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Physical Parameters of the Visually Close Binary Systems Hip70973 and Hip72479

M. Al-Wardat

Physics Department, Yarmouk University, PO Box 566 Irbid, 21163 Jordan
and Department of Physics, Al-Hussein Bin Talal University,
PO Box 20, 71111 Ma'an, Jordan. Email: mwardat@ahu.edu.jo

Abstract: Atmospheric modelling of the components of the visually close binary systems Hip70973 and Hip72479 was used to estimate the individual physical parameters of their components. The model atmospheres were constructed using a grid of Kurucz solar metalicity blanketed models and used to compute a synthetic spectral energy distribution for each component separately, and hence for the combined system. The total observational spectral energy distributions of the systems were used as a reference for comparison with the synthetic ones. We used the feedback modified parameters and iteration method to obtain the best fit between synthetic and observational spectral energy distributions. The physical parameters of the components of the system Hip70973 were derived as $T^a_{\rm eff} = 5700 \pm 75$ K, $T^b_{\rm eff} = 5400 \pm 75$ K, $\log g_a = 4.50 \pm 0.05$, $\log g_b = 4.50 \pm 0.05$, $R_a = 0.98 \pm 0.07$ $R_\odot$, $R_b = 0.89 \pm 0.07$ $R_\odot$, and $\pi = 26.25 \pm 1.95$ mas, with G4 and G9 spectral types, and those of the system Hip72479 as $T^a_{\rm eff} = 5400 \pm 50$ K, $T^b_{\rm eff} = 5180 \pm 50$ K, $\log g_a = 4.50 \pm 0.05$, $\log g_b = 4.60 \pm 0.05$, $R_a = 0.89 \pm 0.07$ $R_\odot$, $R_b = 0.80 \pm 0.07$ $R_\odot$, and $\pi = 23.59 \pm 1.00$ mas, with G9 and K1 spectral types.

Keywords: stars: atmospheres — binaries: close — binaries: visual — stars: fundamental parameters — stars: individual: Hip70973 — stars: individual: Hip72479

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1 Introduction

The *Hipparcos* mission revealed that many previously known single stars were actually binary or multiple systems (Shatskii & Tokovinin 1998; Balega et al. 2002). Most of these resolved systems are nearby stars that appear as a single star even with the largest ground-based telescopes, except when we use high-resolution techniques like speckle interferometry (SI: Balega et al. 2002; Tokovinin, Mason, & Hartkopf 2010) and adaptive optics (AO: Roberts 2011; Roberts et al. 2005). These systems are known as visually close binary systems (VCBSs).

The study of binary systems plays an important role in determining several key stellar parameters, which is more complicated in the case of VCBS. Hundreds of binary systems with periods of the order of 10 years or fewer are routinely observed with high-resolution techniques. In spite of that, there is still a paucity of individual physical parameters for the components of the systems, so spectrophotometry with atmospheric modelling provides a complementary solution to this problem by giving an accurate determination of the effective temperature, radius and luminosity for each component of a binary system. The method was successfully applied to some binary systems like ADS11061, Cou1289, Cou1291, Hip11352 and Hip11253 (Al-Wardat 2002a, 2007, 2009; Al-Wardat & Widyan 2009).

The two binary systems Hip70973 and Hip72479 are well-known VCBSs. They therefore fulfil the requirements to be analysed by the aforementioned method in order to obtain their complete physical parameters. Table 1 contains basic data for the systems from SIMBAD, NASA/IPAC and the Geneva–Copenhagen survey of the Solar neighbourhood (Nordström et al. 2004). Table 2 contains data from *Hipparcos* and *Tycho* Catalogues (ESA 1997).

The system Hip70973 was discovered by Rossiter (1938.51) with the 27-inch (0.69-m) telescope at the Lamont–Hussey Observatory (Docobo et al. 2000). Orbits of the system had been calculated by Couteau (1960), Morel (1970), Heintz (1981; two orbits: the first one with period 45.4 yr and dynamical parallax 0.020 arcsec, and the second one with period 22.4 yr and dynamical parallax 0.029 arcsec), Söderhjelm (1999), and Docobo et al. (2000; elements of this orbit are listed in Table 3).

