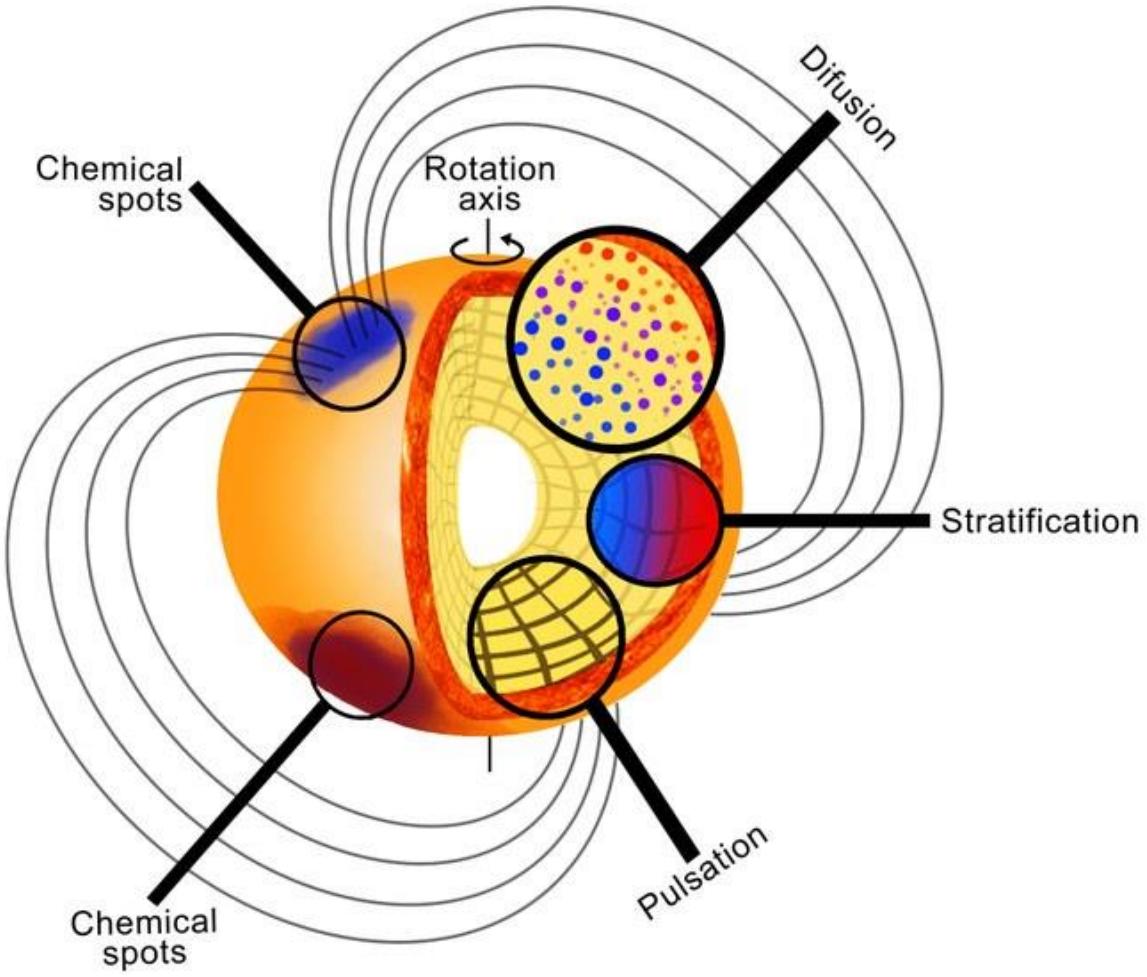
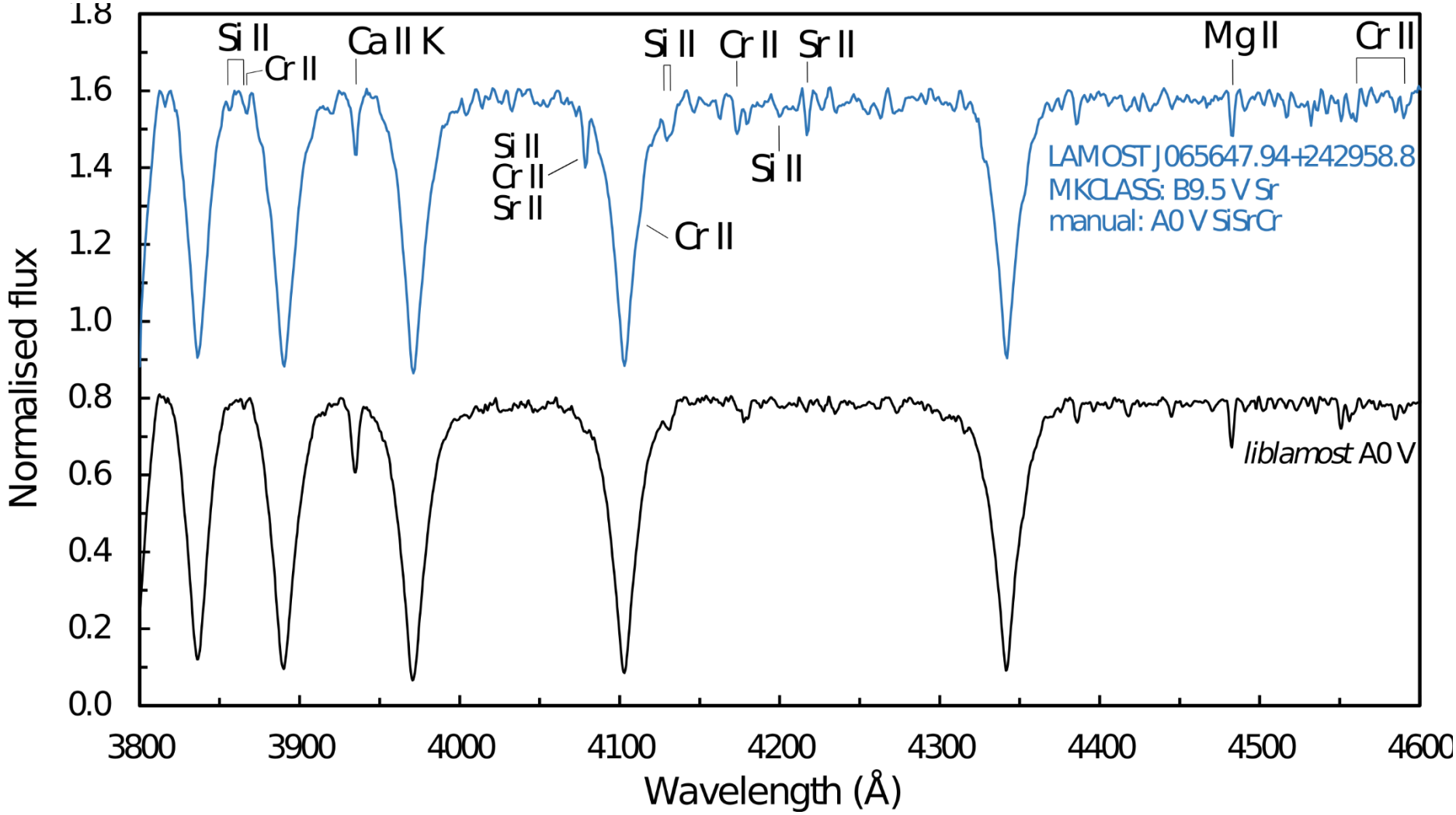
Classical chemically peculiar stars

- CP stars
- Upper main sequence stars
- Low rotational rate (< 100 km/s)
- Stable and organized stellar magnetic field
- Diffusion
- Spots

