A new HW Vir binary from the Palomar Transient Factory

PTF1 J072455.75+125300.3

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- sdB + dwarf companion
- eclipsing binary system
- 17 known systems
- characteristic lightcurve (reflection effect)
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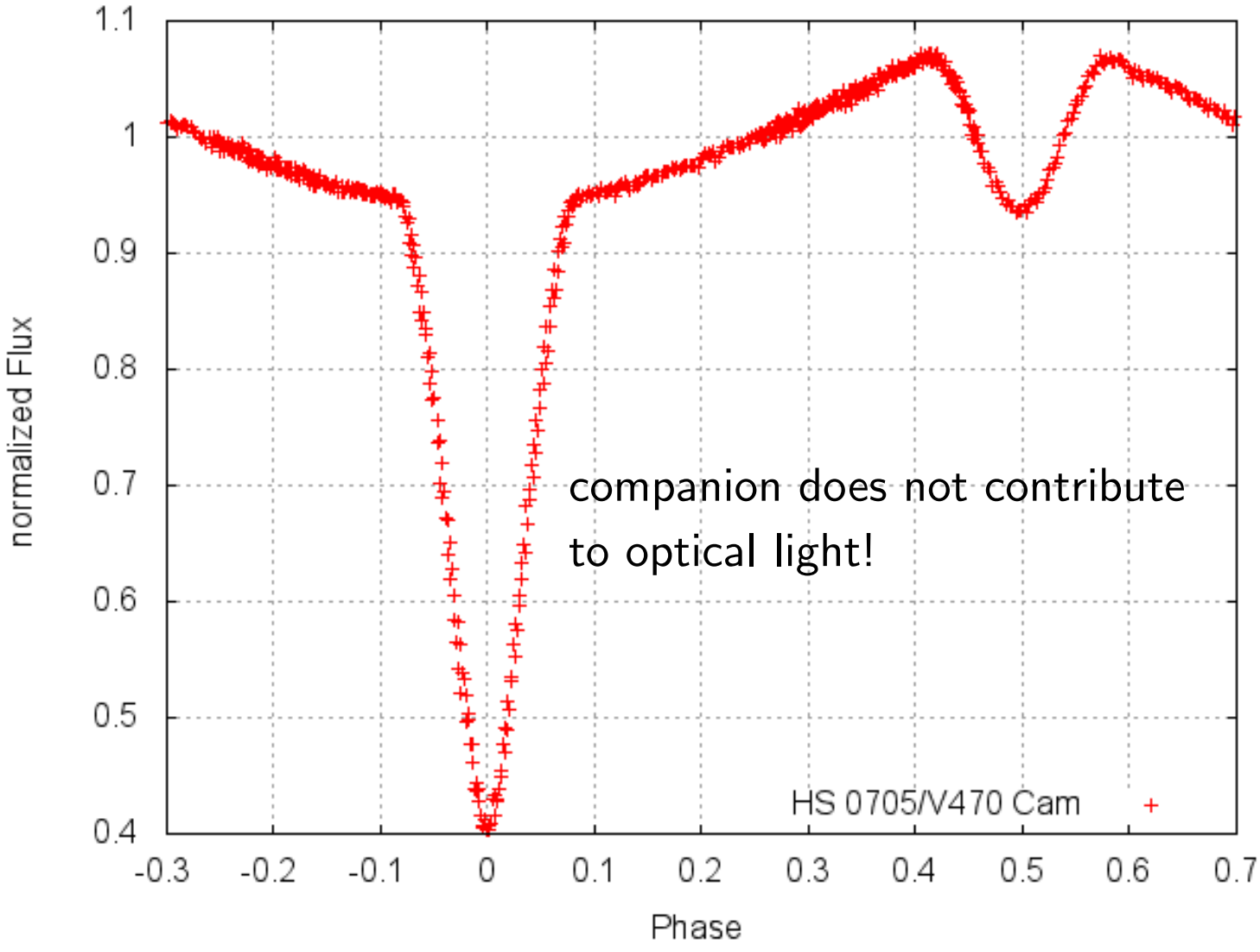

