Non- solar scaled models *vs* observations for planet host stars

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A&A 427, 607–612 (2004)
DOI: 10.1051/0004-6361:20041141

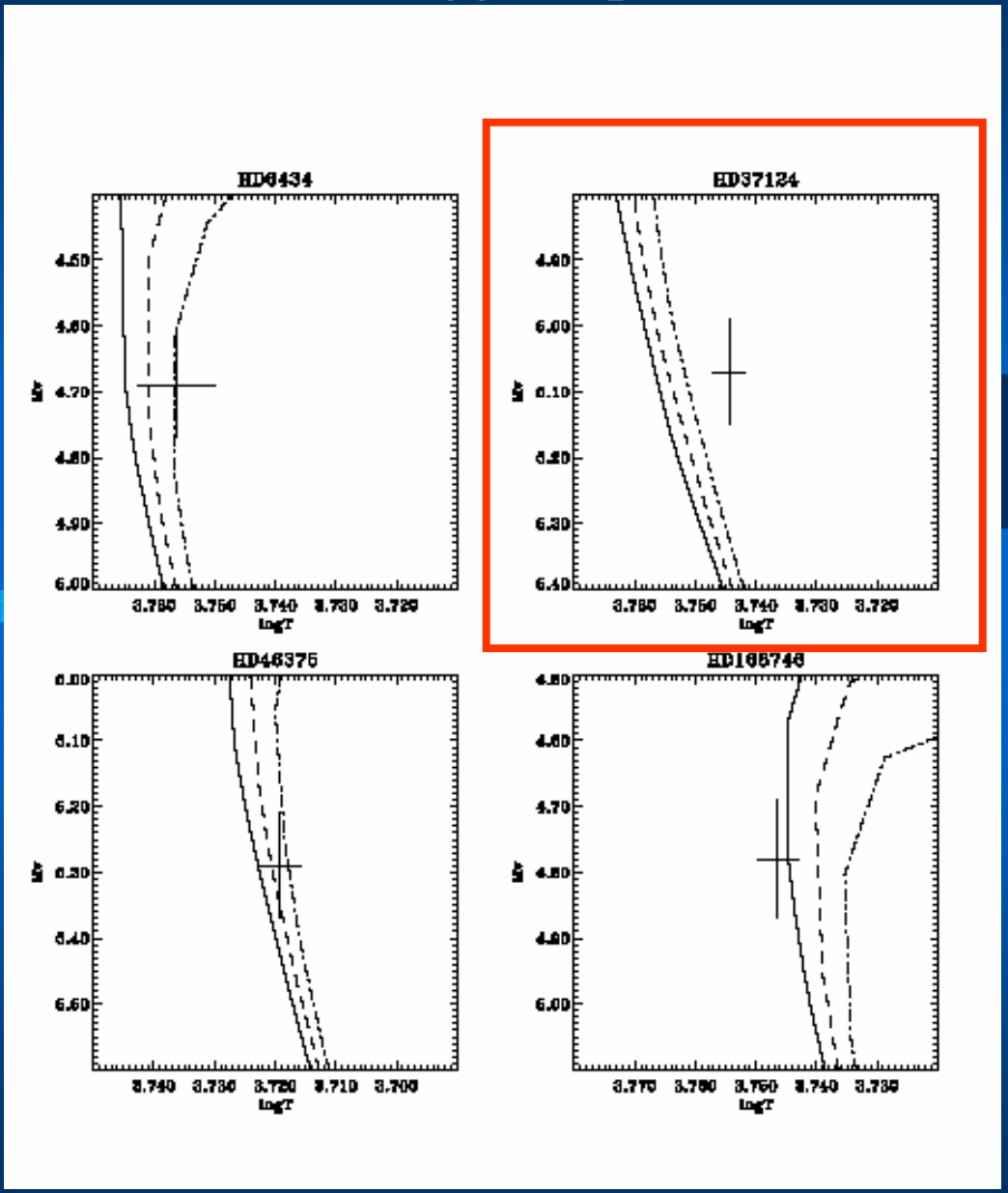
