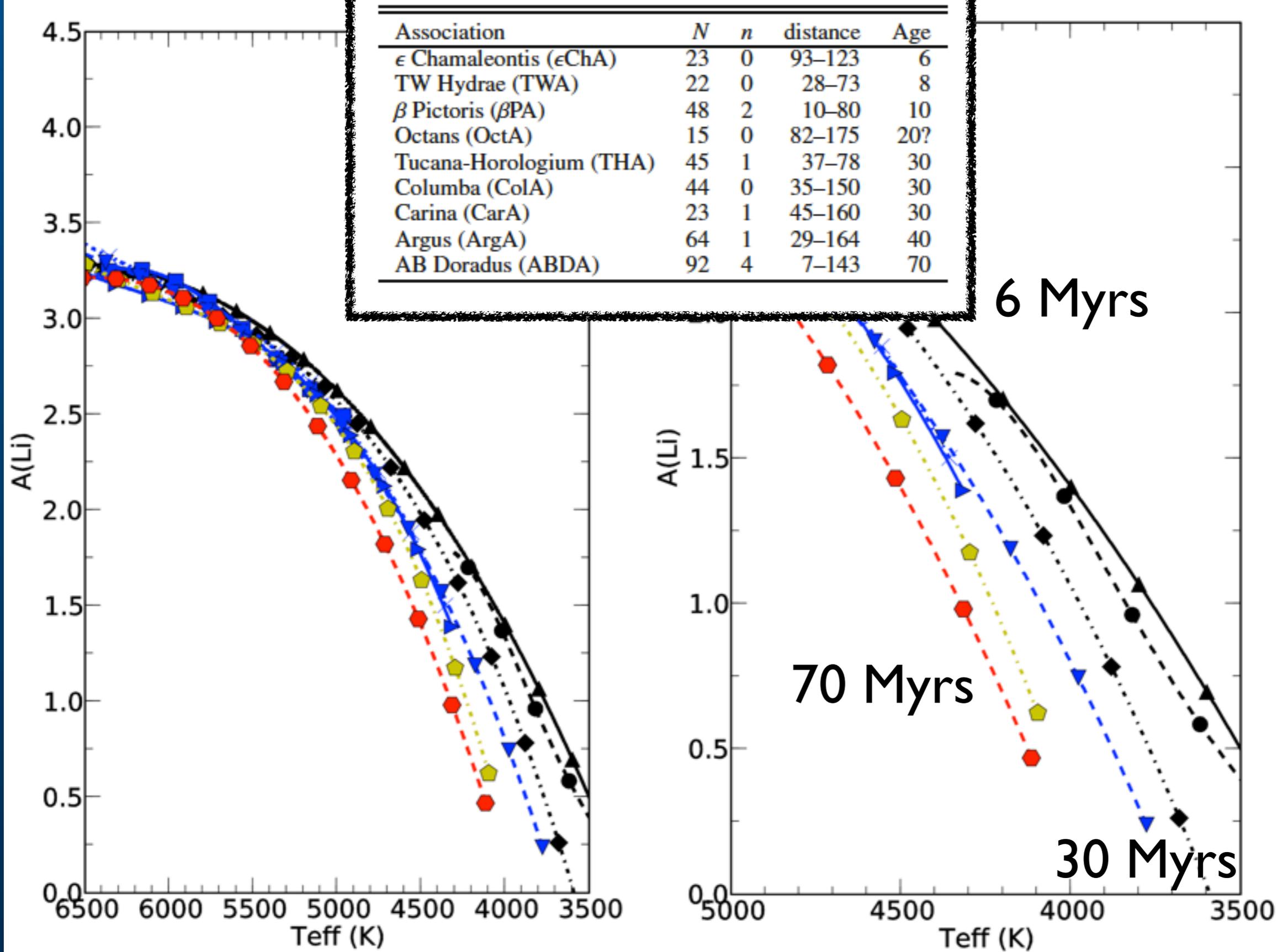
$\alpha=0$

$\alpha=18$





Torres et al. (2006, 2008)