Figure : HS 0705, Data provided by H.Drechsel

Detected at the **Palomar Transient Factory (PTF)**

- Palomar Observatory (Caltech)
- Wide field survey
- Search for optical transients and variable sources
- 48" telescope: robotic survey-telescope
- 60" telescope: follow-up observations

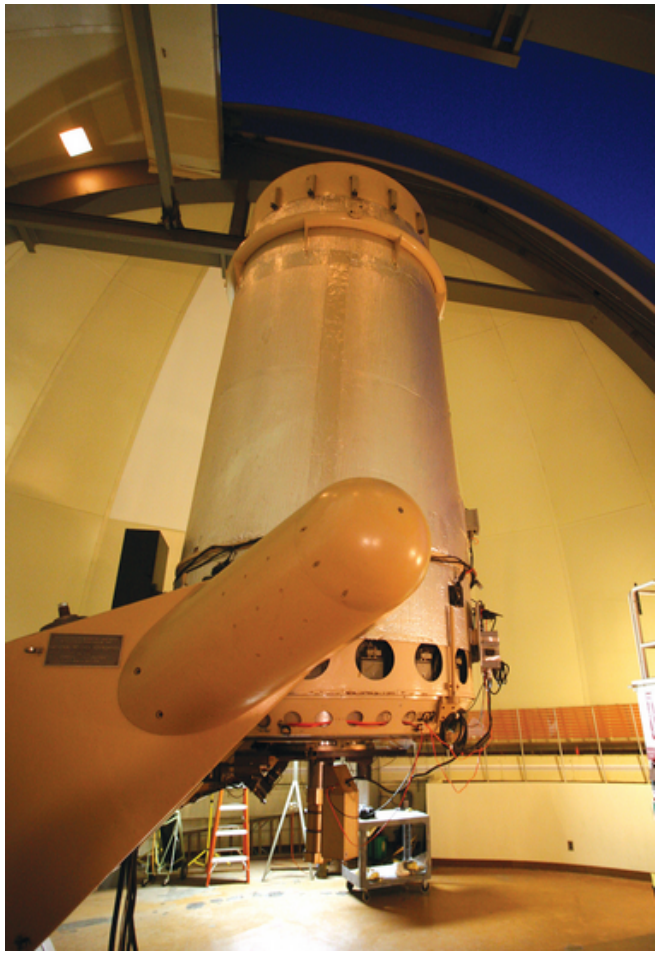

Figure : `http://www.astro.caltech.edu/palomar/about/telescopes.html`

Obtaining the data...

- **Photometry**
  - seven lightcurves, each $\sim$ 150 datapoints
  - blue filter (400 nm to 550 nm)
  - mostly covered more than one orbit $\rightarrow$P=0.09980(25) d
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- **Spectroscopy**
  - 38 spectra
  - Palomar 200" and Double Spectrograph (DBSP)
  - R $\sim$ 1500