Astronomy & Astrophysics

Detailed theoretical models for extra-solar planet-host stars

The "red stragglers" HD 37124 and HD 46375

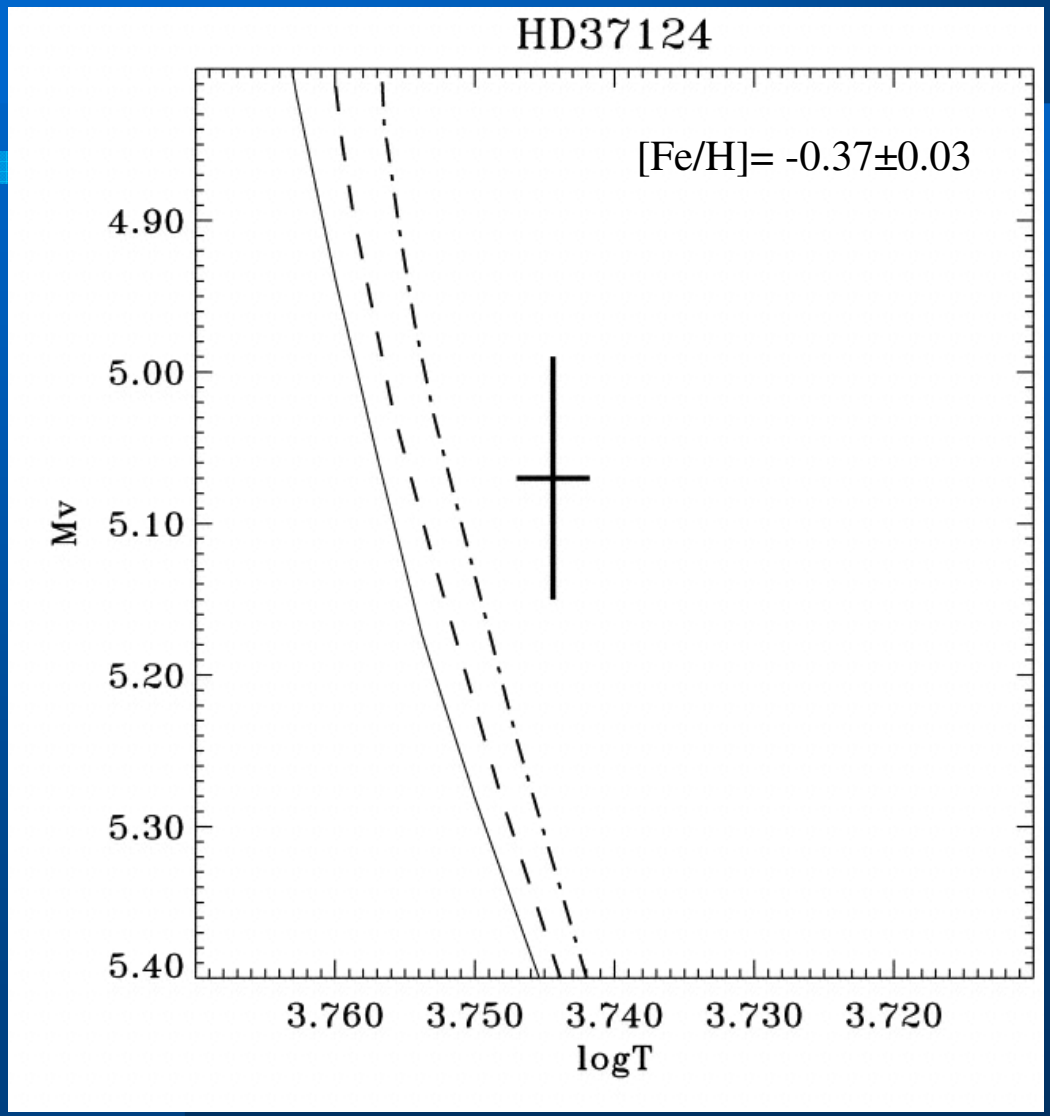
J. Fernandes[1,2] and N. C. Santos[3,4]