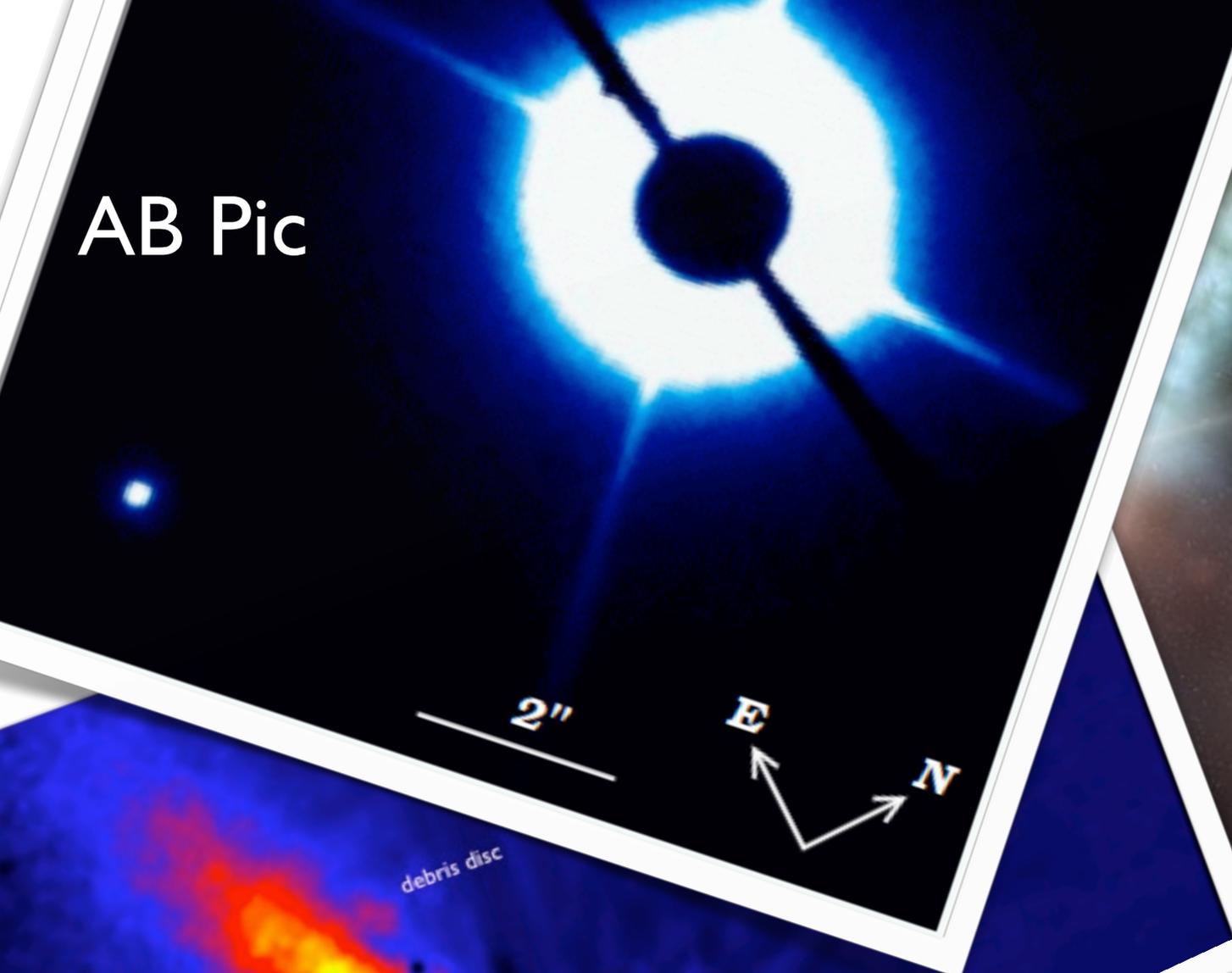


Kinematical and Ages of the SACY associations

assoc. Name	distance mas	U km/s	V km/s	W km/s	Num. mem.	age Myr	ΔM mag.
OctA	7.0/ 1.2	-14.3/ 1.0	-3.9/ 1.6	-10.7/ 1.1	17	10	-0.07 (0.35)
ARGA(+IC)	11.5/14.6	-21.9/ 0.3	-14.3/ 1.3	-4.8/ 1.2	64	30	0.02 (0.36)
ARGA-IC	16.3/20.8	-22.5/ 0.4	-14.5/ 1.5	-4.6/ 1.2	29	30	-0.01 (0.38)
IC 2391	7.3/ 0.4	-21.7/ 0.2	-14.3/ 1.1	-5.1/ 1.1	35	30	0.02 (0.35)
ABDA	29.0/22.5	-7.0/ 1.2	-27.2/ 1.0	-13.6/ 1.6	91	40	0.02 (0.41)
ASYA	24.8/11.9	-15.0/ 1.2	-26.9/ 0.9	-2.3/ 1.5	30	50	0.02 (0.34)
GAYA complex							
THA	20.3/ 3.6	-9.5/ 0.8	-20.8/ 0.9	-1.3/ 0.9	57	20	0.01 (0.32)
CarA	12.9/ 7.1	-11.2/ 0.6	-22.7/ 1.2	-3.4/ 1.1	49	20	-0.02 (0.38)
ColA	14.4/ 5.1	-12.3/ 0.9	-21.8/ 1.0	-5.7/ 1.0	72	20	0.05 (0.35)
related with Sco-Cen?							
ChaI/II	6.6/ 0.8	-7.1/ 1.5	-18.8/ 1.7	-8.8/ 1.8	24	5	0.13 (0.45)
ϵ ChaA	9.5/ 0.8	-11.1/ 0.8	-20.0/ 1.4	-10.4/ 1.3	28	6	-0.02 (0.34)
TWA	19.1/ 4.8	-11.4/ 0.7	-18.8/ 1.5	-5.6/ 1.0	27	8	-0.06 (0.35)
β PicA	30.5/21.0	-10.0/ 1.2	-16.0/ 0.8	-9.1/ 0.9	57	10	0.03 (0.36)
Sco-Cen complex							
LCC	11.4/ 1.8	-5.0/ 0.7	-19.1/ 1.1	-4.1/ 1.4	51	20	0.01 (0.34)
UCL	10.1/ 2.2	-2.7/ 1.2	-16.6/ 0.7	-3.5/ 1.1	92	20	0.02 (0.48)
US	9.0/ 1.6	-5.4/ 0.9	-18.1/ 0.5	-4.4/ 1.3	39	10	-0.02 (0.36)
CrA ext.	8.0/ 0.7	-3.7/ 1.1	-14.4/ 1.3	-7.0/ 1.7	18	8	0.07 (0.29)
Lupus	7.0/ 1.0	-6.1/ 1.3	-16.4/ 0.6	-7.7/ 1.1	12	6	0.07 (0.37)
ρ Oph ext.	7.1/ 0.9	-4.9/ 1.4	-15.7/ 0.9	-7.7/ 1.5	35	5	0.06 (0.29)

