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ABSOLUTE PARAMETERS AND PHOTOMETRIC PROPERTIES OF V1073 CYG AND V357 PEG

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Abstract. In this work, we present the photometric study of A-type contact binaries V1073 Cyg and V357 Peg. The simultaneous solutions of BVR light and radial velocity curves of the systems are given. During the analysis of the light curves of V357 Peg, we have used two models included hot and dark spots. The third light contribution was also found for V357 Peg. The absolute parameters of the components of V1073 Cyg and V357 Peg were also calculated.

Keywords: *binary stars: eclipsing, W UMa type binaries, stars: individual: V1073 Cyg, V357 Peg*

1. Introduction

V1073 Cyg (HD 204038, HIP 105739, BD +33 4252) was discovered as a variable by Strohmeier (1960). Fitzgerald (1964) observed the system spectroscopically and reported that V1073 Cyg has an elliptical orbit with the eccentricity e=0.115. Kondo (1966) derived photometric solution using the Russell and Merrill approach. Further observations were made by Bendinelli et al. (1967), Kruseman (1968), Sezer (1993) and Ekmekçi et al. (2012). Mass ratio of V1073 Cyg was given to be q=0.34 by Fitzgerald (1964) and reported the spectral type of the primary component as A3V. Spectroscopic observations of system were also made by Pribulla et al. (2006). They obtained the radial velocity curves of the components of V1073 Cyg and also found mass ratio of the system to be

q= 0.303. First O-C analysis of the system was made by Wolf and Diethelm (1992) and it was found that the orbital period of V1073 Cyg was decreasing.

V357 Peg (HD 222994, HIP 117185) was discovered by HIPPARCOS (ESA, 1997). First photometric observations of V357 Peg were obtained by Yaşarsoy et al. (2000). Rucinski et al. (2008) measured radial velocities of the components and given orbit solution of the system using the first spectroscopic observations. In that study, the mass ratio of V357 Peg was found to be 0.401. Very recently, a photometric work on V357 Peg was published by Ekmekçi et al. (2012).

2. Observations

V1073 Cyg and V357 Peg were observed during eight nights at the Çanakkale Onsekiz Mart University Observatory, using a 30 cm Schmidt-Cassegrain telescope with CCD camera SBIG STL-1001E. Comparison and check stars were selected as GSC 2711-2412 and GSC 2711-2014 for V1073 Cyg, and also GSC 2254-2520 and GSC 2254-2451 for V357 Peg, respectively.

3. Light Curve Analysis

The light curves of V1073 Cyg and V357 Peg were analysed with Wilson-Devinney (WD, Wilson & Devinney, 1971) code. Photometric analysis of systems was made by using BVR light and radial velocity curves, simultaneously. For V1073 Cyg and V357 Peg, the surface temperature of primary stars was taken from Cox (2000), as equal to 7300 K and 7000 K corresponding to A9 V and F2V spectral types, respectively. For details and other selected parameters of the solution, one can look at the study published by Soydugan et al. (2011). For the light curve solution of V1073 Cyg, we assumed a cool spot on the surface of the secondary component to represent the asymmetric region of the light curve. The resulted parameters are listed in Table 1, while theoretical light curves and the observational data of V1073 Cyg were shown in Fig. 1.

We used two different models for V357 Peg to represent the observational data. For the first model (Model 1), we assumed that there is a cool spot on the surface of the secondary component and in the other model (Model 2), an assumption of one hot spot on the surface of the primary component was used. The parameters obtained from two different models are given in Table 1. The observational data and the theoretical light curves obtained applying Model 1 and Model 2 for V357 Peg are shown in Fig. 2 and 3, respectively.

Table 1: Photometric parameters obtained from simultaneous analysis of BVR light curves of V1073 Cyg and V357 Peg.

Parameters	**V1073 Cyg**	**V357 Peg (Model 1)**	**V357 Peg (Model 2)**
P (day)	0.7858495	0.5784507	0.5784507
T_0 (HJD)	245792.39219	2452500.3031	2452500.3031
q (M_2/M_1)	0.3069(10)	0.3789(14)	0.3984(20)
Vγ (km/s)	-8.13(1)	10.1(4)	10.6(4)
i (°)	69.5(6)	82.6(4)	82.1 (1)
T_1 (K) ,T_2 (K)	7300, 6613(8)	7000, 7087(10)	7000, 6829(11)
Ω_1, Ω_2	2.4748(25), 2.4748	2.5294(32), 2.5294	2.5618 (31), 2.5618
L_3 (B,V,R)	-	0.22(4),0.20(4),0.18(4)	0.24(4),0.21(4),0.19(4)
L_1 / (L1+L2) (B,V,R)	0.821, 0.808, 0.799	0.689, 0.689, 0.688	0.711, 0.706, 0.703
Longitude	15 (2)	92 (3)	91 (2)
Latitude	358 (7)	314 (12)	344(10)
R_1, T_1	47 (3), 0.898	21 (3), 0.860(5)	91 (5), 1.021(5)

