The Sun Like Star : HT Vir

Mehmet TANRIVER[1], Ferhat Fikri ÖZEREN[1]

[1] Erciyes University, Astronomy and Space Sciences Department, 38039, Kayseri, Turkey

Abstract

This study is focused on the photometric (light curve) analysis of the Sun like star HT Vir which is a binary star located in the ASAS catalogue, shows variation in W UMa (EW/KW) type. The solution of light curve was executed using the PHOBE code. We conducted an unspotted solution for the HT Vir binary system. The positions in the HR diagram of the components are also discussed.

1 INTRODUCTION

HT Vir is the sun like a photometric binary star. The general information belongs to this star are given the following Table2. HT Vir is an eclipsing variable with ESD (Eclipsing Semi-Detached) type according to data of ASAS catalog. The U, B, V, R, I, J, H and K bands magnitudes of the Sun were taken from (Tanrıver, 2012), Tanrıver (2014a), Tanrıver (2014b) and Tanrıver & Özeren (2016) as shown in Table**??**. As seen, it is in compliance the colour indices of the Sun with the colour indexes of HT Vir (see Table3).

Table 1: The informations of HT Vir

ASAS ID	134607+0506.9	J	6.11
RA (2000)	13:46:06.9	H	5.85
DEC (2000)	05:06:54.0	K	5.79
Period (day)	0.407672	V-J	1.10
T0 (2450000+)	2490.0	V-H	1.36
V	7.1	V-K	1.42
V_{Amp}	0.45	J-H	0.26
Class	EC/ESD	H-K	0.06
		J-K	0.32

Table 2: The colour indexes of the Sun (Tanrıver (2012), Tanrıver (2014a), Tanrıver (2014b)).

B-V	0.6457 ± 0.0421	V-J	1.1413 ± 0.1063
H-K	0.0572 ± 0.0351	U-B	0.1463 ± 0.0596
V-H	1.4613 ± 0.1183	J-K	0.3777 ± 0.0494
R-I	0.3403 ± 0.0356	V-K	1.5210 ± 0.1149
J-L	0.4187 ± 0.0558	U-V	0.7926 ± 0.1032
V-L	1.5167 ± 0.0959	J-M	0.3711 ± 0.0529
V-R	0.4674 ± 0.0639	V-M	1.4621 ± 0.0759
K-L	0.0403 ± 0.0517	V-I	0.7053 ± 0.0872
J-H	0.3196 ± 0.0432	K-M	0.0063 ± 0.0546

Table 3: Comparison the colour indexes of the Sun and star.

	V-J	V-K	J-K
The Sun	1.14	1.52	0.37
134607+1506.9 (HT Vir)	1.10	1.42	0.32

2 OBSERVATION AND PHOTOMETRIC SOLUTION

The light curves and data in the V band of HT Vir variable in the ASAS catalog have been taken into account (Pojmanski, 1997). The graphics according to the time (HJD) of the magnitudes (Vmag) is given in Figure1. The light curve according to phase of the stars is given in Figure2. The light curve created according to the average (averaged every each third point) is given in Figure3. The photometric solution was carried out using the PHOEBE interface with based Wilson-Devinney, photometric solution methods (see Figure4). While the photometric solution, hot component of the binary system is taken as a Sun like star. Physical parameters of hot component (temperature: 5800K, mass: $1M_{sun}$ and radius: $1R_{sun}$) which is compatible with the Sun are firstly kept constant during solution. The parameters obtained from the photometric solution results are given in Table4. The positions in the HR diagram of the component stars are given in Figure5.

3 CONCLUSION

HT Vir shows variation like W UMa (EW/KW) type. The component stars belong to a contact binary which filled Roche lobes and main sequence stars. The positions in the HR diagram of components are shown figure 5. Both components are Sun like stars.

Figure 1: The light curve according to HJD of the star (V band).

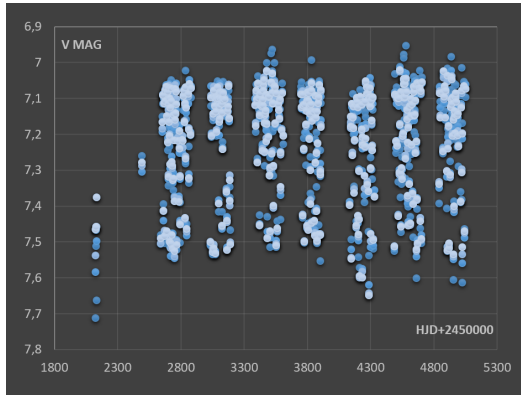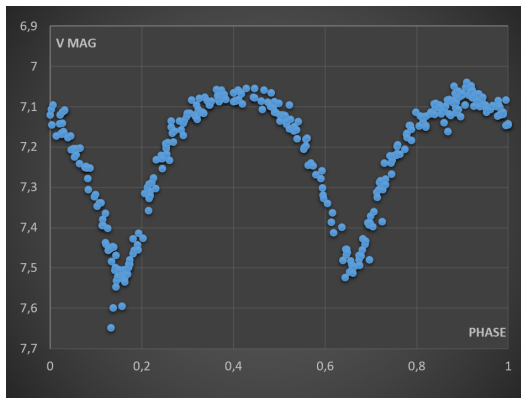Figure 2: The light curve according to phase of the star (V)