app*L*íCaTIons

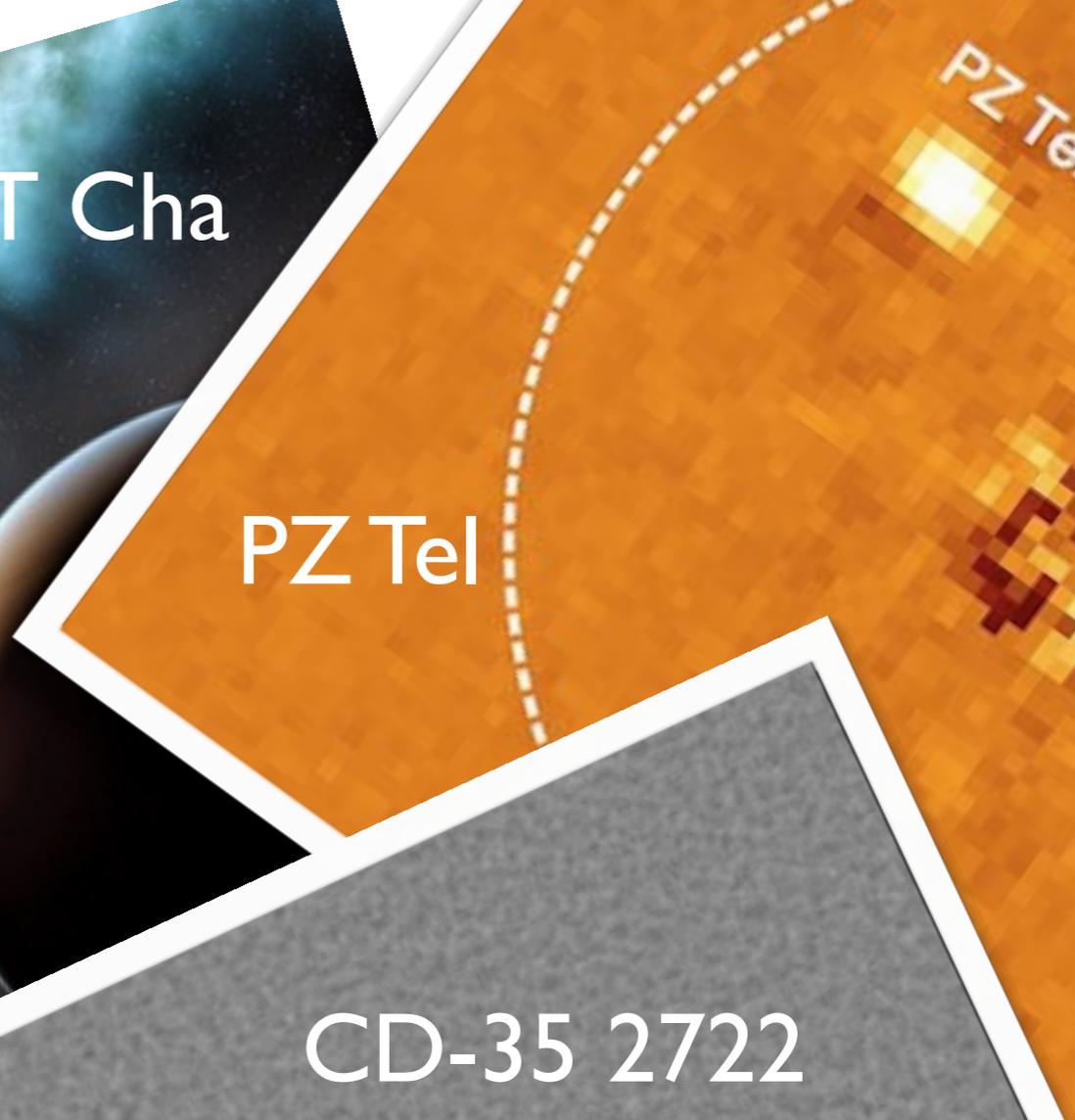
AB Pic