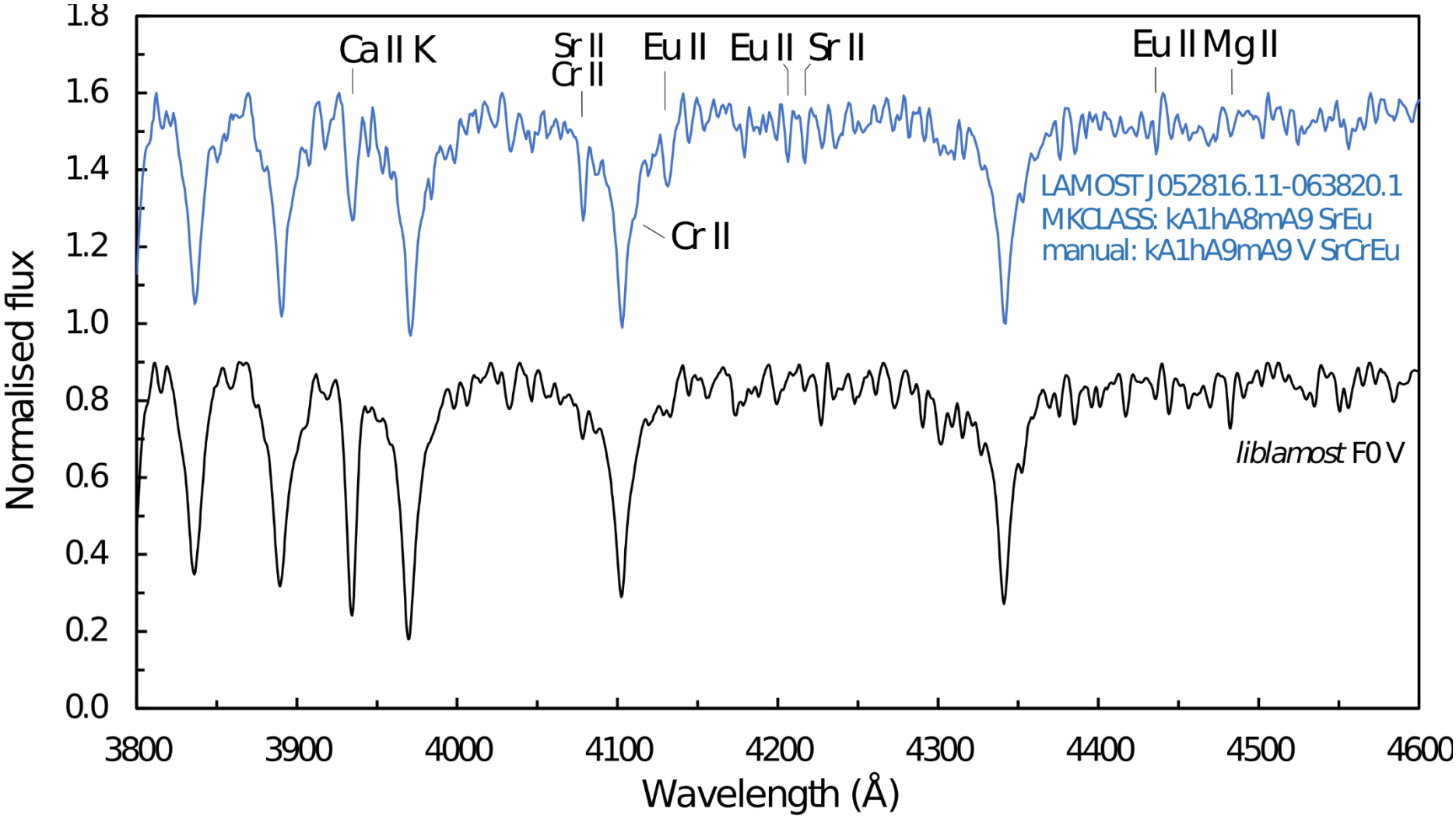
Classical chemically peculiar stars

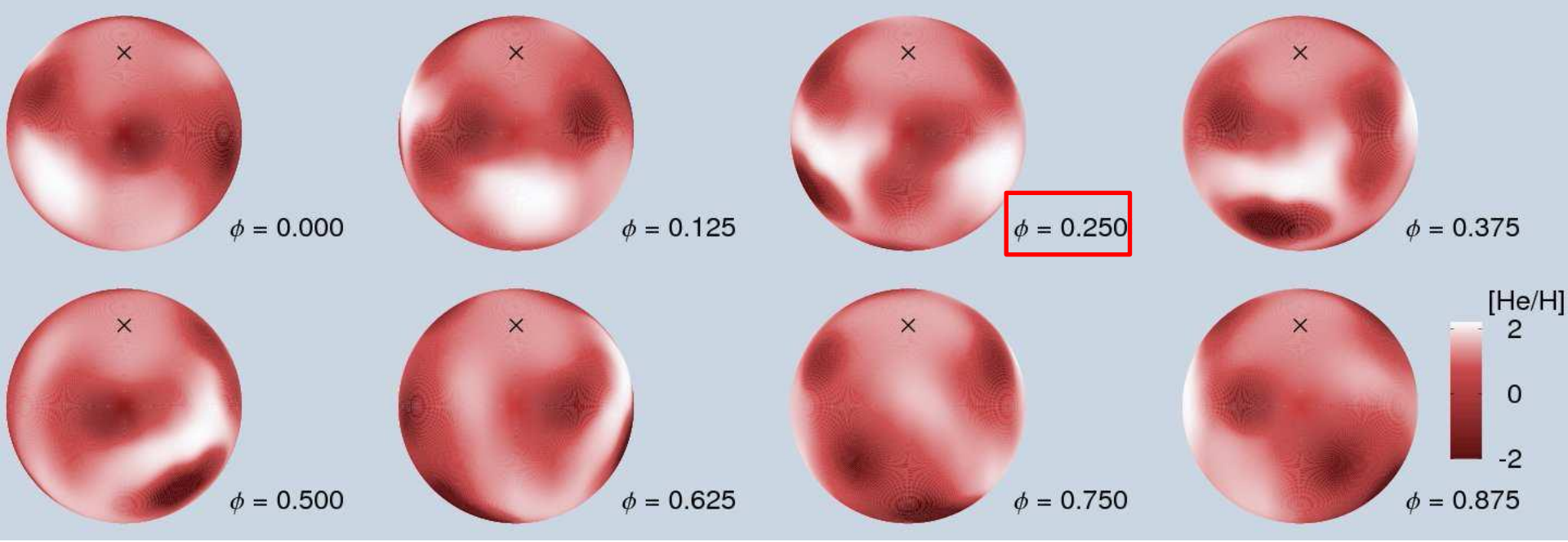


Our stars

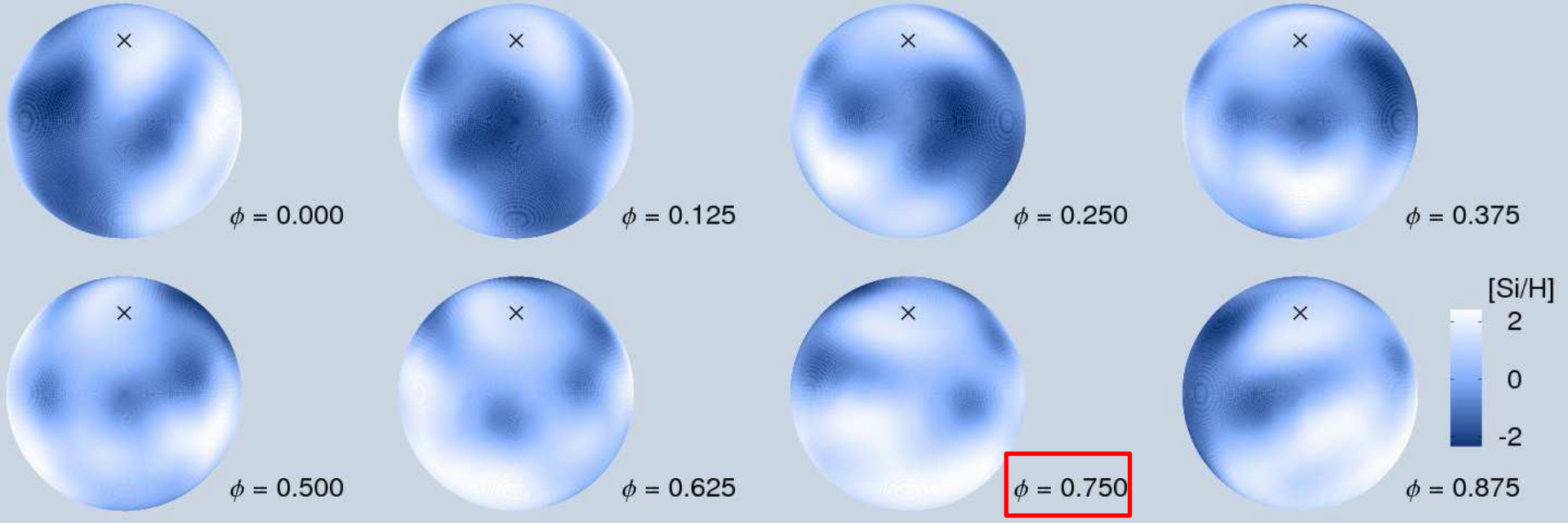

Si II
Cr II
Ca II K
Si II
Cr II
Sr II
Mg II
Cr II
Si II
Cr II
Sr II
Si II
Cr II
LAMOST J065647.94+242958.8
MKCLASS: B9.5 V Sr
manual: A0 V SiSrCr
liblamost A0 V
Normalised flux
Wavelength (Å)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
3800
3900
4000
4100
4200
4300
4400
4500
4600