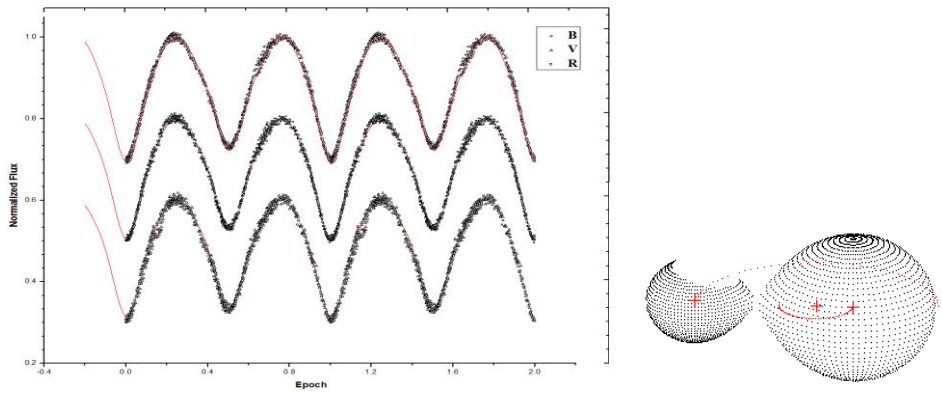

Figure 1: BVR light curves of V1073 Cyg with the theoretical ones (solid lines) and 3D model of the system's components.

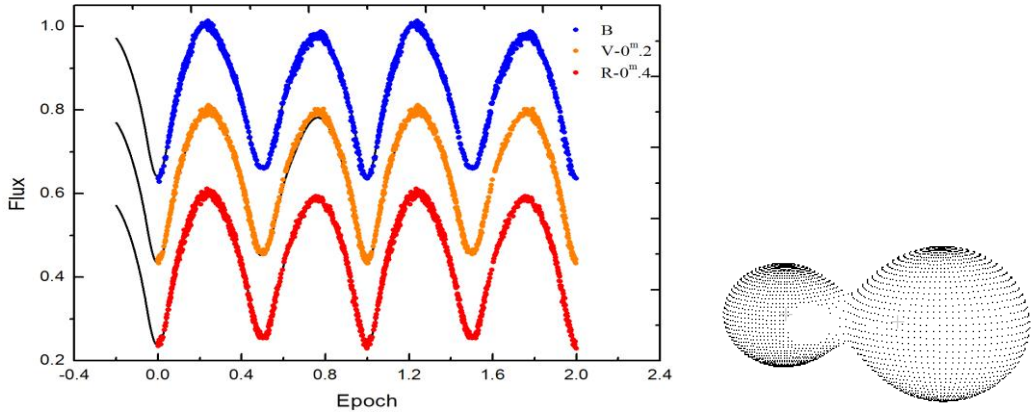

Figure 2. BVR light curves of V357 Peg with the theoretical ones included one dark spot (solid lines) and 3D model of the system's components.

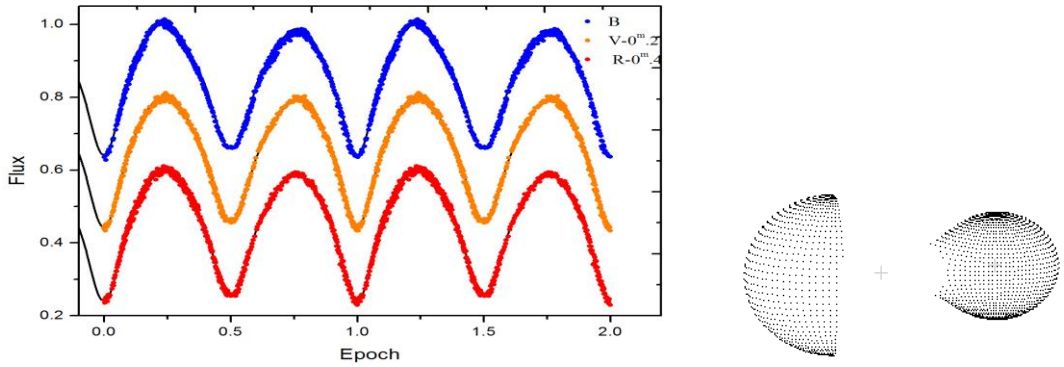

Figure 3. BVR light curves of V357 Peg with the theoretical ones included one hot spot (solid lines) and 3D model of the system's components.