The system Hip72479 (ADS9397) was discovered by Aitken in 1916.40 at the Lick Observatory. Its orbits had been calculated by van den Bos (1954, 1945, 1964), Eggen (1965, 1967; different orbits using photometrical parallax 0.026 arcsec), Söderhjelm (1999), and Docobo et al. (2000; elements of this orbit are listed in Table 3).

The estimated parameters will enhance our knowledge about stellar parameters in general, and consequently help

Table 1. Basic data of the systems

	Hip70973 RST4529	Hip72479 A2983	Ref.
α_{2000}	$14^h31^m00\overset{s}{.}650$	$14^h49^m13\overset{s}{.}621$	1
δ_{2000}	$-05°48'08\overset{''}{.}46$	$+10°12'52\overset{''}{.}06$	1
WDS	$14310-0548$	$14492+1013$	1
Tyc	4996-131-1	921-918-1	1
HD	127352	130669	1
Sp. Typ.	G5	K2V	1
$E(B-V)$	0.0499	0.0268	2
A_v	$0\overset{m}{.}156$	$0\overset{m}{.}083$	2
$\log T_{\rm eff}$	3.722	3.705	3
[Fe/H]	-0.14	0.11	3
M_v	$4\overset{m}{.}75$	$5\overset{m}{.}32$	3

[1]SIMBAD.
[2]NASA/IPAC: `http://irsa.ipac.caltech.edu.`
[3]Nordström et al. (2004).

Table 2. Data from *Hipparcos* and *Tycho* catalogues

	Hip70973 HD127352	Hip72479 HD130669
V_J (*Hip*)	$7\overset{m}{.}68$	$8\overset{m}{.}42$
B_T	$8\overset{m}{.}667\pm0.014$	$9\overset{m}{.}540\pm0.020$
V_T	$7\overset{m}{.}781\pm0.011$	$8\overset{m}{.}534\pm0.014$
$(B-V)_J$ (*Tyc*)	$0\overset{m}{.}775\pm0.003$	$0\overset{m}{.}866\pm0.007$
π_{Hip} (mas)	26.04 ± 1.04	24.21 ± 1.29
π_{Tyc} (mas)	30.6 ± 8.7	20.8 ± 10.6
π^{a}_{Hip} (mas)	24.31 ± 0.89	22.59 ± 1.23

[a]Reanalysed *Hipparcos* parallax, van Leeuwen (2007).

Table 3. Orbital elements of the systems (Docobo et al. 2000)

Hip WDS	70973 $14310-0548$	72479 $14492+1013$
P (yr)	22.98 ± 0.30	9.98 ± 0.04
T^a	1993.62 ± 0.02	1988.059 ± 0.03
e	0.499 ± 0.010	0.491 ± 0.001
a (arcsec)	0.243 ± 0.002	0.127 ± 0.001
i (deg)	49.1 ± 2.0	45.8 ± 2.0
Ω (deg)	13.8 ± 2.0	142.3 ± 2.0
ω (deg)	121.0 ± 2.5	156.8 ± 3.0
$\pi_{\rm dyn}$ (mas)	23.2	21.1

[a]Periastron transit time (yr).

in understanding the formation and evolution mechanisms of binary stellar systems.

2 Atmospheric Modelling

2.1 Hip70973

We adopted the magnitude difference between the two components $\Delta m = 0.56$ mag as the average of all Δm measurements under the speckle filters 550 nm/40 and 551 nm/22 (see Table 4) as the closest filters to the visual. This value was used as an input to the equation

Table 4. Magnitude difference between components of the system Hip70973, along with filters used to obtain the observations

Δm	Filter ($\lambda/\Delta\lambda$)	Ref.
$0\overset{m}{.}42\pm0.15$	V_{Hip}: 550 nm/40	1
$0\overset{m}{.}52$	550 nm/40	2
$0\overset{m}{.}55$	698 nm/39	2
$0\overset{m}{.}60$	551 nm/22	3
$0\overset{m}{.}60$	657 nm/5	3

[1]ESA (1997).
[2]Horch et al. (2008).
[3]Tokovinin et al. (2010).

$$\frac{f_1}{f_2} = 2.512^{-\Delta m}, \tag{1}$$

along with the visual magnitude of the combined system $m_v = 7.68$ mag from Table 2 as an input to the equation

$$m_v = -2.5\log(f_1 + f_2). \tag{2}$$

From these we calculated a preliminary individual m_v for each component as $m_{va} = 8.19$ mag and $m_{vb} = 8.75$ mag.