Our stars

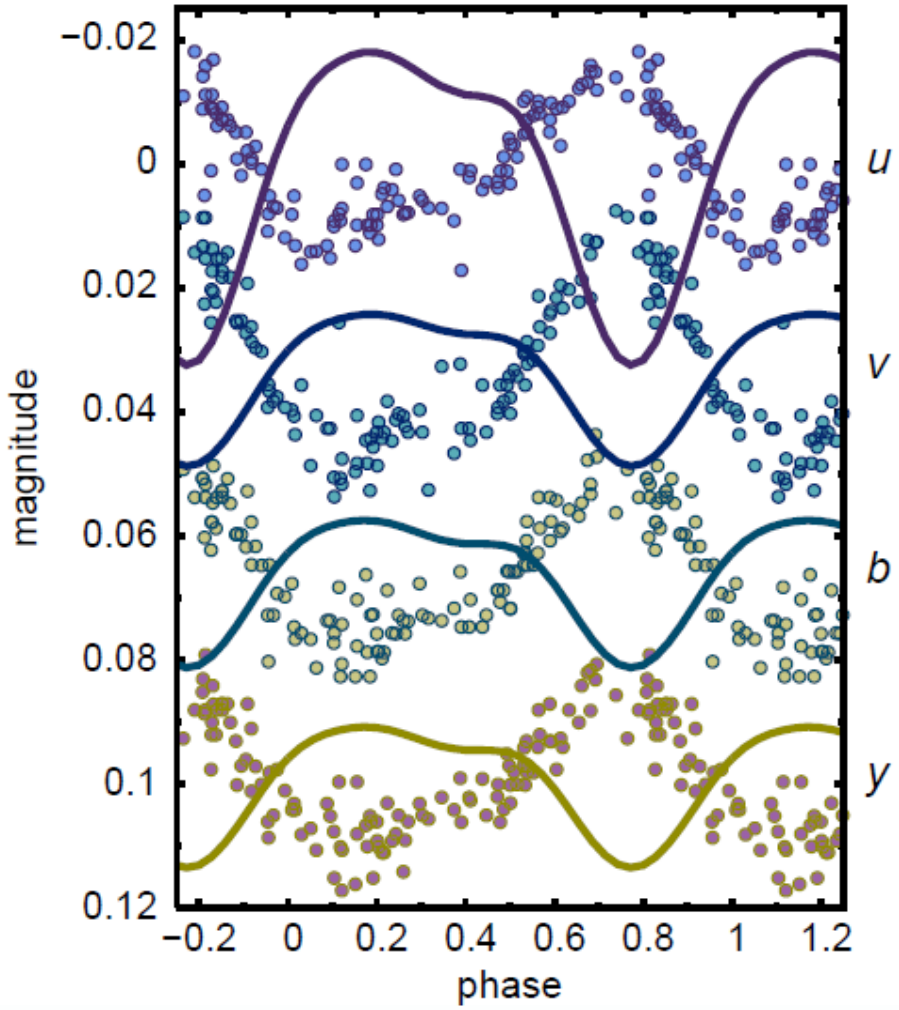

Ca II K
Sr II
Cr II
Eu II
Eu II
Sr II
Eu II
Mg II
Cr II
LAMOST J052816.11-063820.1
MKCLASS: kA1hA8mA9 SrEu
manual: kA1hA9mA9 V SrCrEu
liblamost F0 V
Normalised flux
Wavelength (Å)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
3800
3900
4000
4100
4200
4300
4400
4500
4600