Figure 3: The average phase-magnitude light curve of the star (V band).
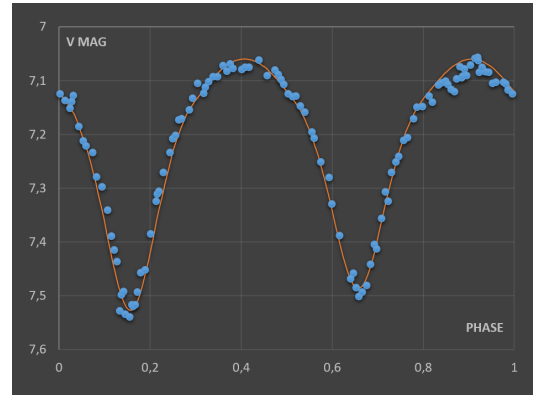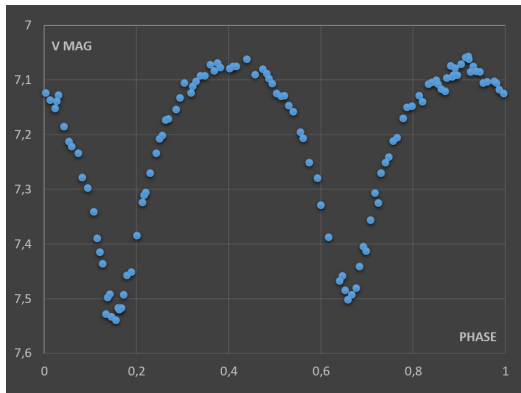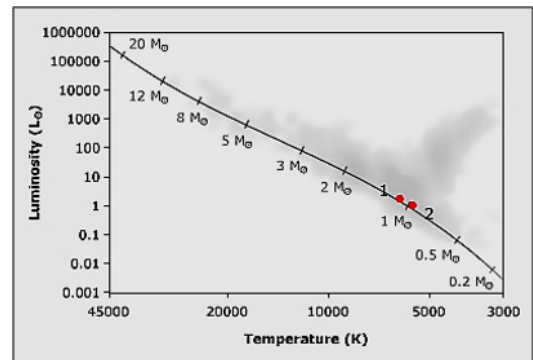

Figure 4: theoretical and observational light curves of the star (V band)

Figure 5: The positions in the HR diagram of the component stars

Table 4: Solution parameters.

Zero point of orbital ephemeris, T_0 (HJD)	24512490.0
Period of binary orbit, P (days)	0.407672
Phase shift	0.15679
Semi-major axis (SMA)	3.1 R_sun
Mass ratio (q)	0.815
Orbit inclination (i)	71.89365
Orbit eccentricity (e)	0.0
T_1	6100
T_2	5922
Surface potential($\Omega_1 = \Omega_2$)	3.442565
Bolometric albedo of stars (A_1, A_2)	0.5, 0.5
Gravity brightening of stars (g_1, g_2)	0.32, 0.32
Third light (l_3)	0.0
Linear limb darkening coefficients(x,y)	0.6458 0.2240

References

Pojmanski, G. 1997, AcA, 47, 467.

Tanrıver, M. 2012, 18th Congress of the National Astronomy and Space Sciences.

Tanrıver, M. 2014a, NewA, 28, 79.

Tanrıver, M. 2014b, NewA, 31, 20.

Tanrıver, M. & Özeren 2016, The 19th Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun.

Table 5: The absolute parameters.

$\Omega(L_1)$	3.442565	$Mbol_2$	4.094504
$\Omega(L_2)$	2.984983	$Mbol_1$	4.429334
M_1	1.329473 M_{sun}	$Log(g)_1$	4.378937
M_2	1.083520 M_{sun}	$Log(g)_2$	4.372581
R_1	1.233944 R_{sun}	L_1	1.891473 L_{sun}
R_2	1.122154 R_{sun}	L_2	1.389531 L_{sun}