“Red-Stranggler” planet host stars



Laws, C., Gonzalez, G., Walker, K. M., et al. 2003, AJ, 125, 2664

"Red-Stranggler" planet host star



Padova models (Salanish etal. 2000) for [Fe/H] = -0.38

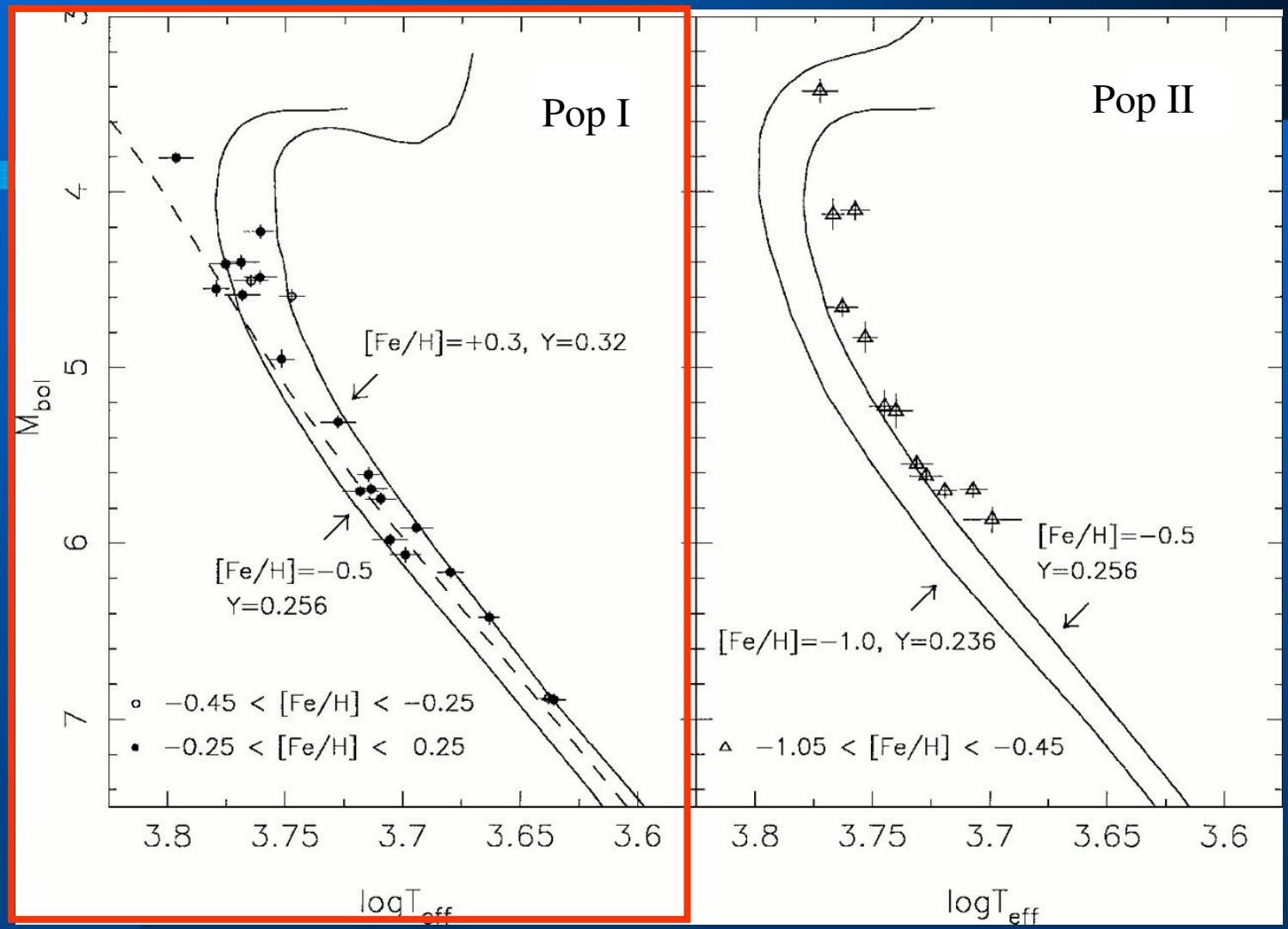
14.1 Gg

15.8 Gg

17.8 Gg

Laws et al (2003)

Hipparcos + Fbol (Alonso et al 1997)



Field stars

Lebreton et al (1999)

Helium abundance scaled to metals:

$$Y = (\Delta Y/\Delta Z)\, Z + \ldots$$

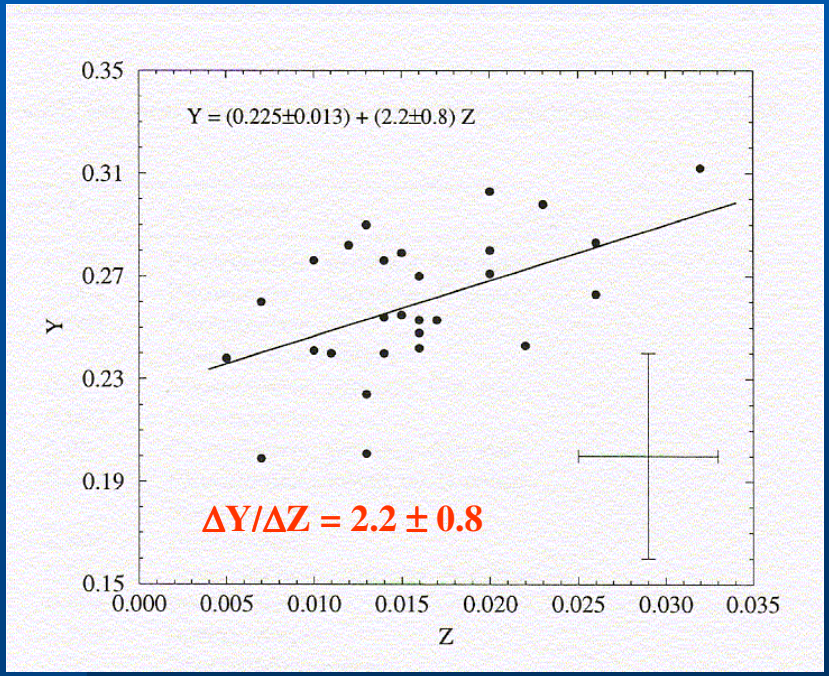
$(\Delta Y/\Delta Z)_{SUN} \sim \ldots$-2.5