Using the following main-sequence relations and tables (e.g. Lang 1992; Gray 2005):

$$M_v = m_v + 5 - 5\log(d) - A, \tag{3}$$

$$\log(R/R_\odot) = 0.5\log(L/L_\odot) - 2\log(T/T_\odot), \tag{4}$$

$$\log g = \log(M/M_\odot) - 2\log(R/R_\odot) + 4.43, \tag{5}$$

we calculated the preliminary input parameters (bolometric magnitudes, luminosities, and effective temperatures) of the individual components. We used bolometric corrections of Lang (1992) and Gray (2005), $T_\odot = 5777$ K and extinction (A_v) given in Table 1 by NASA/IPAC.

These calculated input parameters allow construction of model atmospheres for each component using grids of Kurucz's (1994) blanketed models (ATLAS9), where we used solar abundance model atmospheres. Hence a spectral energy distribution for each component can be built.

The total energy flux from a binary star is created from the net luminosity of the components *a* and *b* located at a distance *d* from the Earth. Thus, we can write

$$F_\lambda d^2 = H^a_\lambda R^2_a + H^b_\lambda R^2_b, \tag{6}$$

from which

$$F_\lambda = (R^2_a/d)^2[H^a_\lambda + H^b_\lambda \cdot (R_b/R_a)^2], \tag{7}$$

where H^a_λ and H^b_λ are the fluxes from a unit surface of the corresponding component. F_λ here represents the total spectral energy density (SED) of the system.

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Within the criteria of the best fit, which are the maximum values of the absolute flux, the shape of the continuum, and the profiles of the absorption lines, and starting with the preliminary calculated parameters, many attempts were made to achieve the best fit between the observed flux and the total computed one using the iteration method of different sets of parameters.

Using the *Hipparcos* modified parallax ($\pi = 24.31 \pm 0.89$ mas; Table 2), the best fit was achieved using the following set of parameters:

$$T^a_{\rm eff} = 5700 \pm 75\,{\rm K}, \qquad T^b_{\rm eff} = 5400 \pm 75\,{\rm K},$$
$$\log g_a = 4.50 \pm 0.05, \qquad \log g_b = 4.50 \pm 0.05,$$
$$R_a = 1.05 \pm 0.07\,{\rm R}_\odot, \qquad R_b = 0.96 \pm 0.07\,{\rm R}_\odot.$$

However, the values of the estimated radii disagree with those given by Gray (2005), Lang (1992) and the R–L–T relation (Equation 4) for main-sequence stars. According to Equation 7, this disagreement refers to a mis-estimation in the parallax of the system, which means that changing the parallax of the system affects the values of the radii of the components.

In order to reach reliable parameters for the system, therefore, we went the other way, i.e. we started with radii that are compatible with the tables of Gray (2005) and changed the parallax. Keeping in mind the values of the total observational V_J, B_T, V_T, and Δm as our goal in achieving the best fit between the synthetic and observational total absolute fluxes, we reached that using the following set of parameters (Figure 1):

$$T^a_{\rm eff} = 5700 \pm 75\,{\rm K}, \qquad T^b_{\rm eff} = 5400 \pm 75\,{\rm K},$$
$$\log g_a = 4.50 \pm 0.05, \qquad \log g_b = 4.50 \pm 0.05,$$
$$R_a = 0.98 \pm 0.07\,{\rm R}_\odot, \qquad R_b = 0.89 \pm 0.07\,{\rm R}_\odot,$$
$$d = 38.10 \pm 3.04\,{\rm pc} \qquad (\pi = 26.25 \pm 1.95\,{\rm mas}).$$

Thus the luminosities of the components follow as $L_a = 0.91 \pm 0.08\,{\rm L}_\odot$ and $L_b = 0.61 \pm 0.05\,{\rm L}_\odot$. These values represent the parameters of the system components adequately enough.

Figure 1 shows the best fit between the total synthetic SED and the observational one taken from Al-Wardat (2002b). Note that some of the strong lines and depressions, especially in the red part of the spectrum (around $\lambda\lambda$ 6867, 7200, and 7605 Å), are H_2O and O_2 telluric lines and depressions.

Depending on the tables of Gray (2005) or using Lang (1992)'s Sp–$T_{\rm eff}$ empirical relation, the spectral types of the components of the systems can be estimated as G4 and G9.