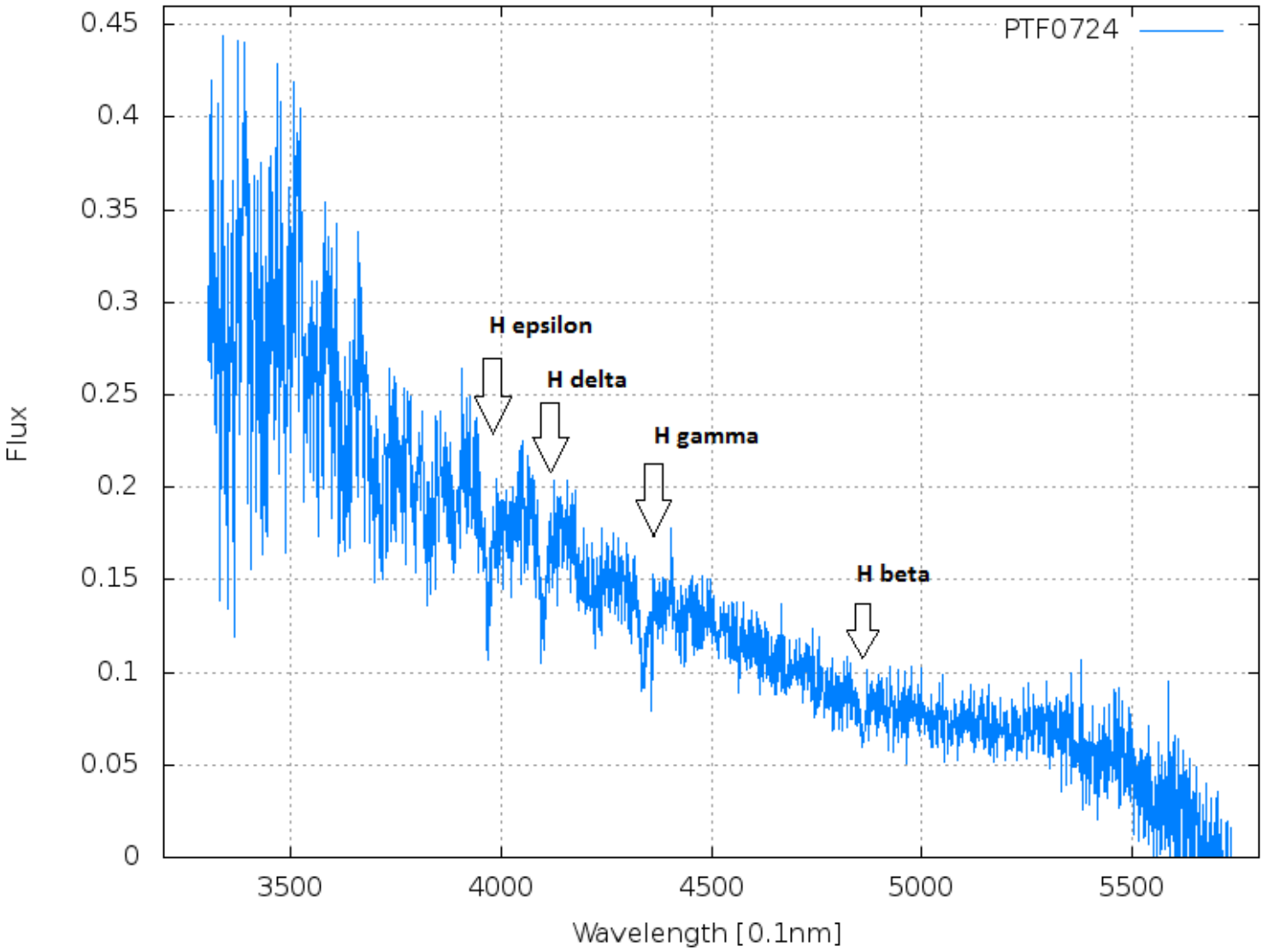