Fixed mixing length parameter :

$$l = \alpha H_P$$

$\alpha_{SUN} \sim 1.\ldots$-1.7

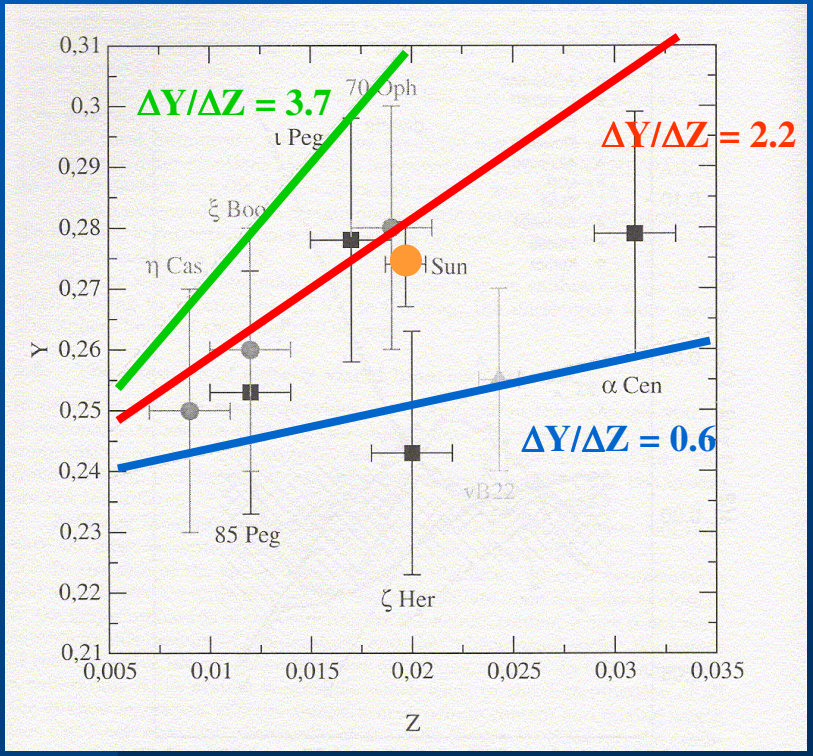
Helium abundance ($\Delta Y/\Delta Z$)



28 Detached double-lined eclipsing binaries

Ribas et al. 2000 (Granada models)

Helium abundance (ΔY/ΔZ)



7 visual binary stars + 1 sp. binary + Sun

Baglin 2002 (CESAM)

Helium abundance ($\Delta Y/\Delta Z$)

- **Hyades**: 1.2 ± 1.0

(Lebreton et al. 2001; Pinsonneault et al. 2003)

- **HII regions**: 2 ± 1 (eg. Izotov & Thuan 1998)
- **Nearby FGK stars**: 3 ± 2

(Pagel & Portinari 1998; Castellani et al. 2000)

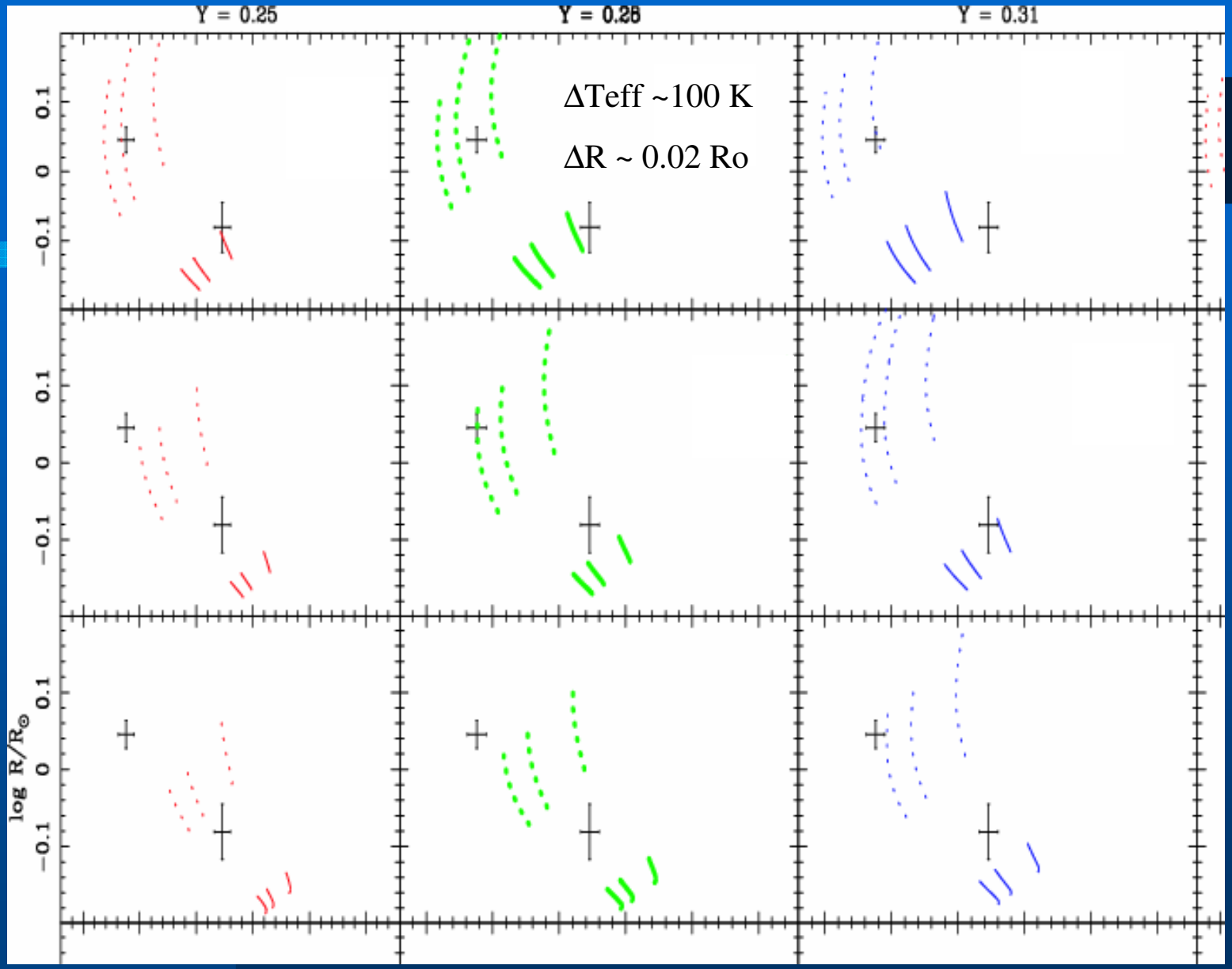
- **GC ω Centauri**: 100 (2nd pop. Noris 2004)