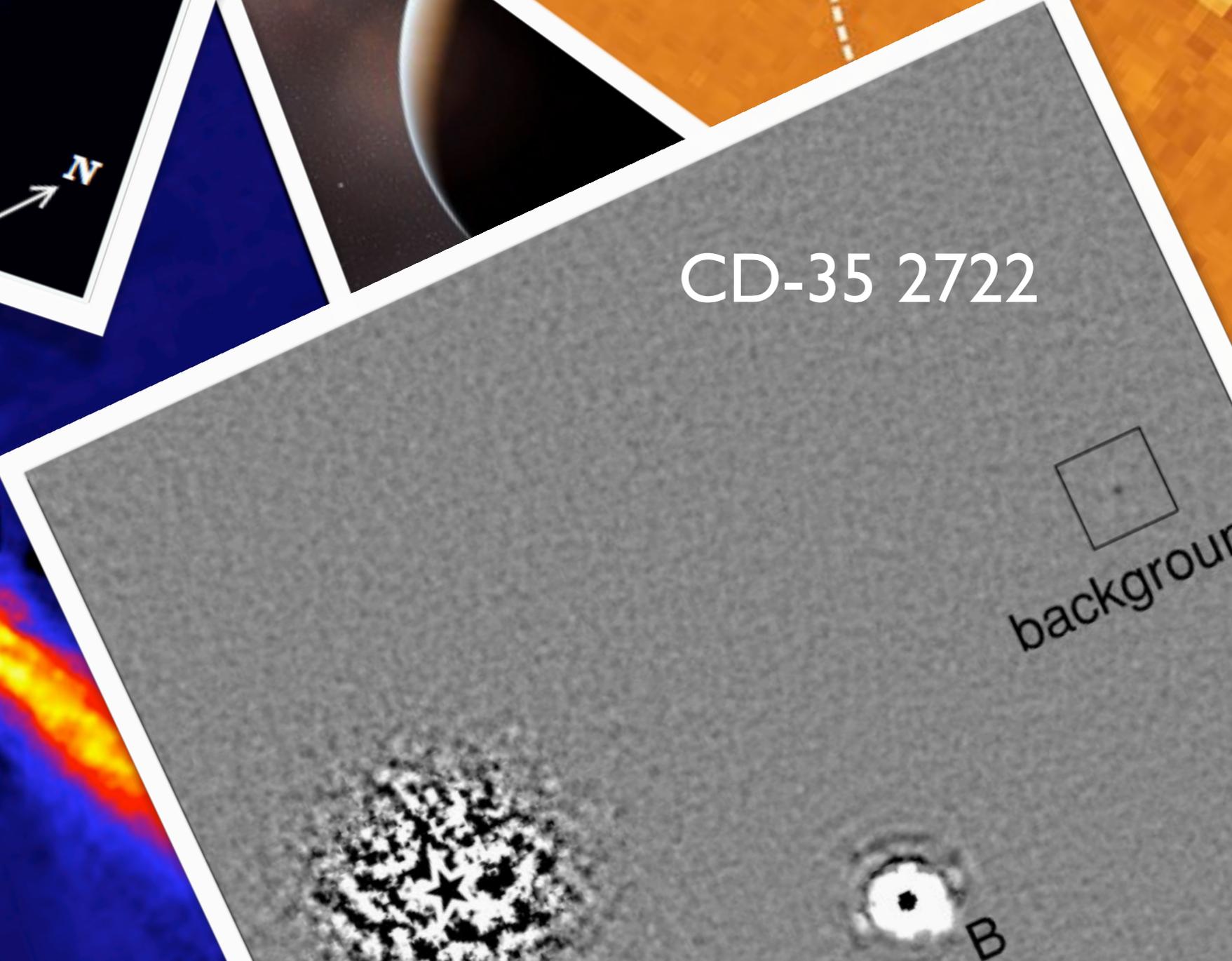
T Cha



PZ Tel