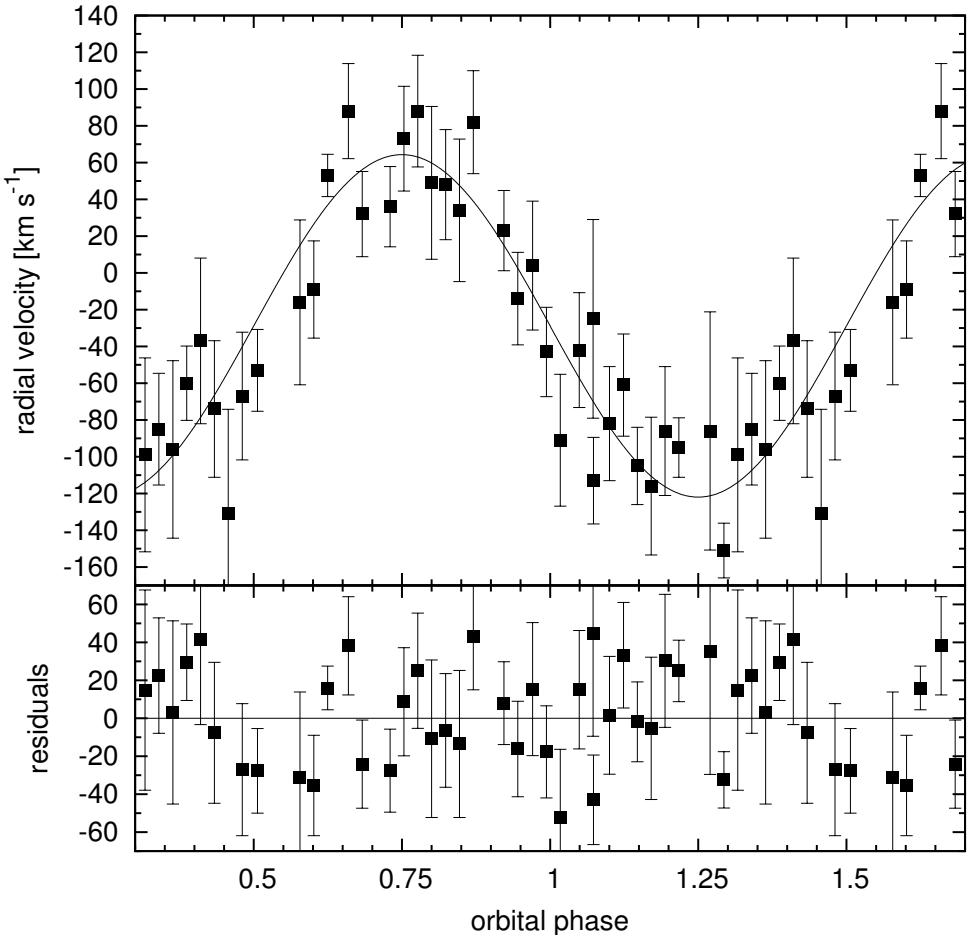


