

# Is EQ Boo a Quadruple System?

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**Abstract.** We present the precise multicolour photometry of the eclipsing variable EQ Boo ( $P = 5^d.43$ ,  $V = 8^m.8$ ), which is component “A” of the visual double star ADS 9422 (F7 V+G0 V,  $\rho = 1.3$ ”,  $\Delta mag = 0.7$ ). From the analysis of these data, we can propose the existence of the fourth component with a late spectral type.

**Keywords.** eclipsing binary, multiple system, stellar evolution

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## 1. Introduction

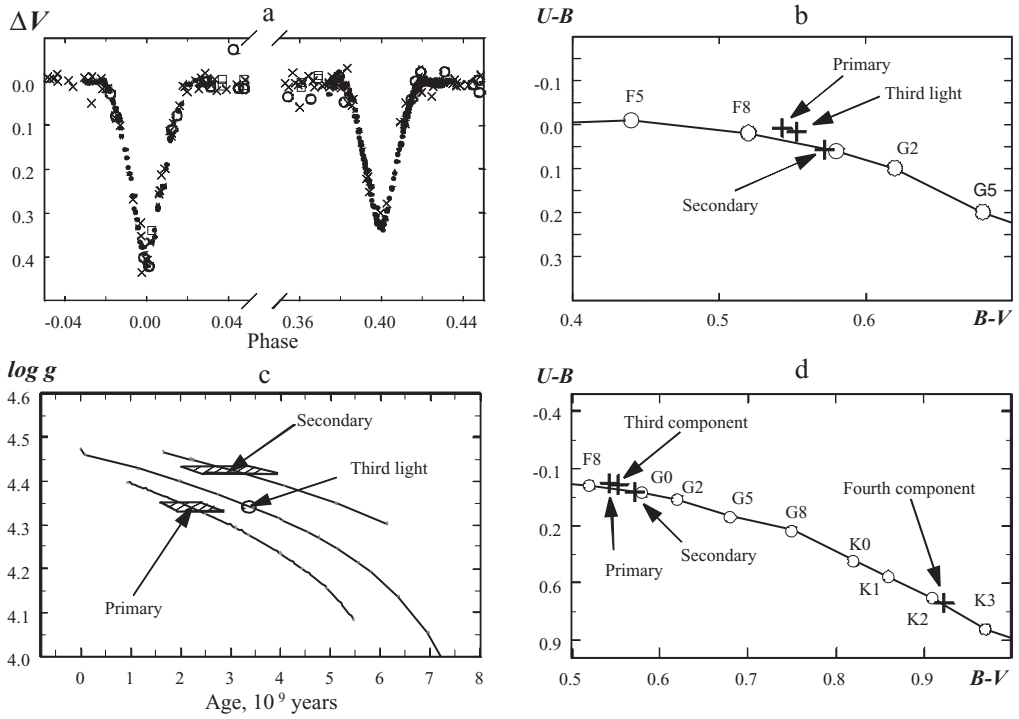
Otero *et al.* (2006) found the position of the secondary minimum of the eclipsing variable EQ Boo at the phase  $\phi(II) = 0.399$ , so its orbit is eccentric. We observed the star in 2007-2010 at the Zvenigorod, Crimean and Stará Lesná observatories. We obtained observations in two primary and three secondary minima. We always measured the brightness of both components of the visual double star together. Our techniques of the atmospheric extinction correction and the solution of the light curves were the same as those used in our previous papers: Volkov & Volkova (2009), Volkov *et al.* (2010).

## 2. Absolute parameters of the system

After the solution of our *UBVRI* light curves by the differential corrections method, we obtained absolute parameters of the system using Kepler’s third law and the mass-luminosity relation for main sequence stars (see Table 1). If we accept that the third light in the system is only due to the component “B”, which is unresolved in our observations, then the parameters of the three stars do not satisfy the value of the common age  $2.0 \cdot 10^9$  years. This contradiction can be resolved by assuming the existence of a fourth star with a later spectral type of K2 V in the system (Fig. 1d). The details of our work are published in Volkov *et al.* (2011).

## Acknowledgements

This research was partly supported by VEGA grants 2/0038/10 and 2/0094/11 (D. Chochoł), and by Russian Foundation for Basic Research grant 11-02-01213-a (I. M. Volkov and N. S. Volkova). We used in our work the SIMBAD database of the Strasbourg center of astronomical data (France) and the ADS service of NASA (USA).



**Figure 1.** a) The light curve of EQ Boo (points - our  $V$  photometry, crosses - ASAS (Pojmanski 2002), circles - Hipparcos (Perryman *et al.* 1997), squares - ROTSE (Woźniak *et al.* 2004)). b) The position of the components in the standard two-colour diagram. c) The evolutionary diagram for the stars with the masses from Table 1. d) The position of the components in the standard two-colour diagram taking into account the complicated structure of the third light.

**Table 1.** Absolute parameters of EQ Boo.

Parameter	Primary	Secondary	The third light
Mass, $M_{\odot}$	$1.15 \pm 0.05$	$1.05 \pm 0.04$	$1.11 \pm 0.07$
Radius, $R_{\odot}$	$1.19 \pm 0.03$	$1.03 \pm 0.03$	$1.16 \pm 0.05$
Luminosity, $L_{\odot}$	$1.45 \pm 0.08$	$1.04 \pm 0.07$	$1.26 \pm 0.08$
$T_{eff}$	$6120 \pm 100$ K	$5980 \pm 80$ K	$5940 \pm 80$ K
Spectral type (from our $UBV$ data)	F8 V	G0 V	G0 V

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