2.2 *Hip72479*

For this system we adopted the magnitude difference between the two components $\Delta m = 0.50$ mag, which is the average of all Δm measurements under the speckle filters 551 nm/22 (see Table 6) as the closest filters to the visual. This value, when used as an input to Equation 1, along with the total visual magnitude of the system $m_v = 8.534$ mag from Table 2 as an input to Equation 2, results in the preliminary individual m_v for each of the component as $m_{va} = 9.07$ mag and $m_{vb} = 9.57$ mag.

Following the same procedures explained in the previous section, and using the *Hipparcos* modified parallax measurement as initial input ($\pi = 22.59 \pm 1.23$, $d = 44.26$ pc) for the calculations, the best fit between the total synthetic

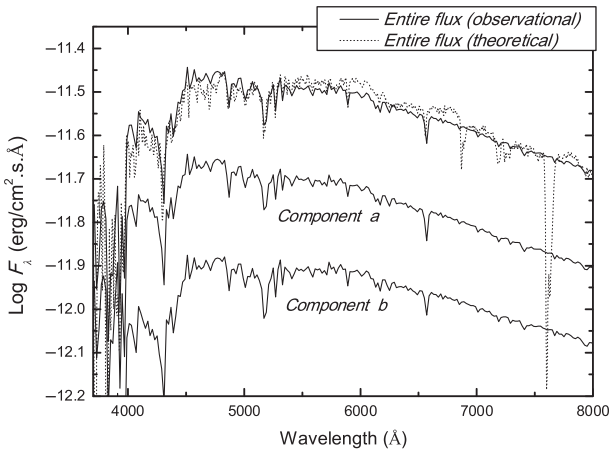

Figure 1 Dotted line: the total observational SED in the continuous spectrum of the system Hip70973. Solid lines: the total computed SED of the two components with $d = 38.10 \pm 3.04$ pc ($\pi = 26.25 \pm 1.95$ mas), the computed flux of the primary component with $T_{\rm eff} = 5700 \pm 75$ K, $\log g = 4.50 \pm 0.05$, $R = 0.98 \pm 0.07$ R$_\odot$, and the computed flux of the secondary component with $T_{\rm eff} = 5400 \pm 75$ K, $\log g = 4.50 \pm 0.05$, $R = 0.89 \pm 0.07$ R$_\odot$.

Table 5. Magnitude difference between components of the system Hip72479, along with filters used to obtain the observations

Δm	Filter ($\lambda/\Delta\lambda$)	Ref.
$0^{\rm m}_{.}09 \pm 0.72$	V_{Hip}: 550 nm/40	1
$1^{\rm m}_{.}00$	657 nm/5	2
$0^{\rm m}_{.}40$	551 nm/22	2
$0^{\rm m}_{.}70$	657 nm/5	2
$0^{\rm m}_{.}60$	551 nm/22	2

[1]ESA (1997).
[2]Tokovinin et al. (2010).

Table 6. Magnitude difference between the components of the system Hip72479, along with filter used to obtain the observations

Δm	Filter ($\lambda/\Delta\lambda$)	Ref.
$0^{\rm m}_{.}09 \pm 0.72$	V_{Hip}: 550 nm/40	1
$1^{\rm m}_{.}00$	657 nm/5	2
$0^{\rm m}_{.}40$	551 nm/22	2
$0^{\rm m}_{.}70$	657 nm/5	2
$0^{\rm m}_{.}60$	551 nm/22	2

[1]ESA (1997).
[2]Tokovinin et al. (2010).

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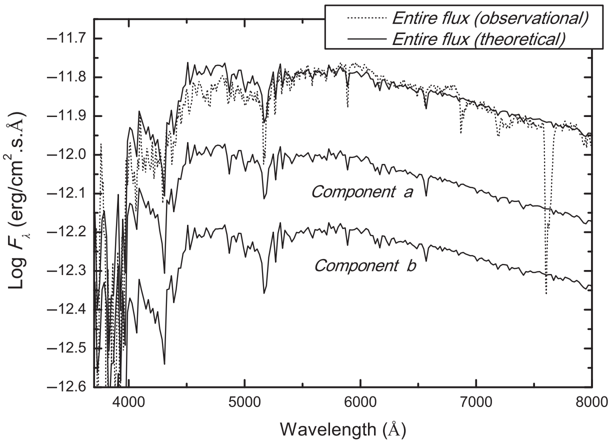