Figure : Spectrum of PTF0724 with hydrogen lines

Radial Velocity Curve



- lines: Hb, Hg, Hd,(He)
- circular orbit
- P=0.09(85) d
- semiamplitude: $95.7 \pm 8.1 \mathrm{km\,s^{-1}}$
- system velocity: $-26.7 \pm 5.5 \mathrm{km\,s^{-1}}$
- mass function: $\rightarrow q = 0.33$

Figure : Radial velocity curve and residuals

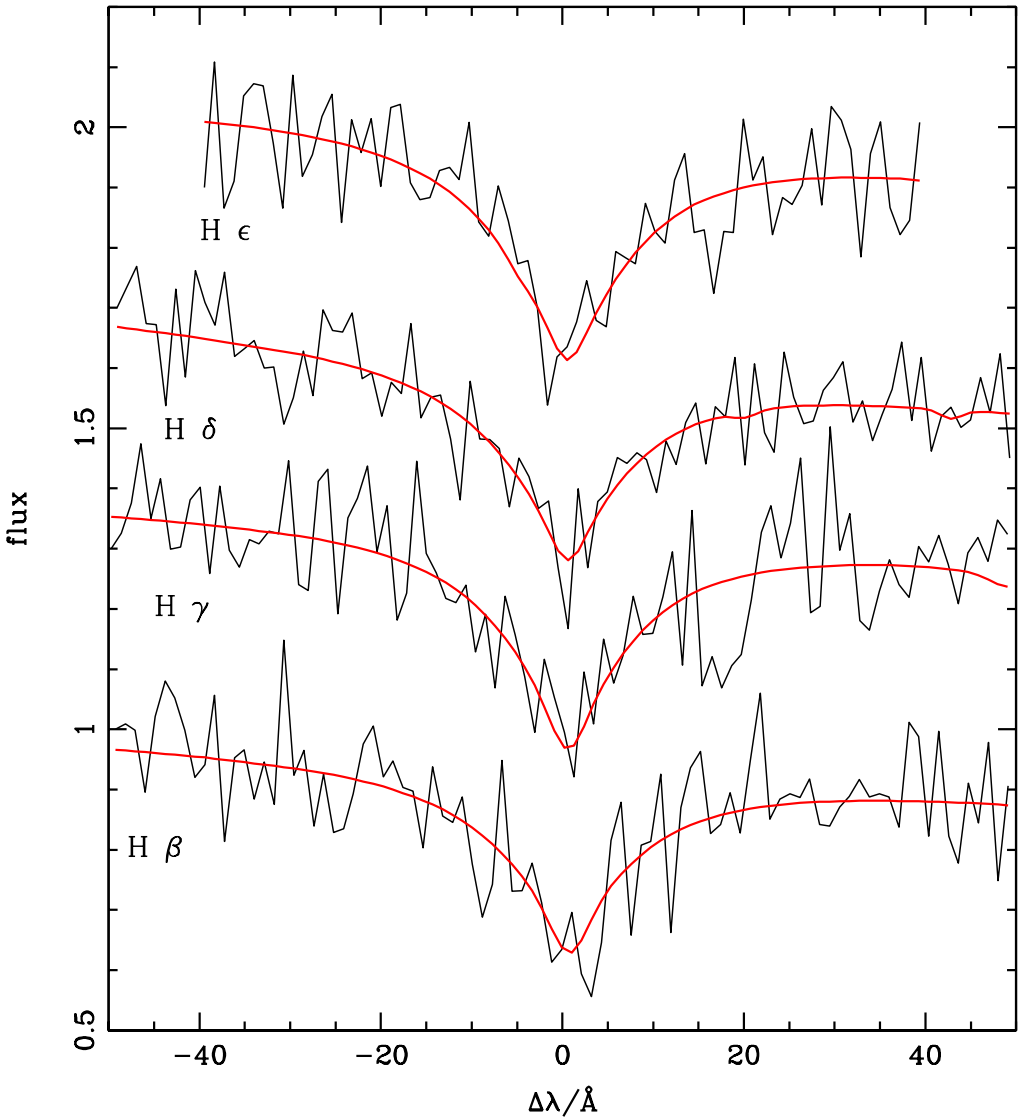


Figure : Example fit to several Balmer lines of an individual spectrum to determine the radial velocities.

Atmospheric Parameters

Determination of atmospheric parameters by fitting synthetic spectra to Balmer- and He-lines of coadded spectra.
Synthetic spectra: LTE (Local Thermodynamical Equilibrium) model atmospheres with solar metallicity and line blanketing

- $T_{\mathrm{eff}} = 33900 \pm 350\,K$
- $\log g = 5.74 \pm 0.08$
- $\log y = -2.02 \pm 0.07$

Comparison with other sdB systems...