4. Discussion

The photometric analysis of BVR light curves of V1073 Cyg and V357 Peg were presented. Using the results of simultaneous light and radial velocity data analysis, we have calculated the absolute parameters of the components of the targets and listed in Table 2. Asymmetries seen in the light curves of V1073 Cyg were modeled with the approach of cool spot on the surface of the cooler component. Also for V357 Peg, we have used two different models to represent asymmetries in the light curve. For both systems, the fillout factors were calculated to be 34 per cent for V1073 Cyg and also 45 per cent (Model 1), 46 per cent (Model 2) for V357 Peg. We have determined a third light contribution (20 per cent) for V357 Peg. Finally, the components of both systems are shown on the Hertzsprung–Russell diagram (H-R) which taken from Kalomeni et al. (2007) and seems to be compatible with components of the other well known W UMa stars.

Table 2: Absolute parameters of program systems.

System	V1073 Cyg	V357 Peg (Model 1)	V357 Peg (Model 2)
a ($R_\odot$)	4.86	3.76	3.83
$M_1(M_\odot)$, $M_2(M_\odot)$	1.91, 0.59	1.55, 0.59	1.62, 0.65
$R_1(R_\odot)$, $R_2(R_\odot)$	2.37, 1.38	1.87,1.24	1.89, 1.29
L_1 ($L_\odot$), L_2 ($L_\odot$)	14.29, 3.26	7.52, 2.10	7.68, 2.10
log g_1 (cgs)	3.97	4.09	4.09
log g_2 (cgs)	3.93	4.02	4.03

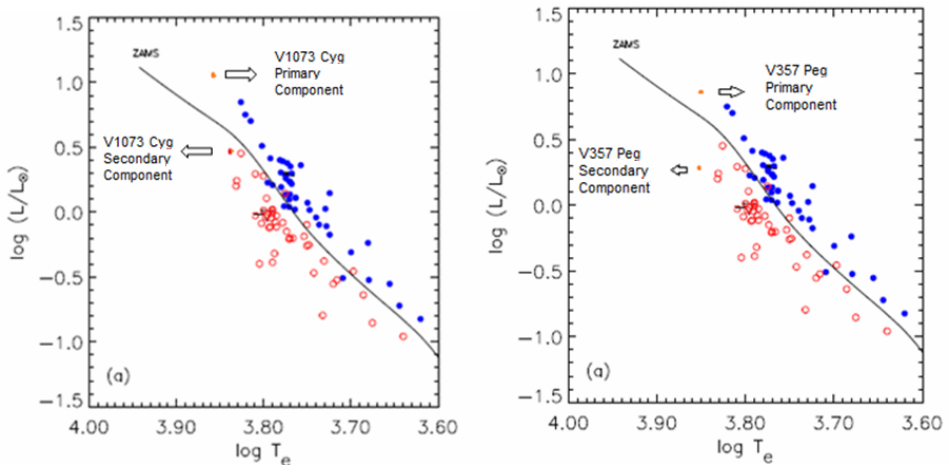

Figure 4. The H-R diagrams [6] showing V1073 Cyg and V357 Peg.

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REFERENCES

[1] Bendinelli, O., Catalano, S., Cristaldi, S., Delli Ponti, C., 1967. Publ. Oss., Astron. Univ. Bologna 9, 11.
[2] Cox, A.N., 2000. Allen's Astrophysical Quantities, 4th ed.

[3] Ekmekçi, F., Elmaslı, A., Yılmaz, M., Kılıçoğlu, T., Tanrıverdi, T., Baştürk, Ö., Şenavcı, H. V., Çalışkan, Ş., Albayrak, B., Selam, S. O., 2012, NewA, 17, 603
[4] Fitzgerald, M.P., 1964, Publ. of the David Dunalp Obs. 2, 417.
[5] Kalomeni, B., Yakut, K., Keskin, V., Değirmenci, Ö. L., Ulaş, B., Köse, O., 2007, AJ, 134, 642.
[6] Kondo, Y., 1966. AJ, 71, 54.
[7] Kruseman, P., 1967. Bull. of the Astron. Inst. of Netherlands Supp. Ser. 2, 377.
[8] Pribulla, Theodor, Rucinski, Slavek M., Lu, Wenxian, Mochnacki, Stefan W., Conidis, George, Blake, R. M., DeBond, Heide, Thomson, J. R., Pych, Wojtek, Ogłoza, Waldemar, Siwak, Michal, 2006, AJ, 132. 769
[9] Rucinski, S. M., Pribulla, T., Mochnacki, S. W. et al., 2008, AJ, 136, 586.
[10] Sezer, C., 1993. Ap&SS, 208, 15.
[11] Sezer, C., 1996. Ap&SS, 245, 89.
[12] Soydugan, E., Soydugan, F., Şenyüz, T., Püsküllü, Ç., Demircan, O., 2011, NewA, 16, 72.
[13] Strohmeier, W., 1960. Veroffentlichungen der Remeis-Sternwarte zu Bamberg, Nr. 27. Veranderlichen-Colloquium Bamberg 1959, p.1.
[14] Yaşarsoy, B., Sipahi, E., Keskin, V., 2000, IBVS, 4866, 1.
[15] Wolf, M., Diethelm, R., 1992, AcA, 42, 363.