Figure 2 Dotted line: the total observational SED in the continuous spectrum of the system Hip72479. Solid lines: the total computed SED of the two components with $d = 42.40 \pm 1.85$ pc ($\pi = 23.59 \pm 1.00$ mas), the computed flux of the primary component with $T_{\rm eff} = 5400 \pm 50$ K, $\log g = 4.50 \pm 0.05$, $R = 0.89 \pm 0.07$ R$_\odot$, and the computed flux of the secondary component with $T_{\rm eff} = 5180 \pm 50$ K, $\log g = 4.60 \pm 0.05$, $R = 0.80 \pm 0.07$ R$_\odot$.

SED and the observational one taken from Al-Wardat (2002b) was achieved using the following set of parameters (Figure 2):

$$T^a_{\rm eff} = 5400 \pm 50\,{\rm K}, \quad T^b_{\rm eff} = 5180 \pm 50\,{\rm K},$$
$$\log g_a = 4.50 \pm 0.05, \quad \log g_b = 4.60 \pm 0.05,$$
$$R_a = 0.92 \pm 0.07\,{\rm R}_\odot \quad R_b = 0.84 \pm 0.07\,{\rm R}_\odot.$$

Again here, the values of the estimated radii do not fit exactly those given by Gray (2005), Lang (1992) and the R–L–T relation (Equation 4) for main-sequence stars. Therefore, we recalculated the absolute flux using the Gray (2005) radii as postulate values, leaving the parallax subject to change. Following the guidance of the total observational V_J, B_T, V_T, and Δm, the best fit between the synthetic and observational total absolute fluxes was achieved using the following set of parameters:

$$T^a_{\rm eff} = 5400 \pm 50\,{\rm K}, \quad T^b_{\rm eff} = 5180 \pm 50\,{\rm K},$$
$$\log g_a = 4.50 \pm 0.05, \quad \log g_b = 4.60 \pm 0.05,$$
$$R_a = 0.89 \pm 0.07\,{\rm R}_\odot, \quad R_b = 0.80 \pm 0.07\,{\rm R}_\odot,$$
$$d = 42.40 \pm 1.85\,{\rm pc} \quad (\pi = 23.59 \pm 1.00\,{\rm mas}).$$

Thus the luminosities follow as $L_a = 0.61 \pm 0.05$ L$_\odot$ and $L_b = 0.41 \pm 0.03$ L$_\odot$, with spectral types G9 and K1 for the primary and secondary components respectively.

3 Synthetic Photometry

In addition to a direct comparison, we can check the reliability of our method of estimating the physical and geometrical parameters by comparing the observed magnitudes of the combined system from different ground- or space-based telescopes with the synthetic ones. For that, we used the relation (Maíz Apellániz 2006, 2007)

Table 7. **Magnitudes and colour indices of the synthetic spectra of the system Hip70973**

Sys.	Fil.	Total $\sigma = \pm 0.03$	Comp. a	Comp. b
Joh-Cou.	U	8.74	9.17	9.96
	B	8.43	8.92	9.55
	V	7.68	8.20	8.73
	R	7.28	7.82	8.29
	$U-B$	0.31	0.25	0.41
	$B-V$	0.76	0.72	0.82
	$V-R$	0.41	0.38	0.44
Ström.	u	9.88	10.31	11.11
	v	8.84	9.30	9.99
	b	8.09	8.59	9.17
	y	7.65	8.17	8.69
	$u-v$	1.04	1.01	1.12
	$v-b$	0.75	0.71	0.82
	$b-y$	0.45	0.43	0.48
Tycho	B_T	8.63	9.10	9.77
	V_T	7.76	8.28	8.82
	$B_T - V_T$	0.87	0.83	0.95

$$m_p[F_{\lambda,s}(\lambda)] = -2.5 \log \frac{\int P_p(\lambda) F_{\lambda,s}(\lambda)\lambda\,{\rm d}\lambda}{\int P_p(\lambda) F_{\lambda,r}(\lambda)\lambda\,{\rm d}\lambda} + {\rm ZP}_p \quad (8)$$

to calculate the total and individual synthetic magnitudes of the systems, where m_p is the synthetic magnitude of the passband p, $P_p(\lambda)$ is the dimensionless sensitivity function of the passband p, $F_{\lambda,s}(\lambda)$ is the synthetic SED of the object and $F_{\lambda,r}(\lambda)$ is the SED of the reference star (Vega). Zero-points (ZP$_p$) from Maíz Apellániz (2007) and references therein were adopted.