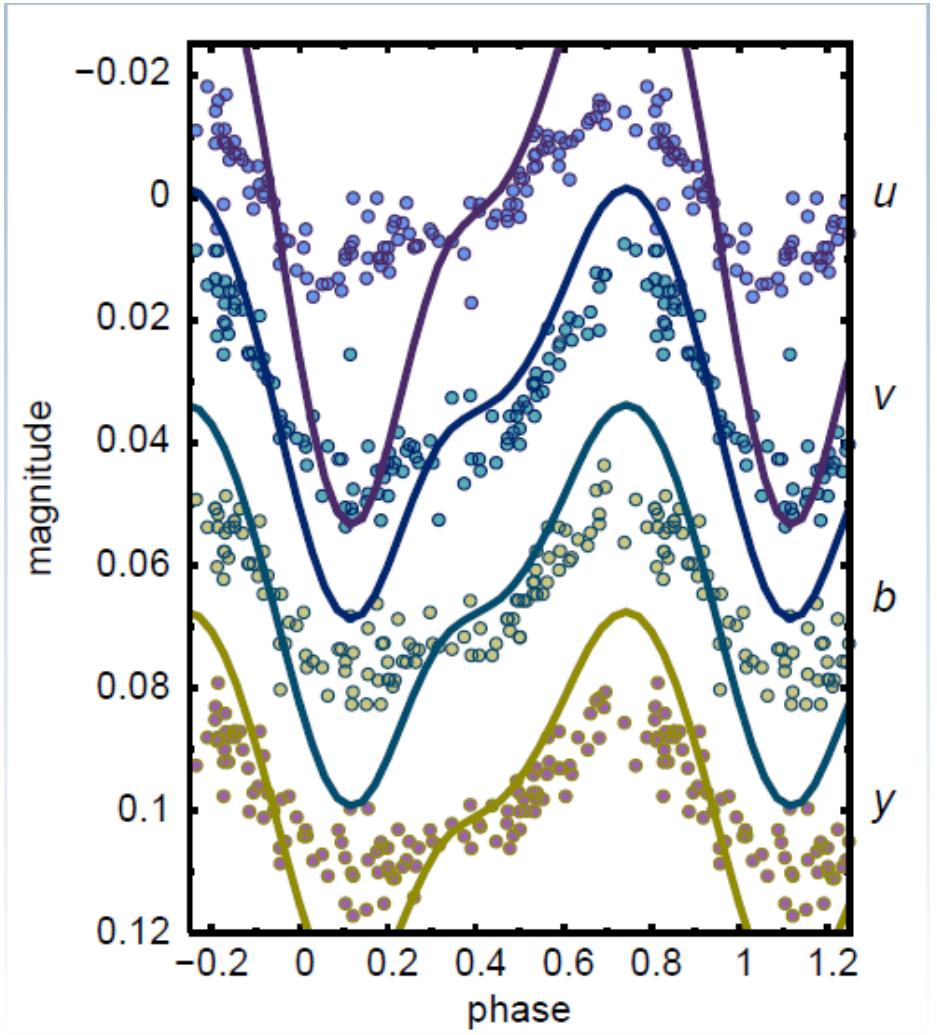


Khokhlova et al., 2000, Astronomy Letters, 26, 177



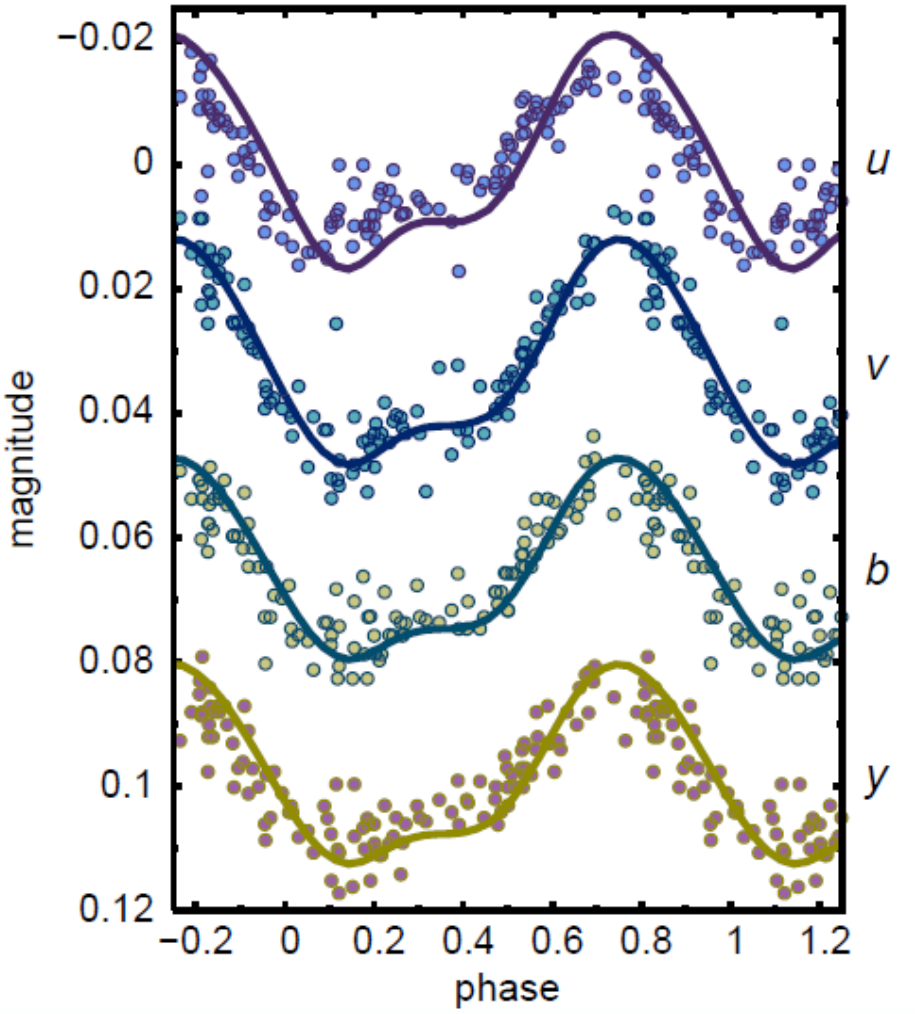
Light variability due to He and Si





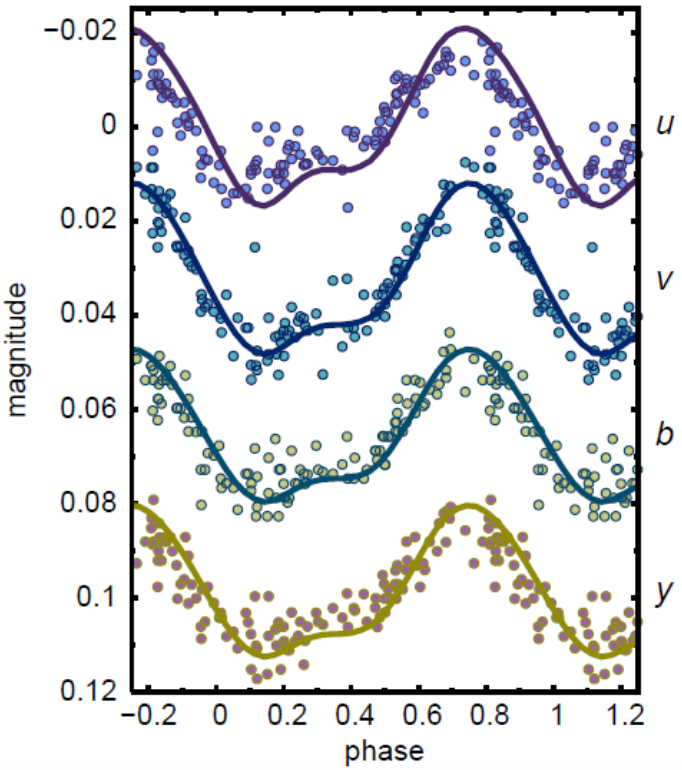
Krticka et al., 2007, A&A, 470, 1089

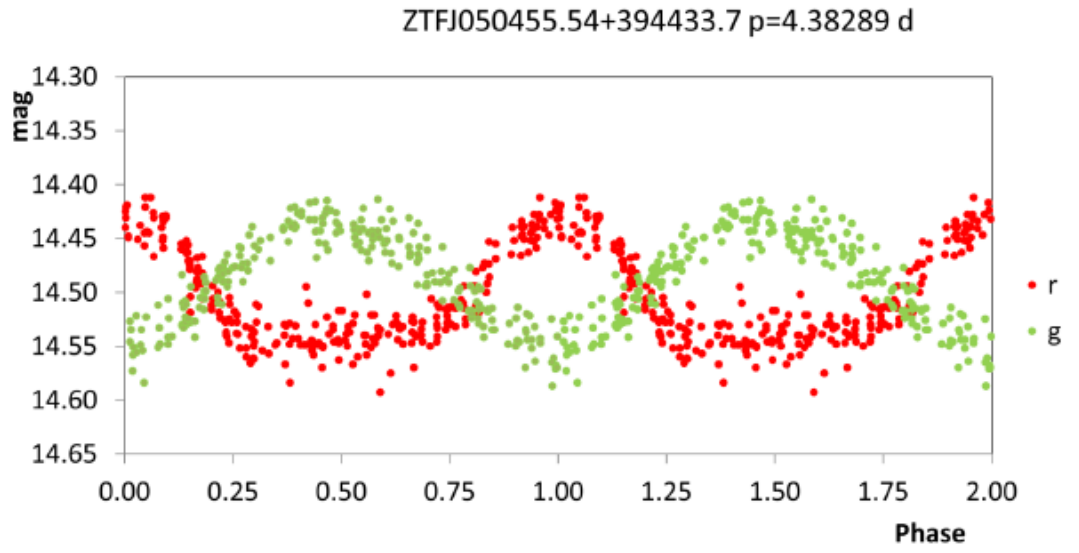
Light variability due to He and Si

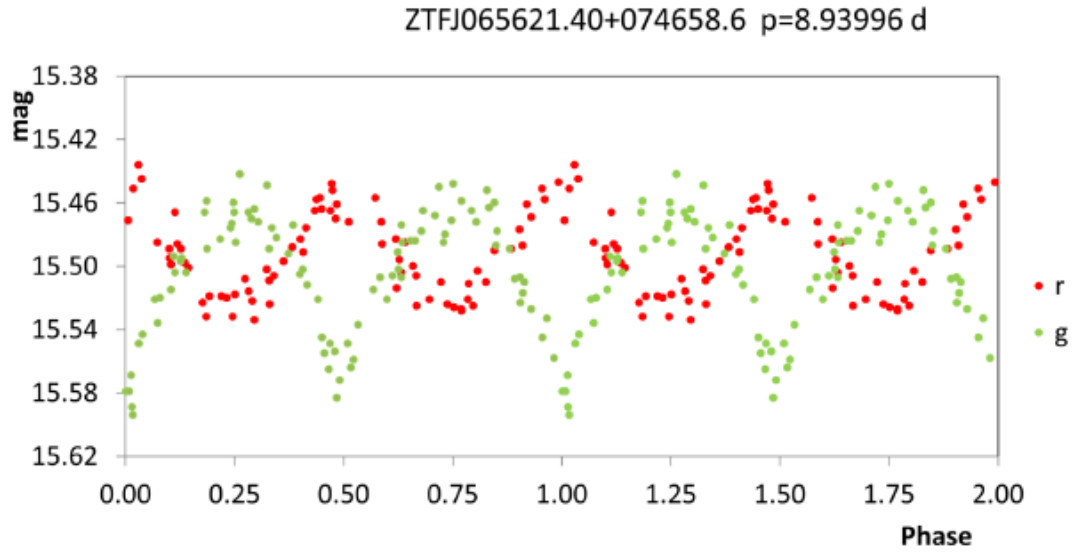


Krticka et al., 2007, A&A, 470, 1089

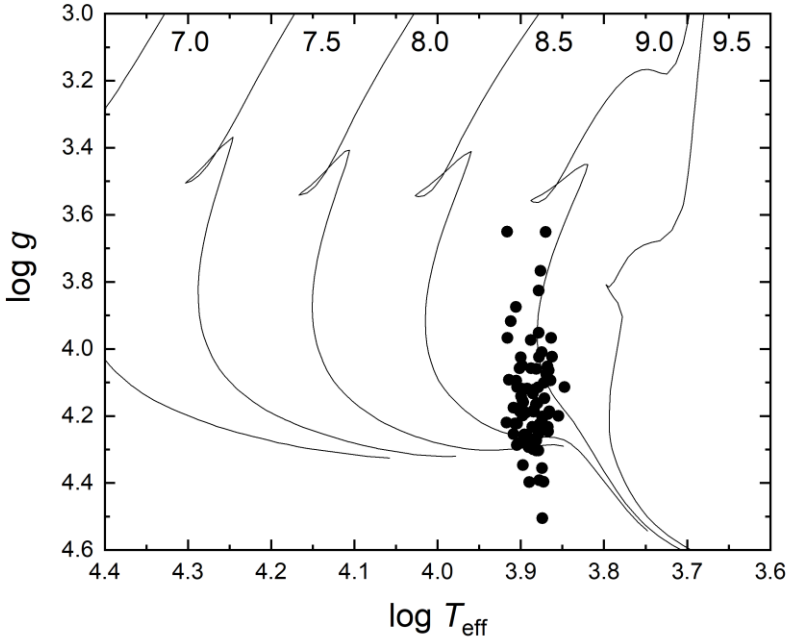
Our stars


magnitude
−0.02
0
0.02
0.04
0.06
0.08
0.1
0.12
−0.2
0
0.2
0.4
0.6
0.8
1
1.2
phase
u
v
b
y

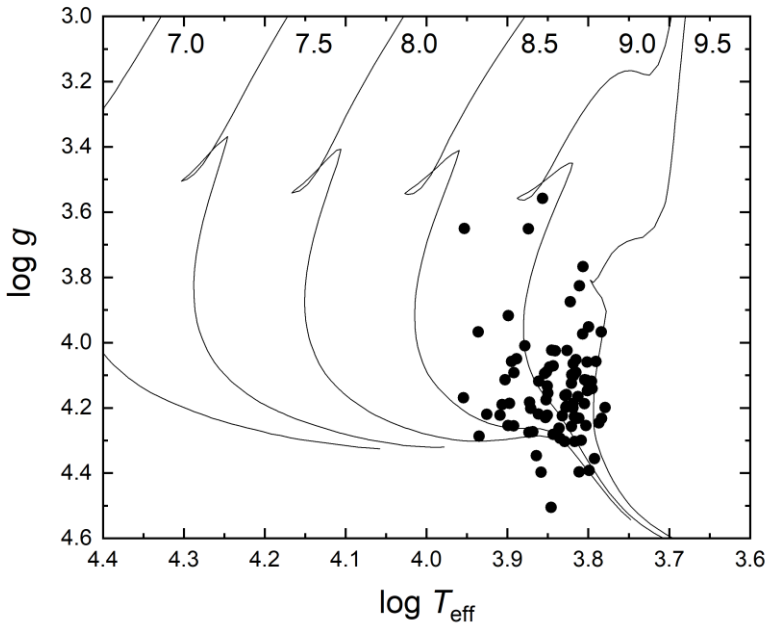