Mixing length parameter

- α Centauri (1.1Mo + 0.9Mo): $\alpha B - \alpha A \sim 0.1/0.2$

(Morel et al. 2000, Eggenberger et al. 2004. See also Montalban, this WS)

- PMS *versus* MS: 1.0 *versus* 1.9 (Hillenbrand and Russel 2004)
- Hyades: from 1.2 (cool) to 1.8 (hot) (Lebreton et al. 2001)
- Simulations: from hot to cool (Ludwig et al. 1999)

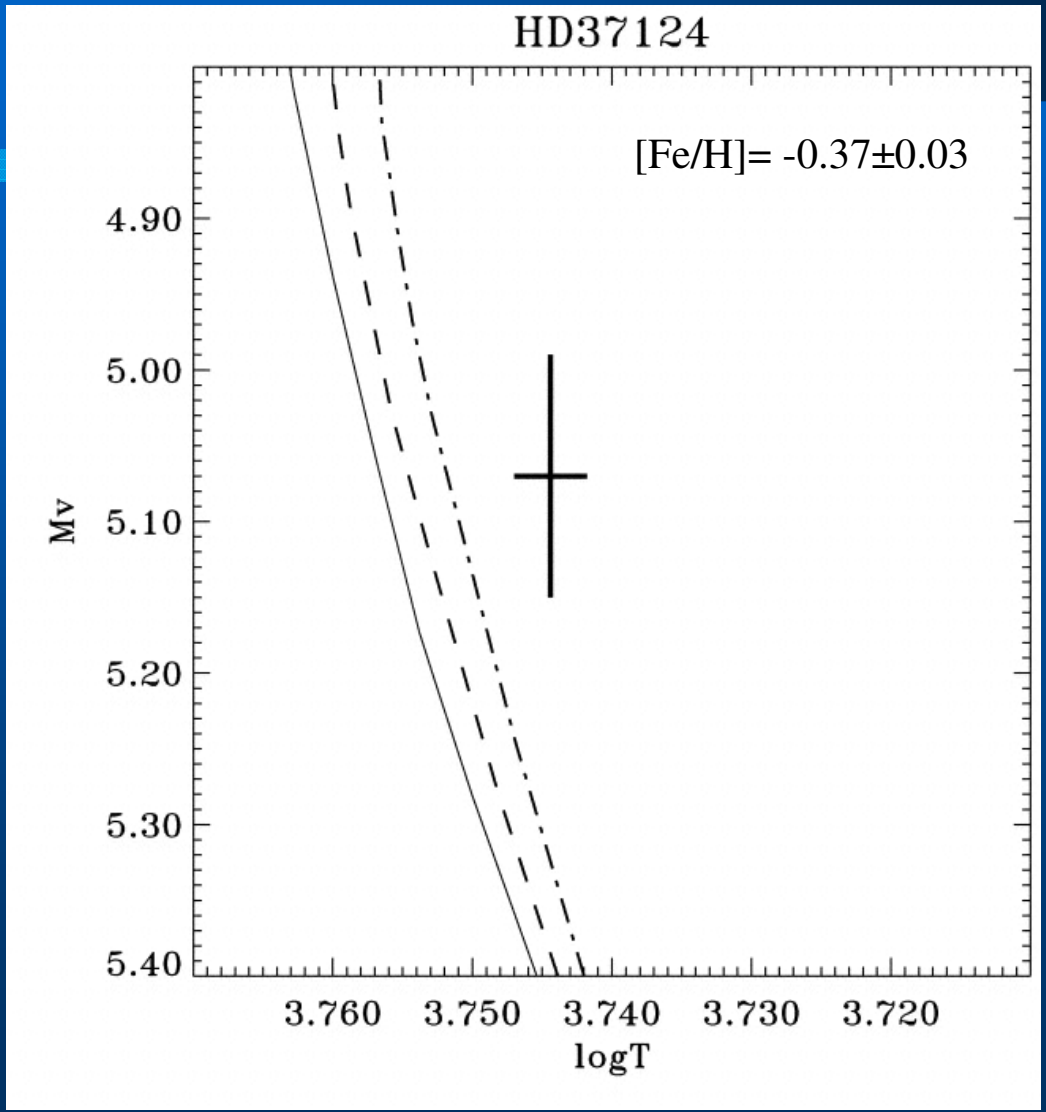


UV Piscium (eclips. Binary) **Log Teff**

$\alpha \in \{0.8, 1.2, 1.7\}$

Lastennet et al. 2003

“Red-Stranggler” planet host star



Laws et al (2003)

Methodology (CESAM v3)