The results of the calculated magnitudes and colour indices of the combined system and individual components, in different photometrical systems, are shown in Tables 7 and 8.

4 Results and Discussion

Looking deeply at the achieved best fit between the total synthetic SEDs and the observational ones (Figures 1 and 2), we see that there is a good overall coincidence in the maximum values of the absolute fluxes and the shape of the continuum, except for the blue part of the spectrum around λ4700 Å (Figure 3). Part of this disagreement is due to the lack of some opacities in the synthetic SEDs and to the difference in resolution between the synthetic and observational spectra.

A comparison between the synthetic magnitudes, colours and magnitude differences and the observational ones (Table 9) shows very good consistency within the error values. This gives a good indication of the reliability of the estimated parameters of the individual components of the system, which are listed in Tables 10 and 11.

Concerning the accuracy of our estimated parallaxes, it depends on the accuracy of the input radii, as is clear from

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Table 8. Magnitudes and colour indices of the synthetic spectra of the system Hip72479

Sys.	Fil.	Total $\sigma = \pm 0.03$	Comp. *a*	Comp. *b*
Joh-Cou.	U	9.74	10.19	10.91
	B	9.28	9.78	10.36
	V	8.43	8.96	9.47
	R	7.97	8.52	8.98
	$U-B$	0.46	0.41	0.56
	$B-V$	0.85	0.82	0.89
	$V-R$	0.46	0.44	0.49
Ström.	u	10.90	11.34	12.08
	v	9.74	10.22	10.86
	b	8.88	9.40	9.93
	y	8.39	8.92	9.37
	$u-v$	1.15	1.12	1.23
	$v-b$	0.86	0.82	0.92
	$b-y$	0.49	0.48	0.51
Tycho	B_T	9.51	10.00	10.60
	V_T	8.52	9.05	9.56
	$B_T - V_T$	0.98	0.95	1.04

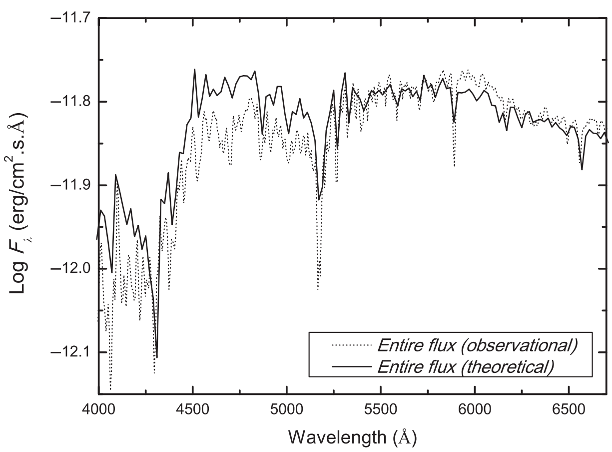

Figure 3 An expanded look at the fit between the total synthetic SEDs and the observational ones for the left part of the spectrum of the system Hip72479.

Table 9. Comparison between the observational and synthetic magnitudes, colours and magnitude differences for both systems

Hip70973	Obs.[a]	Synth. (this work)
V_J	$7^m.68$	$7^m.68 \pm 0.03$
B_T	$8^m.667 \pm 0.014$	$8^m.63 \pm 0.03$
V_T	$7^m.781 \pm 0.011$	$7^m.76 \pm 0.03$
$(B-V)_J$	$0^m.775 \pm 0.003$	$0^m.76 \pm 0.04$
Δm	$0^m.56$[b]	$0^m.53 \pm 0.04$
Hip72479	**Obs.[a]**	**Synth. (this work)**
V_J	$8^m.42$	$8^m.43 \pm 0.03$
B_T	$9^m.540 \pm 0.020$	$9^m.51 \pm 0.03$
V_T	$8^m.534 \pm 0.014$	$8^m.52 \pm 0.03$
$(B-V)_J$	$0^m.866 \pm 0.007$	$0^m.85 \pm 0.04$
Δm	$0^m.50$[b]	$0^m.51 \pm 0.04$

[a]See Table 2.
[b]Average value for the filters 550 nm/40 and 551 nm/22 (Tables 4 and 6).