ZTFJ050455.54+394433.7 p=4.38289 d
mag
14.30
14.35
14.40
14.45
14.50
14.55
14.60
14.65
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Phase
r
g


ZTFJ065621.40+074658.6 p=8.93996 d
mag
15.38
15.42
15.46
15.50
15.54
15.58
15.62
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Phase
r
g

The HRD



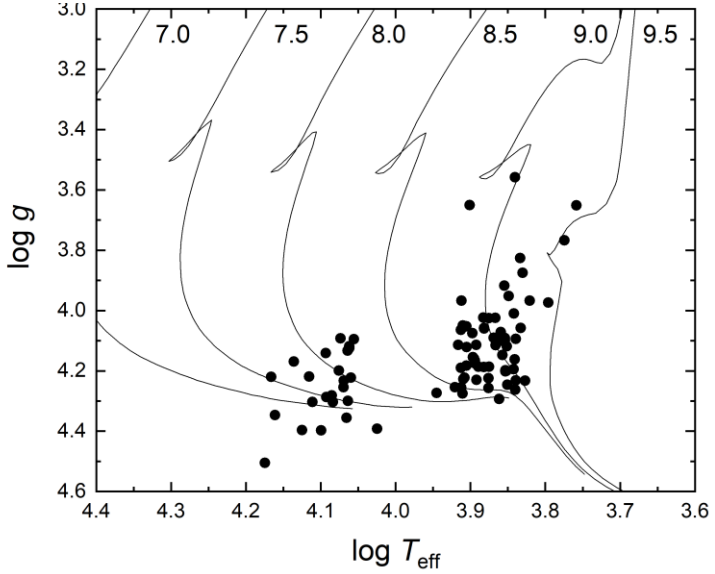
Bai et al., 2019, AJ, 158, 93



Gaia DR2

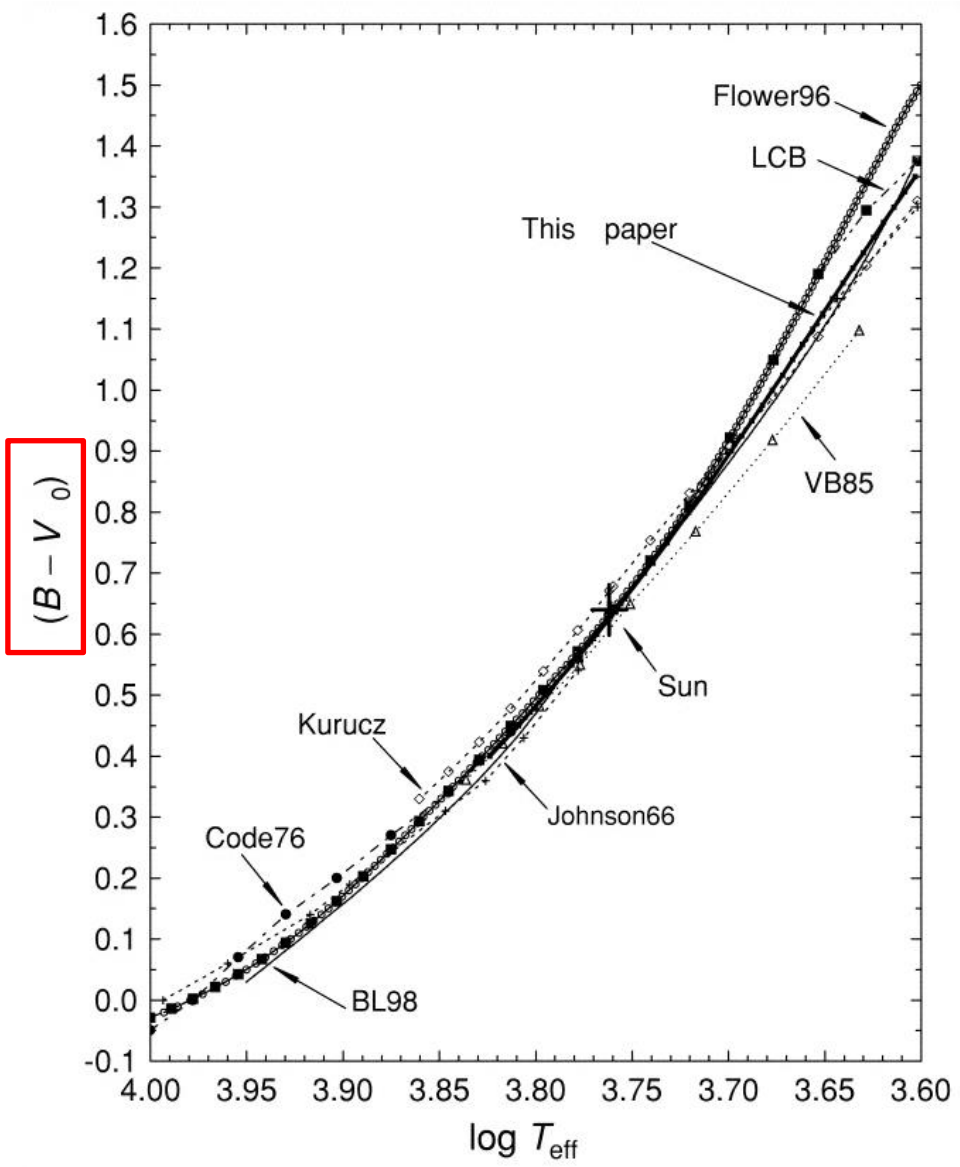
log g = log M + 4log(Teff) –
– log(L/L)

better log L
we need BC



Queiroz et al., 2018, MNRAS, 476, 2556

Colour and T_{eff}



Various calibrations can be used to provide the colour relation:

$(B - V) = f(T_{eff})$

Remember that observed

(B - V) must be corrected for interstellar extinction to

$(B - V)_0$

Most of the calibrations are for cool type stars

Absorption = Extinction = Reddening

- $A_V = k_1\, E(B\text{-}V) = k_2\, E(V\text{-}R) = \ldots$
- *General extinction* because of the ISM characteristics between the observer and the object
- *Differential extinction* within one star cluster because of local environment
- Both types are, in general *wavelength dependent*

Absolute magnitude and bolometric magnitude

- **Absolute Magnitude** *M* defined as apparent magnitude of a star if it were placed at a distance of 10 pc

$$m - M = 5 \log(d/10) - 5$$

where d is in pc

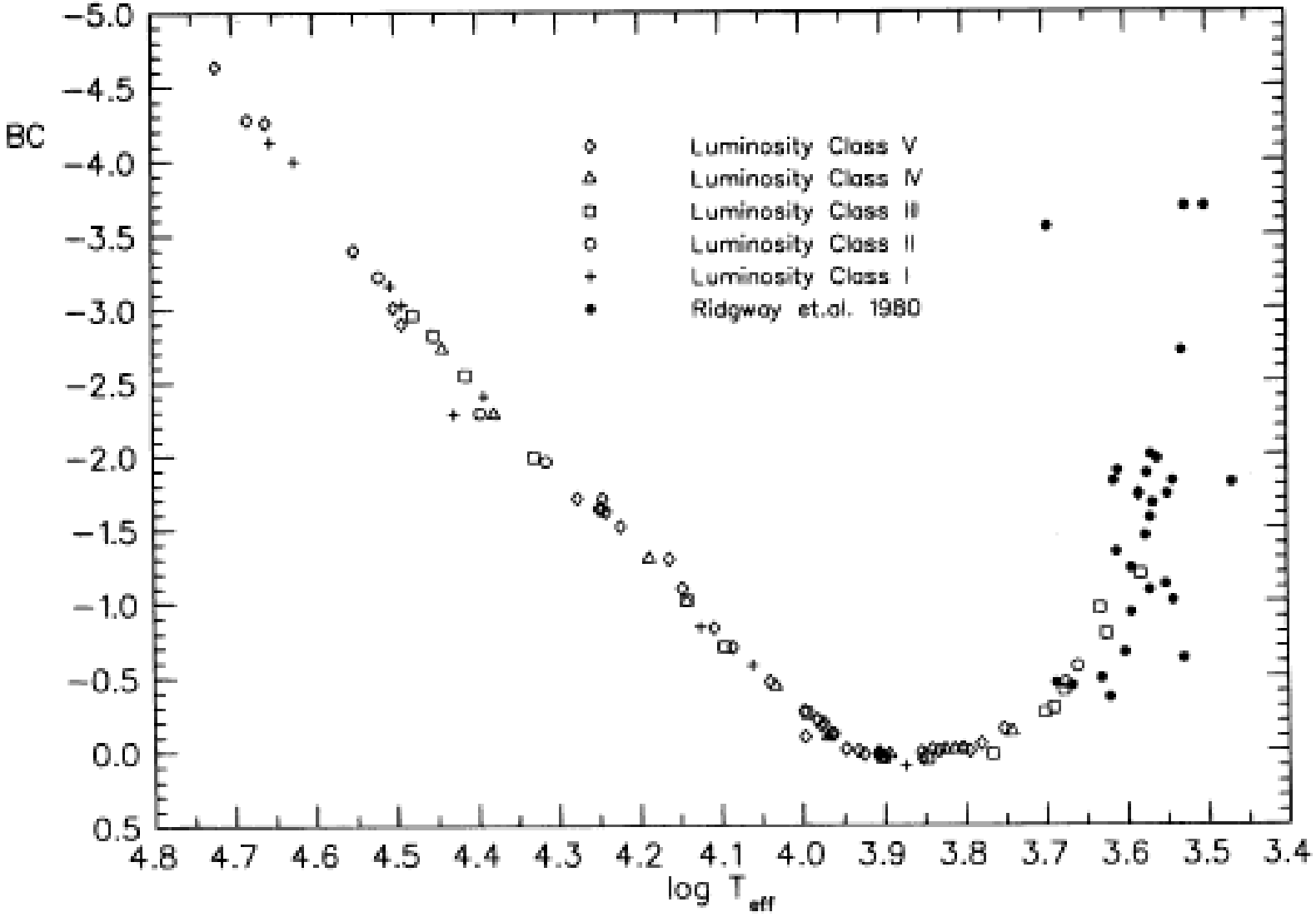
- Magnitudes are measured in some wavelength. To compare with theory it is more useful to determine **bolometric magnitude M_{bol}** – defined as absolute magnitude that would be measured by a bolometer sensitive to all wavelengths. We define the bolometric correction to be

$$BC = M_{bol} - M_V$$

Bolometric luminosity is then

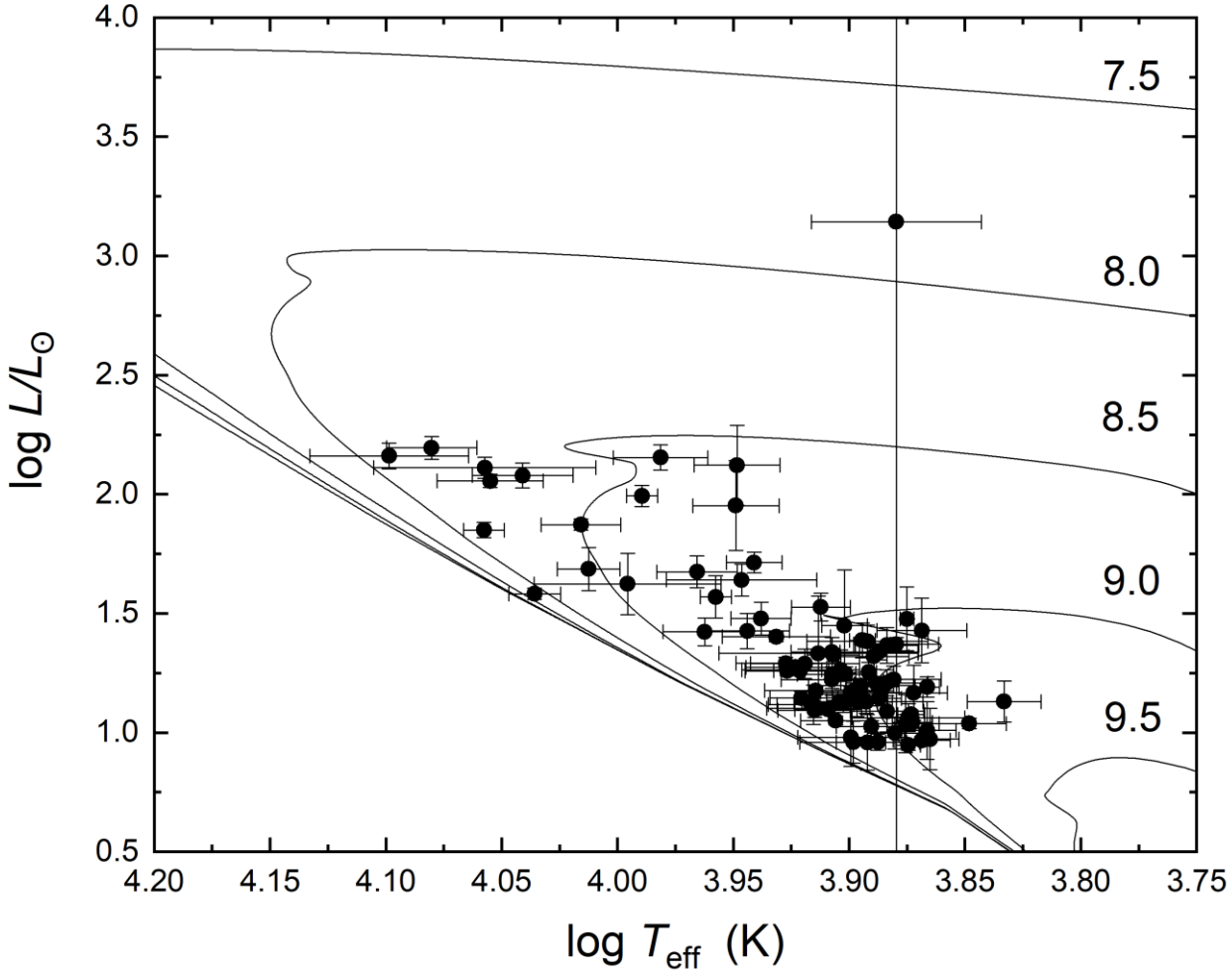
$$M_{bol} - M_{bol,\odot} = -2.5 \log L/L_\odot;\ M_{bol,\odot} = 4.75 \text{ mag}$$