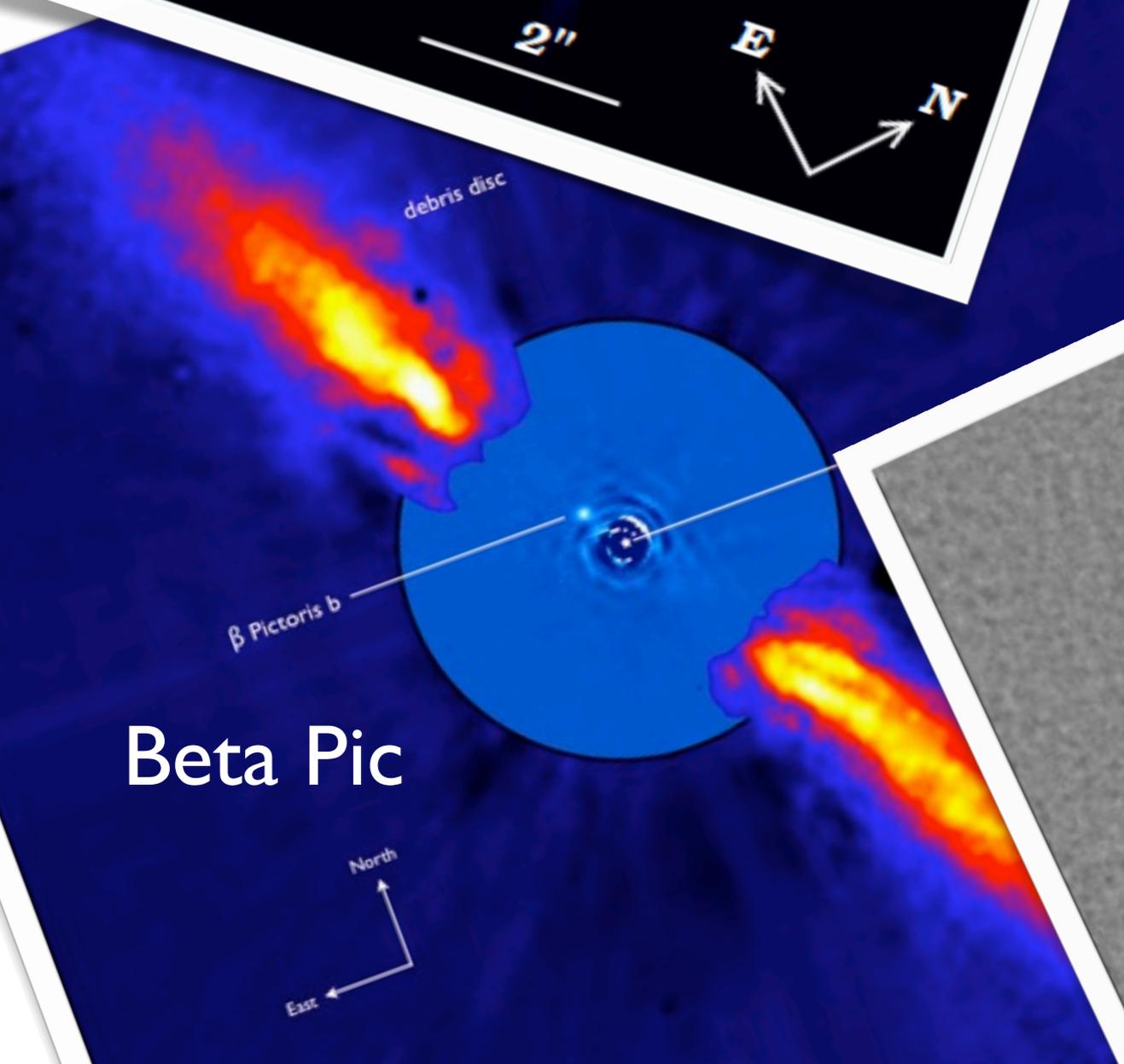
CD-35 2722



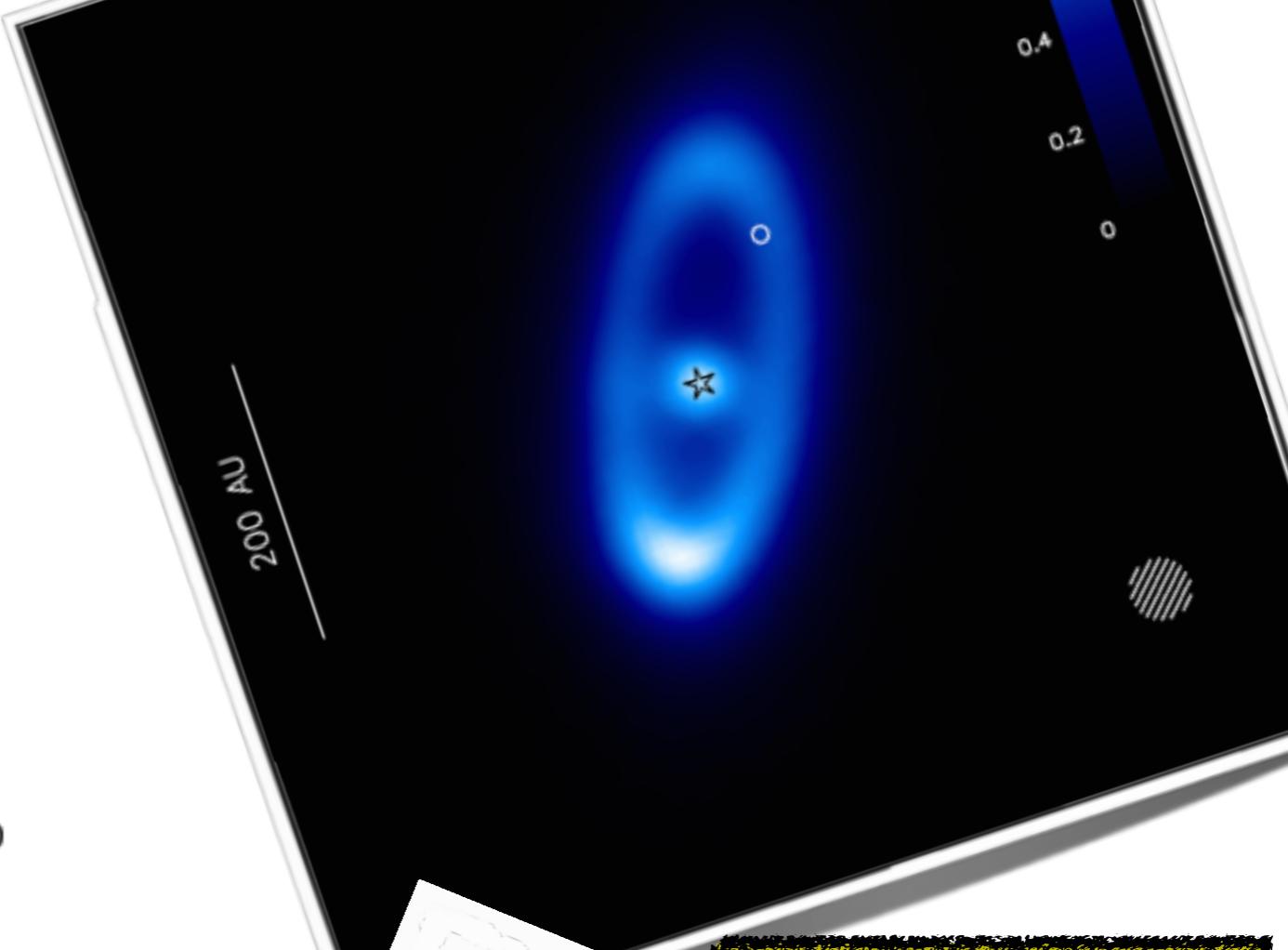