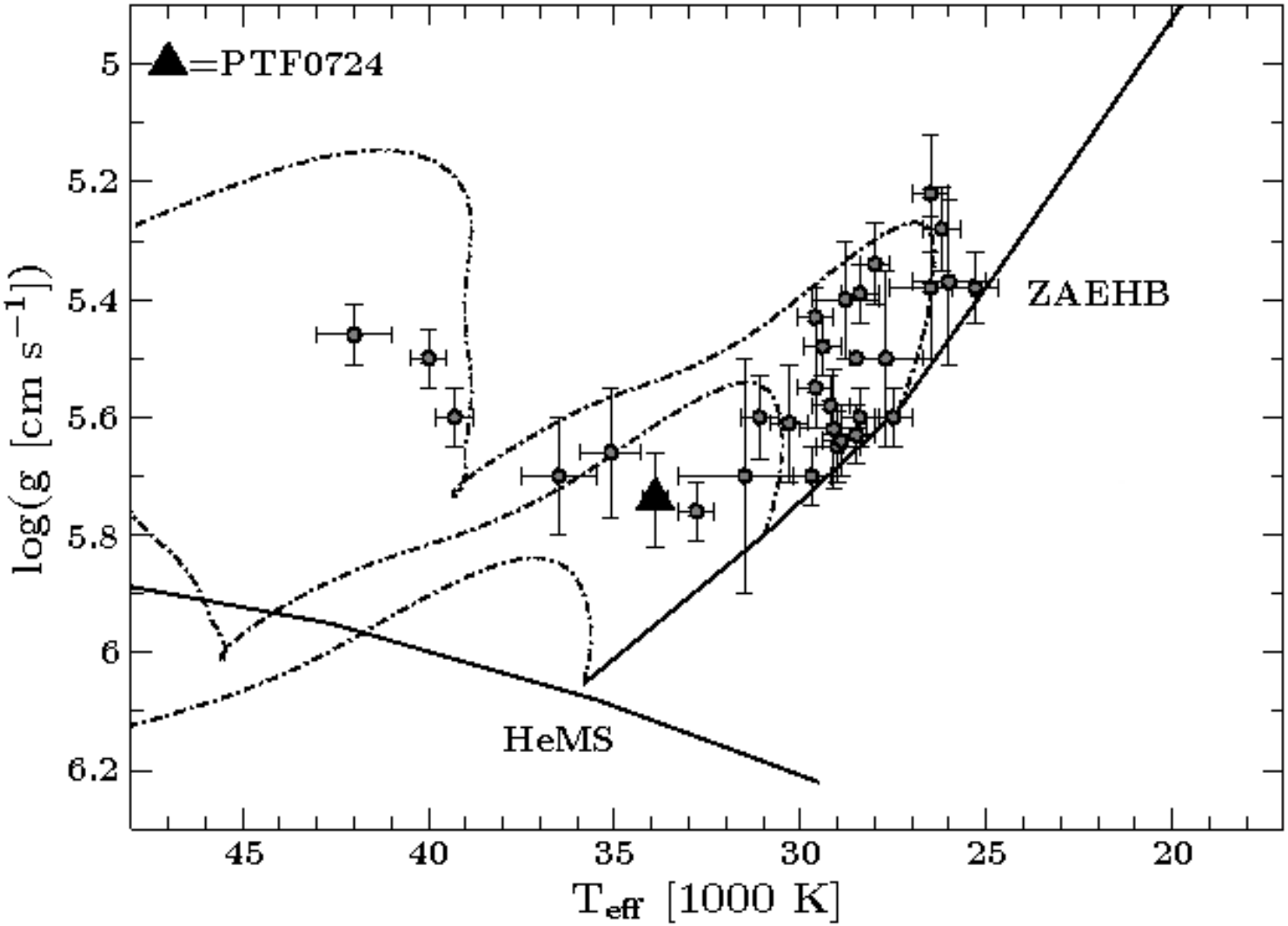


Figure : Position of PTF0724 in a (T_{eff} , log g) diagram in comparison to other known sdB stars in close binary systems.

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- multitude of start parameters for each mass ratio
  $\rightarrow$vary mass ratio around q=0.33
- $\sim$ 2000 sets of start parameters
- sum of squared residuals of all datapoints $\rightarrow$estimation of quality