Bolometric Correction



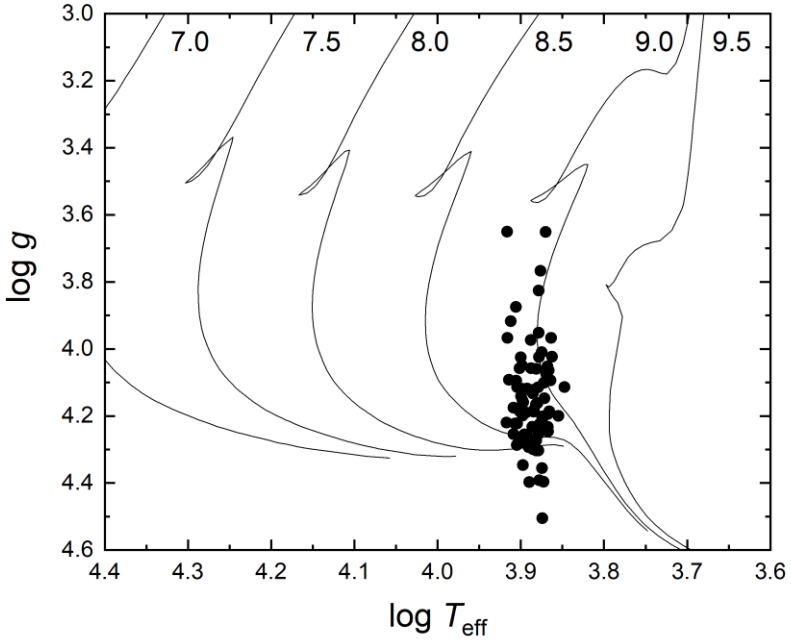
BC from Flower, 1996, ApJ, 469, 355

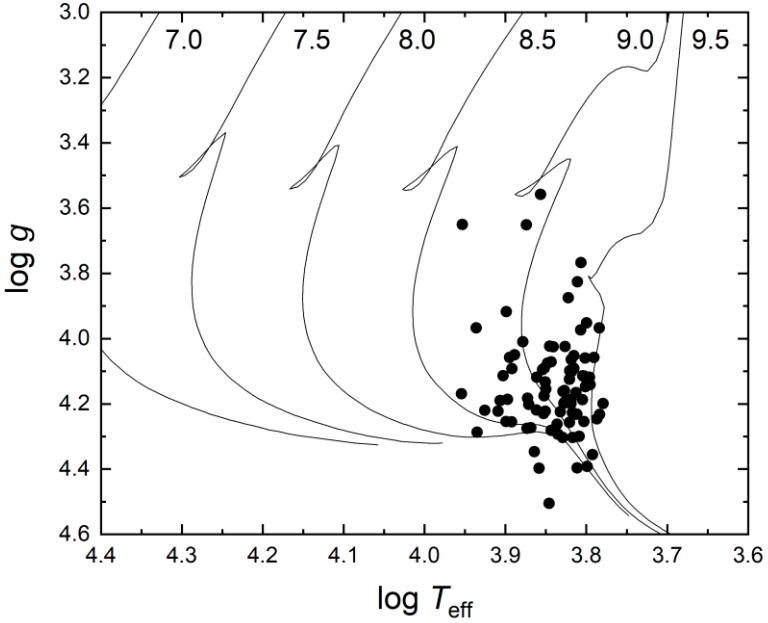
The HRD

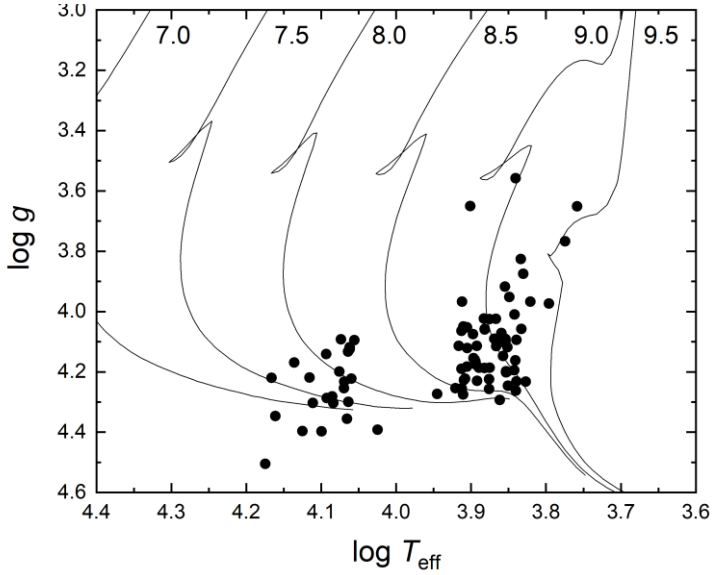


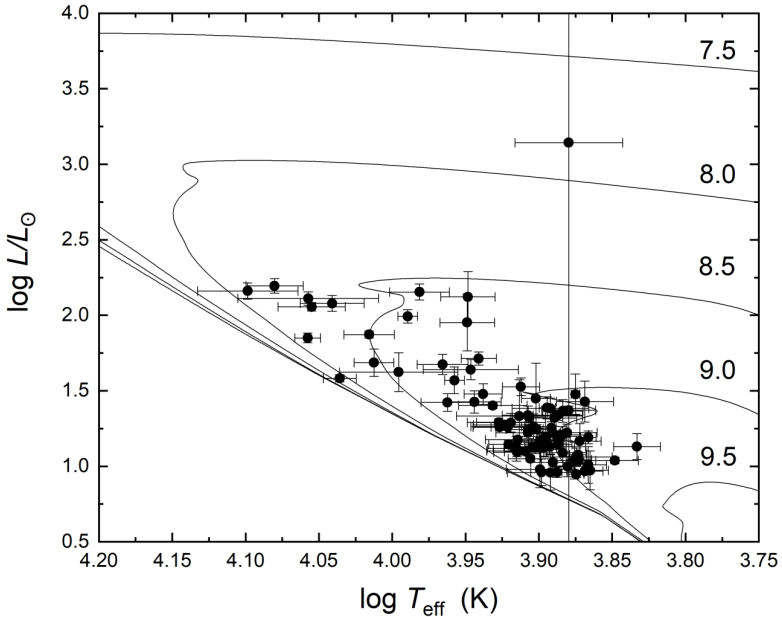
2MASS, APASS and Gaia DR2 photometry, Gaia EDR3 astrometry