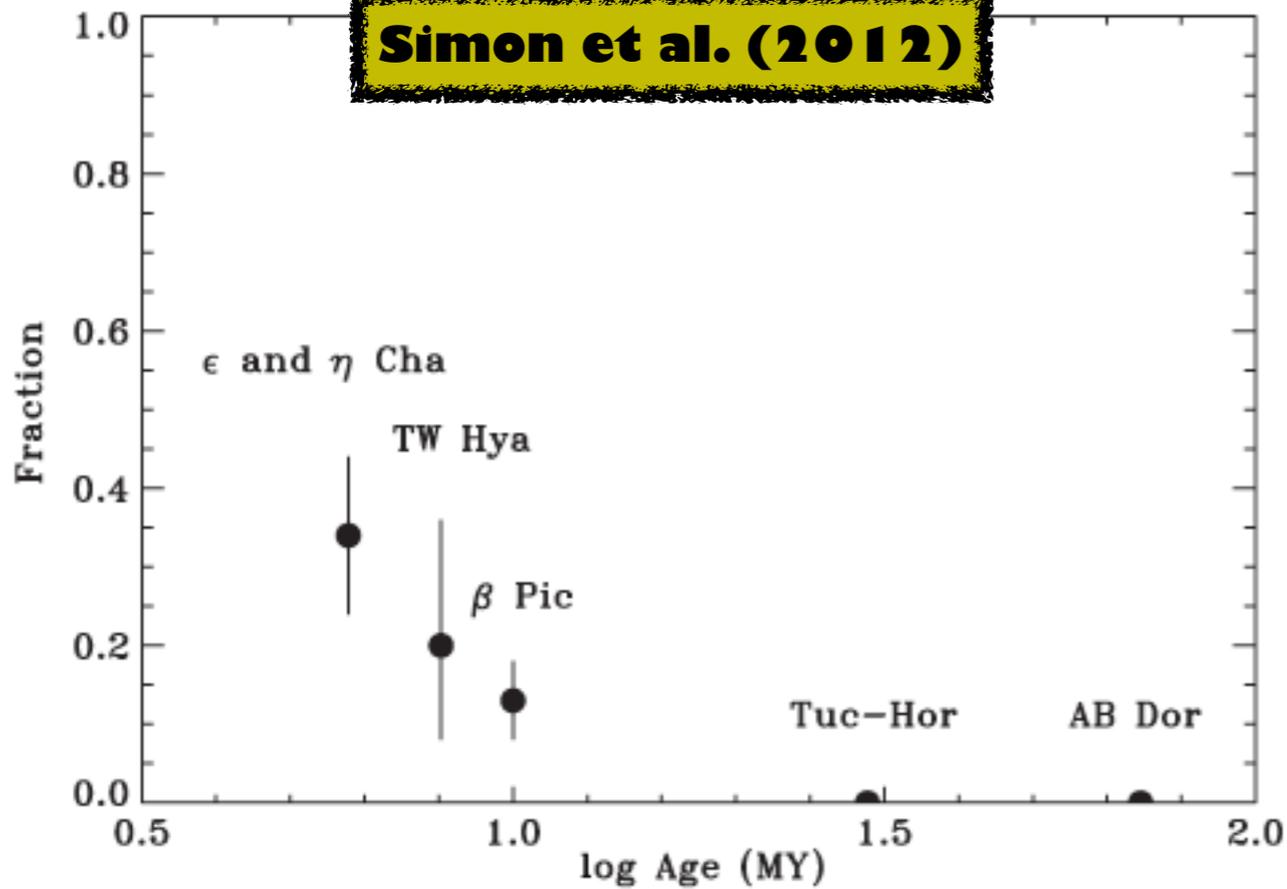
debris disc