- **"observed age" = 3.9 Gy:**

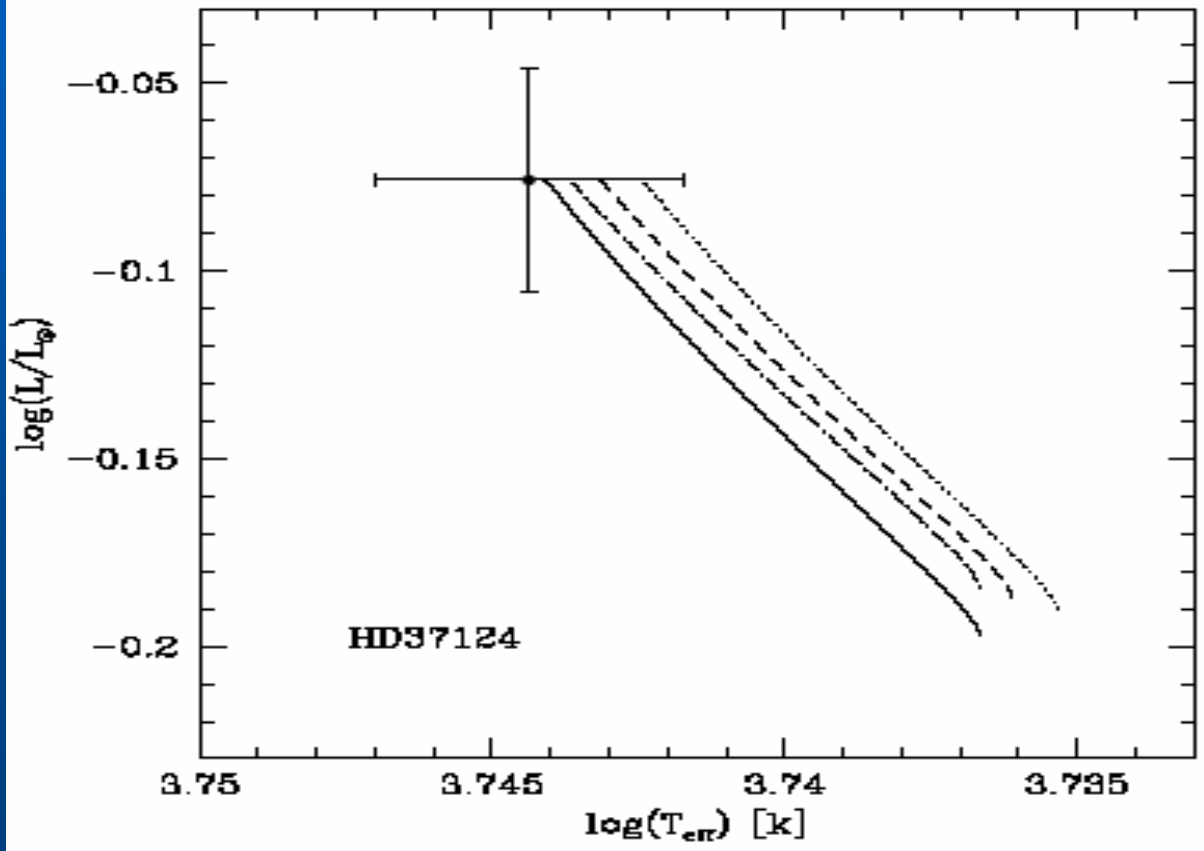
$$L_{obs} = L\,(Z, Y, \alpha MLT, M)$$

$$Teff_{obs} = Teff\,(Z, Y, \alpha MLT, M)$$

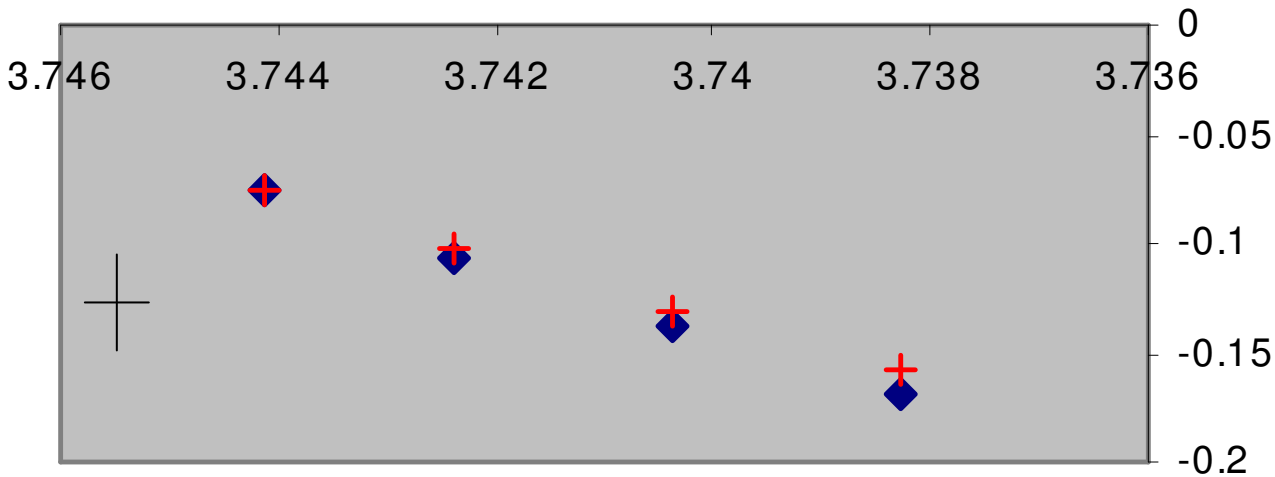
$$Z/X = (Z/X)_{obs}$$

Model	M	Y	Z	α	$T_{\rm eff}$ (K)	$L/L_{\odot}$