The HRD

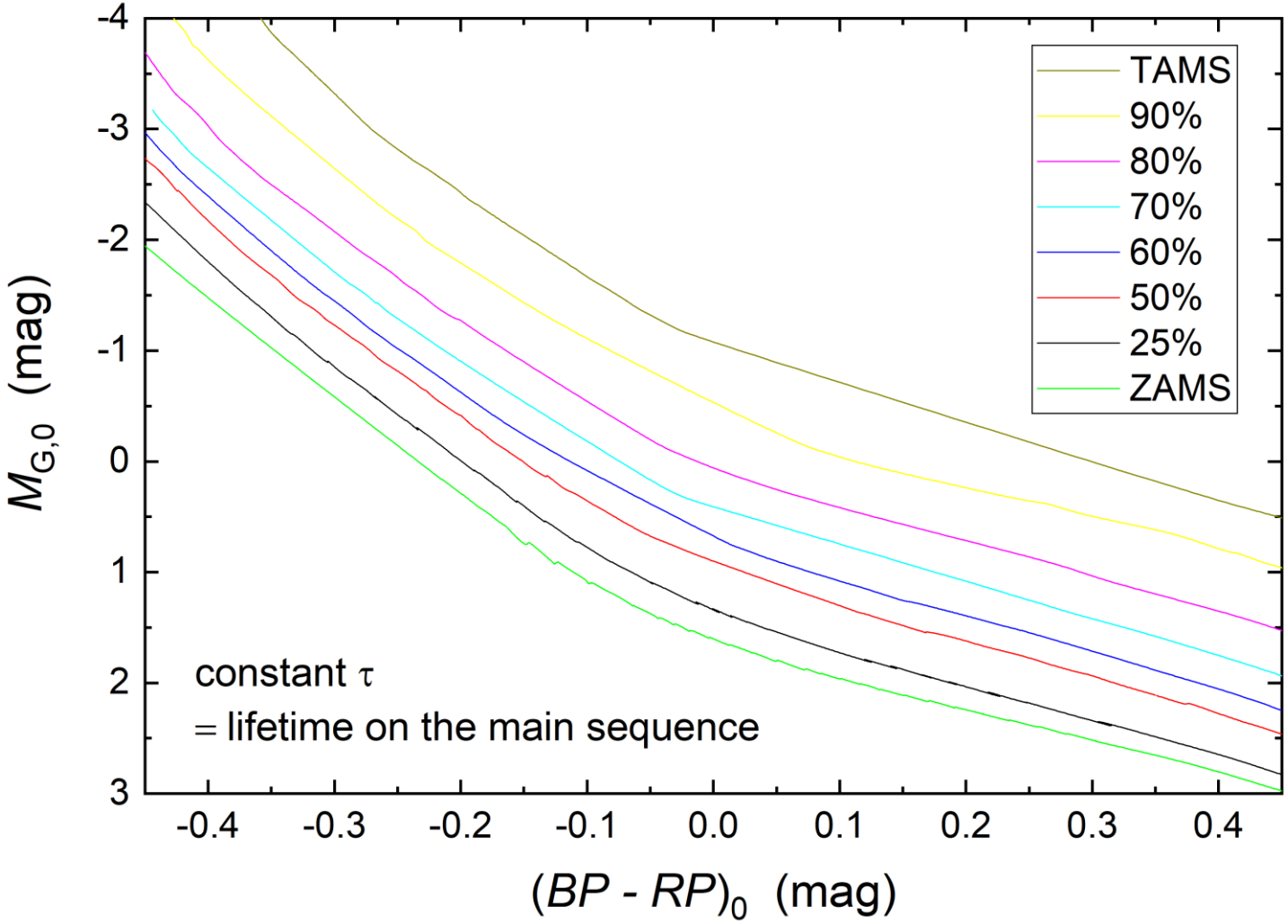

7.0
7.5
8.0
8.5
9.0
9.5
log g
log T_{eff}


7.0
7.5
8.0
8.5
9.0
9.5
log g
log T_{eff}

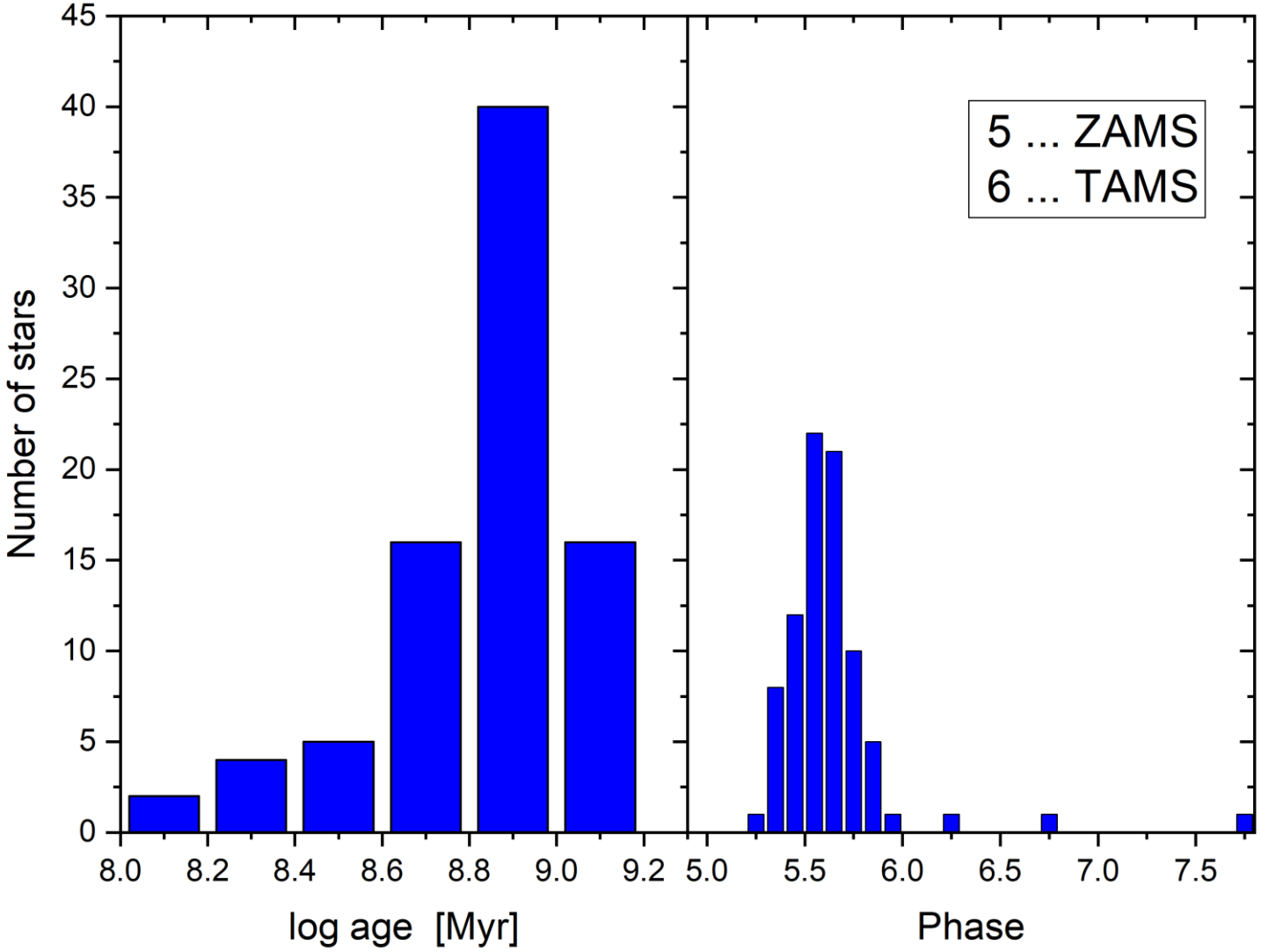

7.0
7.5
8.0
8.5
9.0
9.5
log g
log T_{eff}


7.5
8.0
8.5
9.0
9.5
log $L/L_{\odot}$
log T_{eff} (K)

The lifetime on the Main-Sequence



The lifetime on the Main-Sequence



Mass distribution