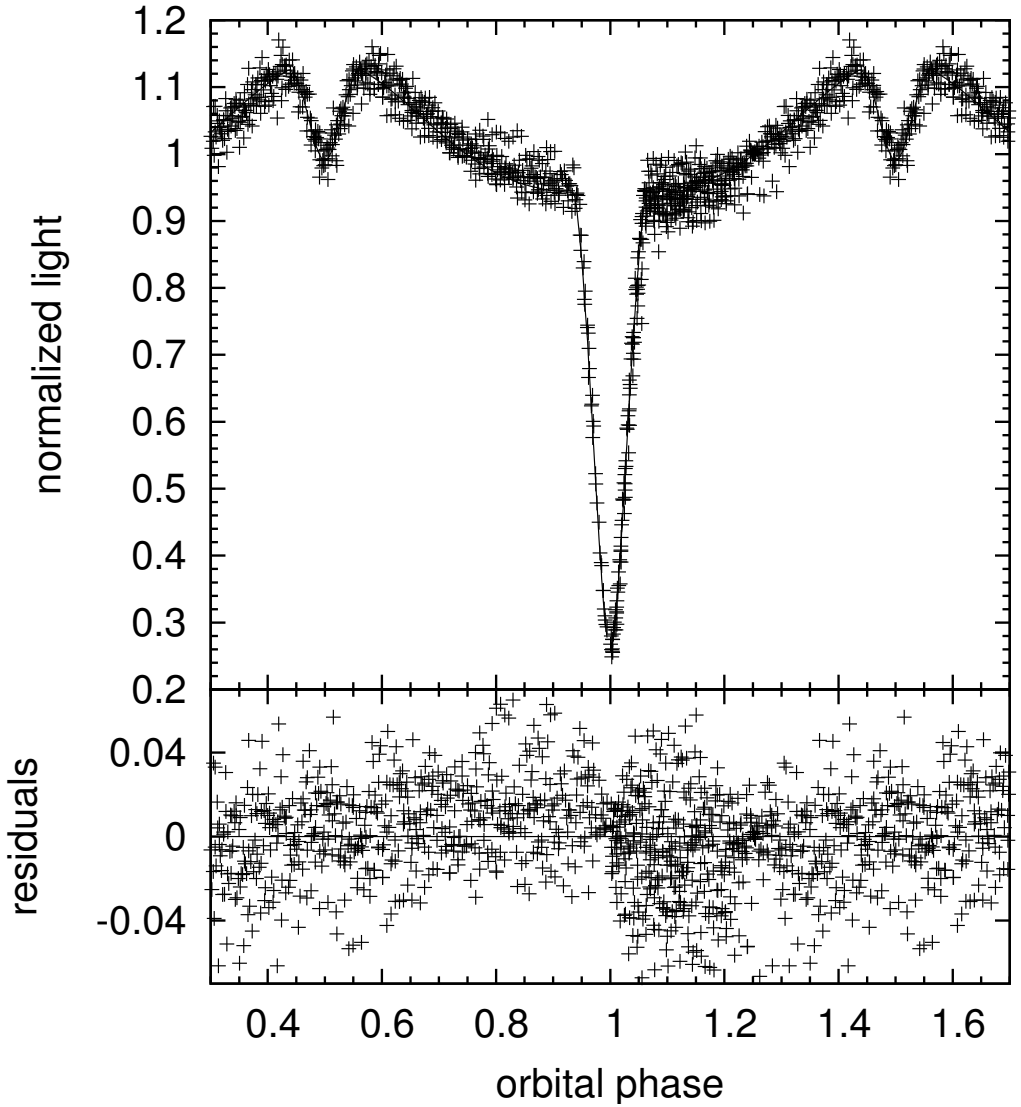

Figure : Lightcurve and best-fit. Bottom panel: residuals

Fixed parameters:	
$T_{\rm eff}(1)$	33900 K
g_1	1.0
g_2	0.32
x_1	0.190
A_1	1.0
δ_2	0.0
l_3	0.00

Fitted parameters:	
i	$83.56 \pm 0.3^\circ$
$T_{\rm eff}(2)$	$3300 \pm 300\,K$
A_2	1.8 ± 0.2
Ω_1	5.544 ± 0.20
Ω_2	2.885 ± 0.15
x_2	0.510 ± 0.05
$\left(\frac{L_1}{L_1+L_2}\right)$	(0.99978 ± 0.00064)
(δ_1)	(0.0006 ± 0.0003)
r_1	0.192 a
r_2	0.218 a

Table : Parameters from the lightcurve analysis

PTF1J072456+125301		
i	$^\circ$	83.56 ± 0.30
$M_{\rm comp}$	$[M_\odot]$	0.155 ± 0.020
a	$[R_\odot]$	0.766 ± 0.041
$R_{\rm sdB}$	$[R_\odot]$	0.1488 ± 0.007
$R_{\rm comp}$	$[R_\odot]$	0.165 ± 0.008
$\log g(\mathrm{sdB}, \mathrm{phot})$		5.760 ± 0.015
$\log g(\mathrm{sdB}, \mathrm{spec})$		5.75 ± 0.08

Table : Adopted stellar parameters for the components of PTF0724.