Table 10. Parameters of the components of the system Hip70973

Component	*a*	*b*
$T_{\rm eff}$ (K)	5700 ± 75	5400 ± 75
Radius ($R_\odot$)	0.98 ± 0.07	0.89 ± 0.07
log g	4.50 ± 0.05	4.50 ± 0.05
L ($L_\odot$)	0.91 ± 0.08	0.61 ± 0.05
M_v^a	4.97 ± 0.10	5.77 ± 0.10
Mass ($M_\odot$)[a]	1.07 ± 0.08	0.94 ± 0.05
Sp. Type[a]	G4	G9
Parallax (mas)	26.25 ± 1.95	
Age (Gyr)	2.7 ± 0.3	

[a]Depending on the tables of Gray (2005).

Table 11. Parameters of the components of the system Hip72479

Component	*a*	*b*
$T_{\rm eff}$ (K)	5400 ± 50	5180 ± 50
Radius ($R_\odot$)	0.89 ± 0.07	0.80 ± 0.07
log g	4.50 ± 0.05	4.60 ± 0.05
L ($L_\odot$)	0.61 ± 0.05	0.41 ± 0.03
M_v^a	5.77 ± 0.10	6.25 ± 0.10
Mass ($M_\odot$)[a]	0.94 ± 0.05	0.85 ± 0.04
Sp. Type[a]	G9	K1
Parallax (mas)	23.59 ± 1.00	
Age (Gyr)	2.7 ± 0.3	

[a]Depending on the tables of Gray (2005).

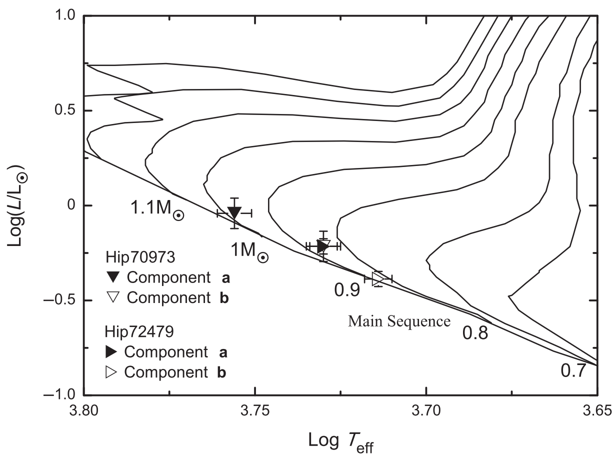

Figure 4 The components of the systems on the evolutionary tracks (solar abundance) of Girardi et al. (2000).

Equations 6 and 7. This means that the first solution, which depends on the *Hipparcos* new parallax, is not excluded at all, especially if we know that the values of the radii were higher in the tables of Gray (2005) in comparison with the tables of Lang (1992).

Figure 4 shows the positions of the components on the evolutionary tracks of Girardi et al. (2000), where the error bars in the figure include the effect of the parallax uncertainty. The ages of the systems can be established from the evolutionary tracks.

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It is clear from the parameters of the components of the systems and their positions on the evolutionary tracks that they are solar-type main-sequence stars in the early stages of their life. Depending on the formation theories, fragmentation is a possible process for the formation of the systems studied in this work. Bonnell (1994) concluded that fragmentation of a rotating disk around an incipient central protostar is possible, as long as there is continuing infall. Zinnecker & Mathieu (2001) pointed out that hierarchical fragmentation during rotational collapse has been invoked to produce binaries and multiple systems.

5 Conclusions

The analysis of the two VCBS, Hip70973 and Hip72479, using atmospheric modelling results in the following main conclusions.

(1) The parameters of the components of the systems were estimated depending on the best fit between the observational SED and synthetic ones built using atmospheric modelling of the individual components.
(2) New parallaxes of the systems were estimated from these stellar parameters.
(3) From the parameters of the components of the systems and their positions on the evolutionary tracks, we showed that the components within each system are similar solar-type main-sequence stars (G4 and G9 for Hip70973 and G9 and K1 for Hip72479).
(4) The total and individual *UBVR* Johnson–Cousins, *uvby* Strömgren and *BV Tycho* synthetic magnitudes and colours of the systems were calculated.
(5) Because of the high similarity of the two components within each system, fragmentation is proposed as the most likely process for the formation and evolution of both systems.

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