model 1	0.86	0.29	0.0074	0.85	5548	0.84
model 2	0.90	0.27	0.0076	0.90	5526	0.84
model 3	0.92	0.25	0.0079	0.95	5535	0.84
model 4	0.94	0.24	0.0079	1.00	5542	0.84

ZAMS to 3.9 Gy

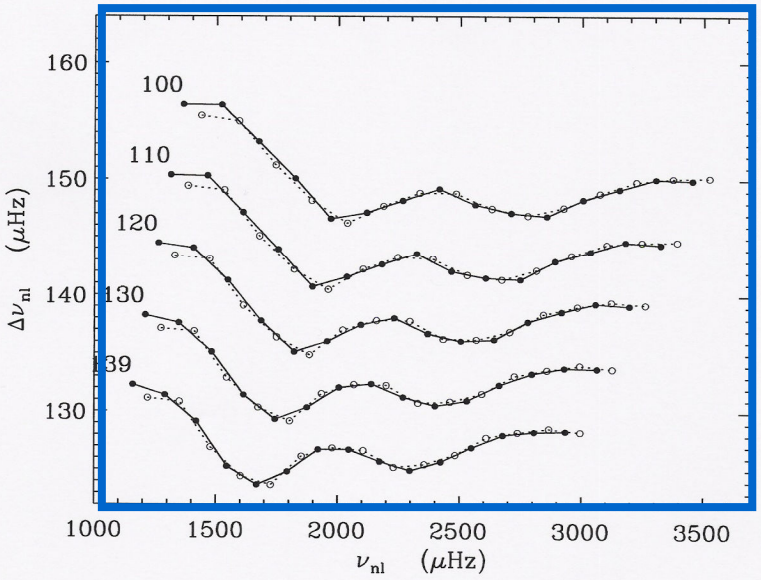


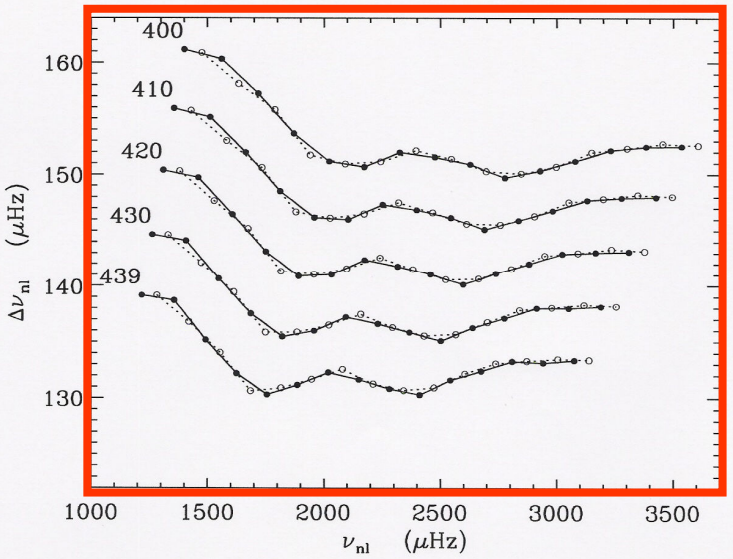
Fernandes & Santos (2004)