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Future tasks:

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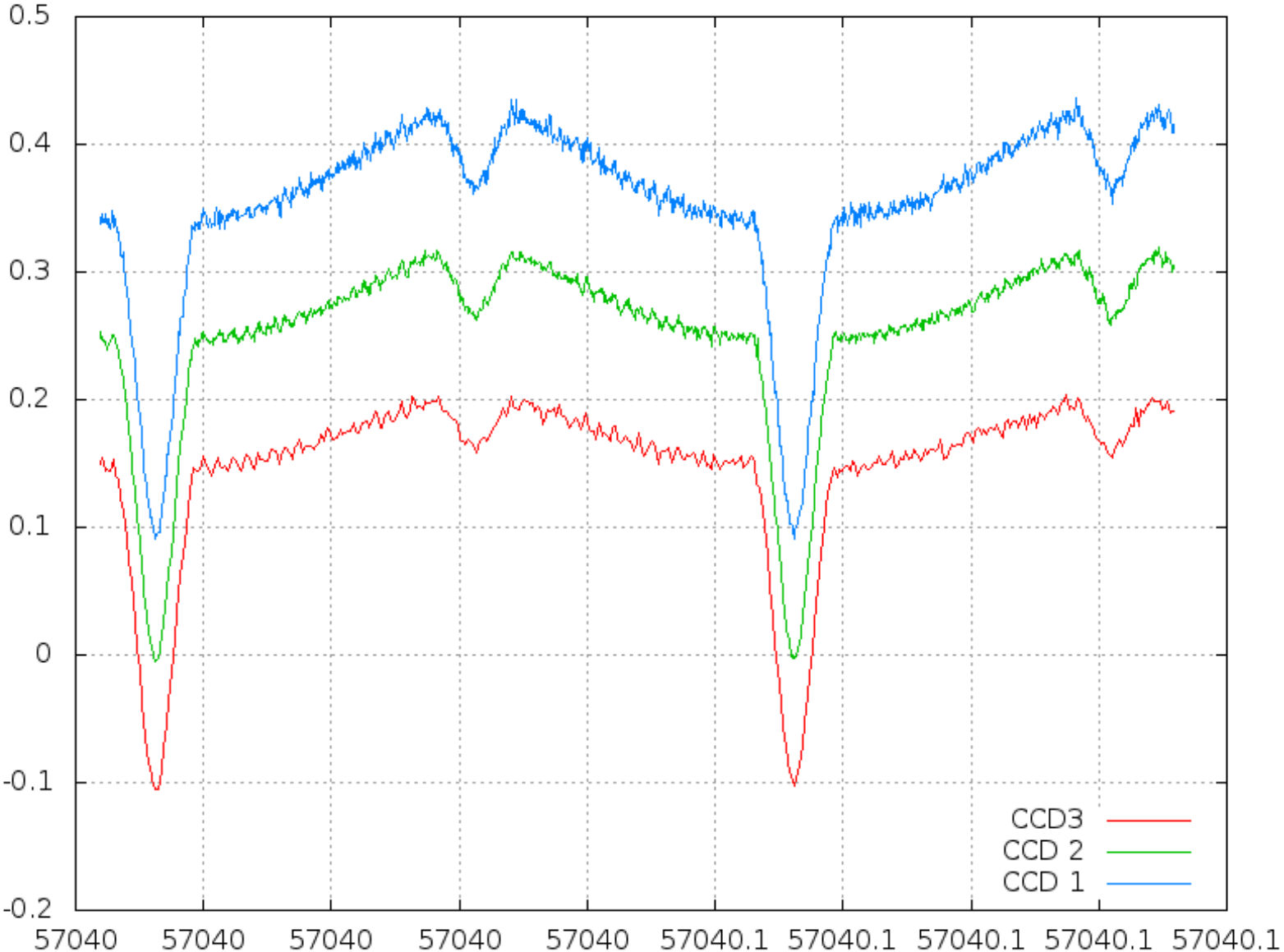

Figure : Ultracam light curve of PTF0724

Thank you for your attention!
Any questions?