β Pictoris b

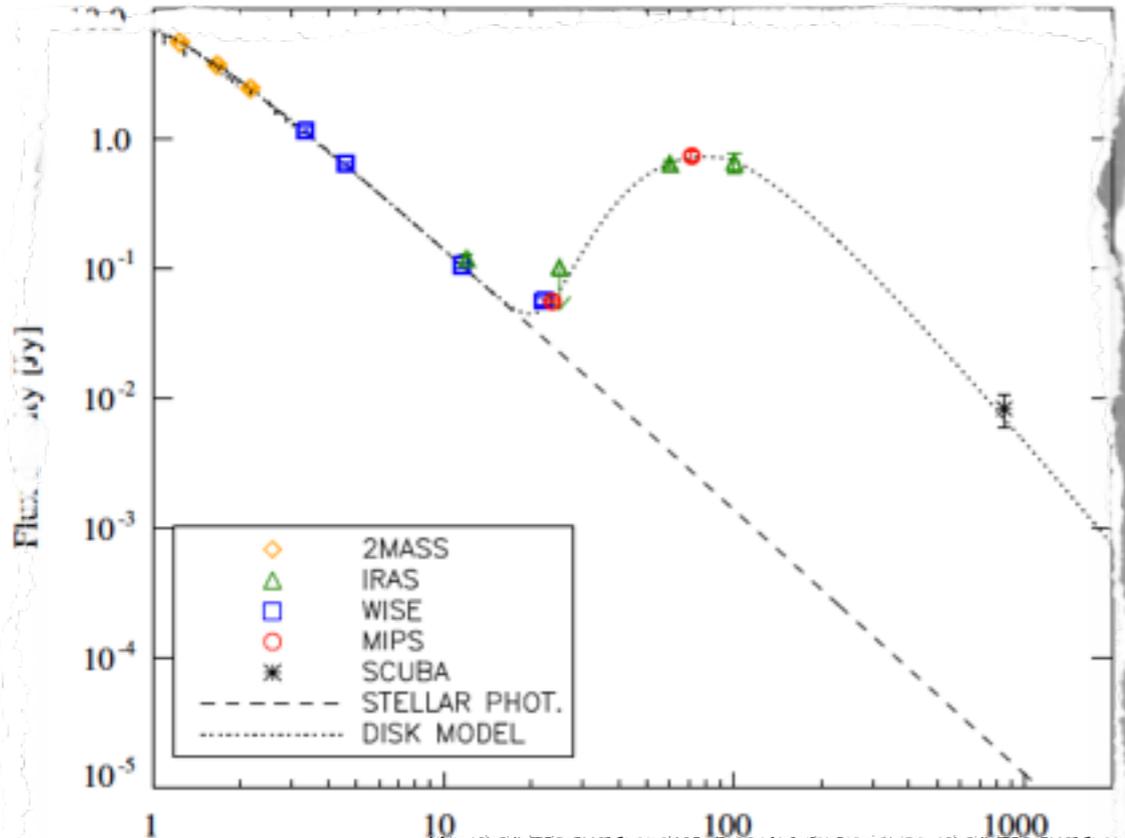
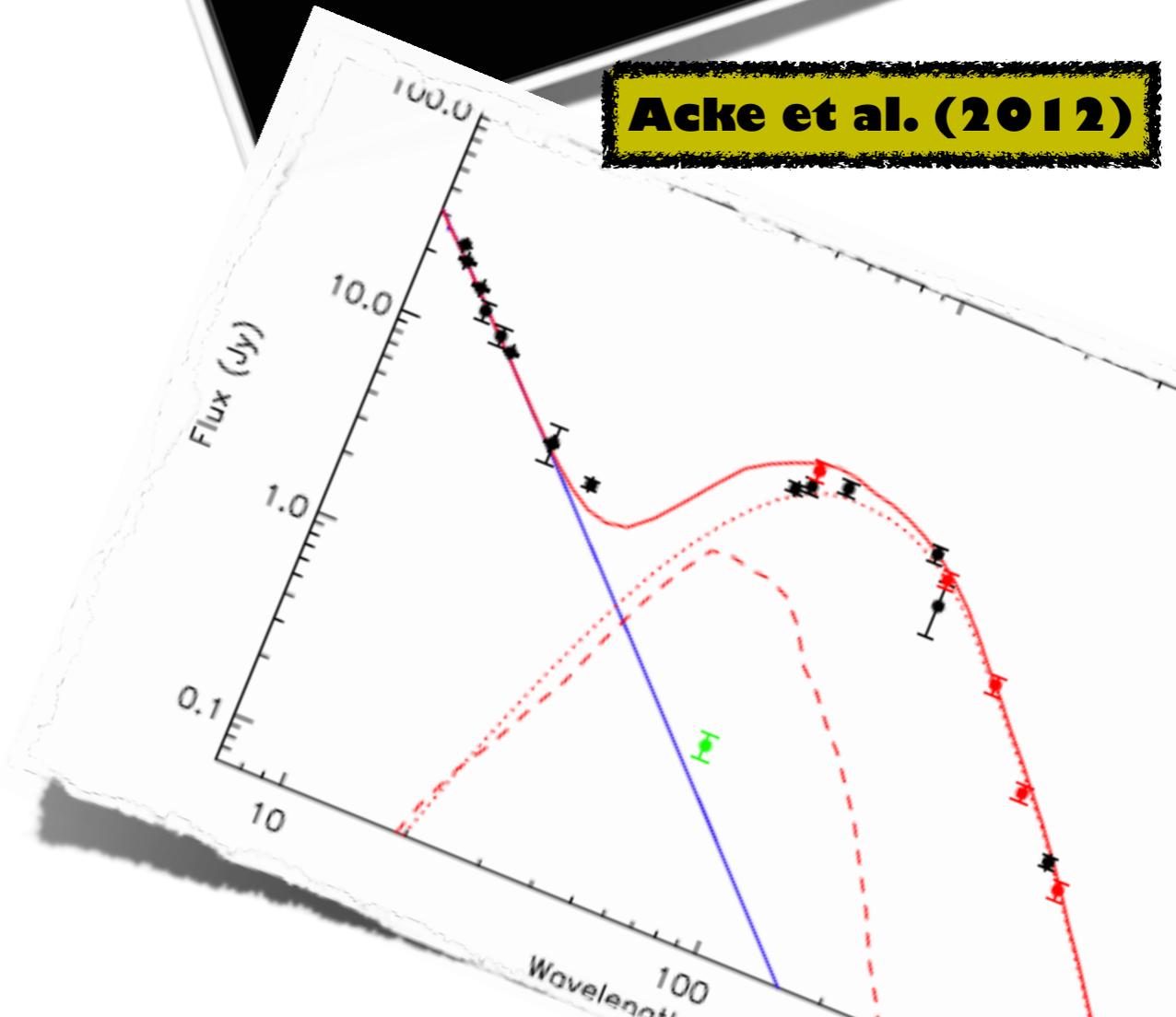
Beta Pic



Simon et al. (2012)



Acke et al. (2012)



HD 21997 - Moor et al. (2011)





OH MY GOD, IT'S FULL OF
(YOUNG) STARS