M	0.86	0.94
Y	0.29	0.24
Z	0.0074	0.0079
α	0.85	1.01

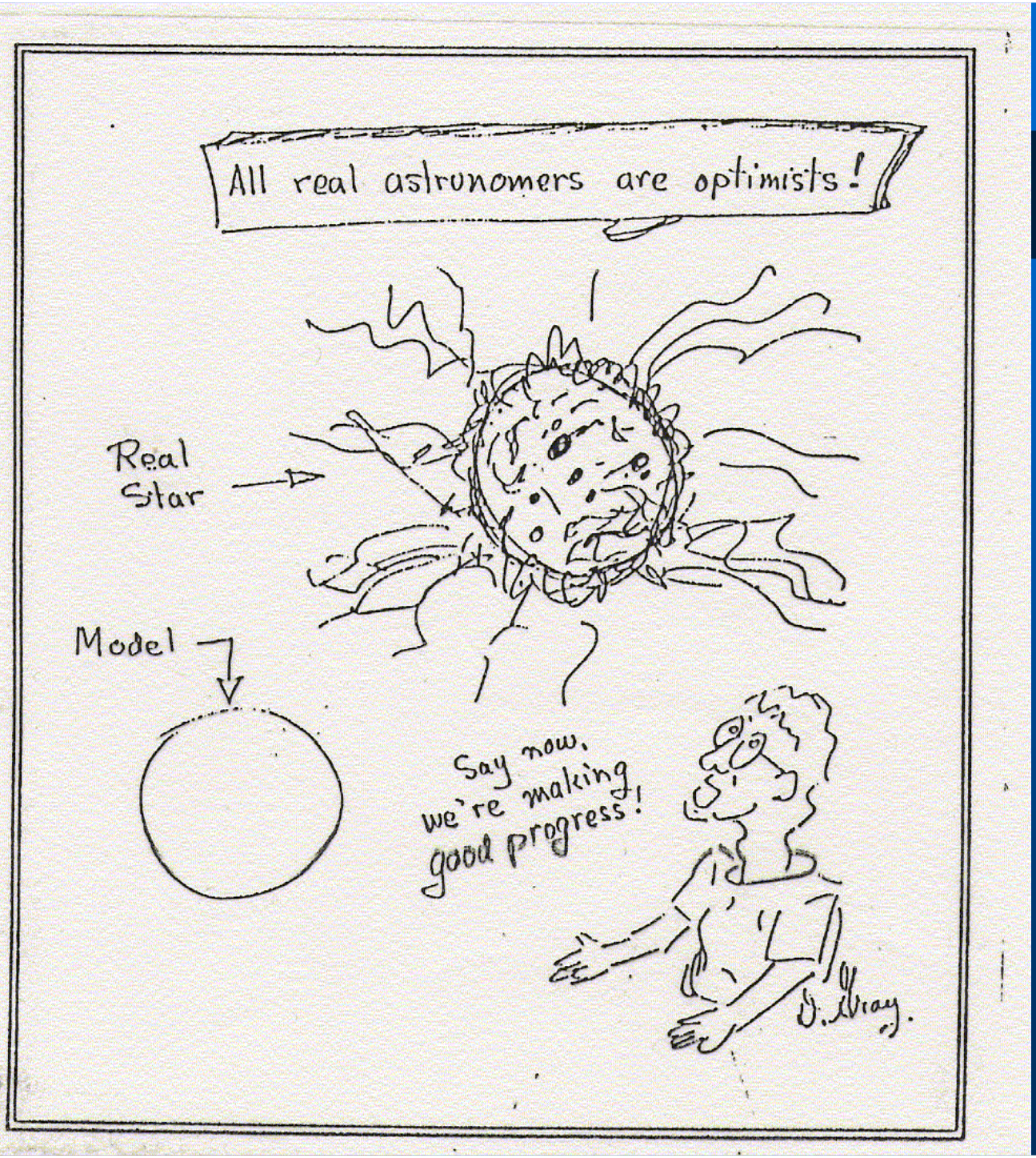
age=1 to 3.9 Gy





Monteiro (priv. Comm. 2005)

Large separation l= 0 and l= 1


All real astronomers are optimists!
Real Star
Model
Say now, we're making good progress!
D. Gray.