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THE ORBIT OF THE O3 V + O8 V BINARY SYSTEM HD 93205

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RESUMEN

Presentamos aquí resultados preliminares de un nuevo estudio espectral del sistema binario O3 V + O8 V HD 93205. Las observaciones se han llevado a cabo con el espectrógrafo échelle Cassegrain REOSC instalado en el telescopio de 2.15-m del Complejo Astronómico El Leoncito (CASLEO), San Juan, Argentina. Combinando nuestros datos con otros disponibles en la literatura, hemos encontrado un período más probable de 6.0807 ± 0.0001 días para las variaciones de velocidad radial de la componente O3 V. La nueva solución orbital sugiere una excentricidad de 0.36 ± 0.01, algo inferior a la obtenida en otras investigaciones, y semiamplitudes de velocidad radial de $135 \pm 3\,\mathrm{km\,s^{-1}}$ y $334 \pm 4\,\mathrm{km\,s^{-1}}$ para ambas componentes del sistema binario, con lo que se derivan masas mínimas de 37 y 15 $M_\odot$, respectivamente.

ABSTRACT

We present preliminary results of a new spectral study of the O3 V + O8 V double lined binary system HD 93205. The observations have been carried out with the REOSC Cassegrain échelle spectrograph attached to the 2.15-m telescope at the Complejo Astronómico El Leoncito (CASLEO), San Juan, Argentina. Combining our data with other available from the literature we obtained a most probable period of 6.0807 ± 0.0001 days for the radial velocity variations of the O3 V component. The new orbital solution suggests an eccentricity of 0.36 ± 0.01, somewhat lower than that obtained previously, and radial velocity semiamplitudes of $135 \pm 3\,\mathrm{km\,s^{-1}}$ and $334 \pm 4\,\mathrm{km\,s^{-1}}$ for the binary components, resulting in minimun masses of 37 and 15 $M_\odot$, respectively.

Key words: **(STARS): BINARIES: SPECTROSCOPIC — STARS: EARLY-TYPE — STARS: INDIVIDUAL (HD 93205)**

1. INTRODUCTION

HD 93205 is a member of the open cluster Trumpler 16 in the Carina OB1 Association. This star was classified as O3 V by Walborn (1971), who also noticed its double-lined binary nature. The first radial velocity study of this binary was published by Conti & Walborn (1976). More recently, Stickland & Lloyd (1993), derived a new orbital solution from *IUE* observations. HD 93205 is at present the only O3 V-type star known to be a member of a double-lined binary system in our Galaxy. Therefore, the determination of even minimun masses for its components is of crucial astrophysical importance for the comparison between masses predicted from stellar evolutionary models (via star's luminosities) and empirical mass determinations obtained from binary orbits; which are lacking for the earliest spectral types. HD 93205 is also one of the targets included in the *X-ray Mega Campaign on Hot Stars*[4] for coordinated X-ray, radio and optical studies of colliding winds in hot binary systems.

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[4] Useful information about the X-ray Mega Campaign (along with an invitation to join it!) can be found at http://lheawww.gsfc.nasa.gov/users/corcoran/xmega/xmega.html.

2. OBSERVATIONS

High-resolution spectral observations of HD 93205 have been carried out during two observing runs in February 1997, at the Complejo Astronómico El Leoncito (CASLEO), San Juan, Argentina. We used the REOSC échelle Cassegrain spectrograph attached to the 2.15-m telescope, with a Tek 1024 × 1024 CCD as detector. This instrumental configuration gives a resolution of $\sim$ 14,000 in the blue region of the spectrum. The observed spectral range runs from 3500 Å to 6000 Å, and the signal to noise ratio for most of these data is between 100 and 200.

The observations were processed and measured for the determination of radial velocities. In order to check the stability of our radial velocity system, radial velocities from six spectra of the O-type star HR 2806 were measured, obtaining an average radial velocity of $26 \pm 1\,\mathrm{km\,s^{-1}}$, in excellent agreement with values previously determined by Garmany, Conti, & Massey (1980), Penny et al. (1993), and García et al. (1998).

3. RESULTS

A new orbital solution for HD 93205 was obtained from the analysis of radial velocities of both binary components. Results of the orbital solutions are presented in Table 1. Orbital elements derived in previous works, are also listed for comparison purposes. An improved period for the binary motion was derived considering the observations published by Conti & Walborn (1976) together with our new data. The most probable period obtained in this way, 6.0807 ± 0.0001 days, is in agreement with the value obtained by Conti & Walborn (1976).

TABLE 1

ORBITAL ELEMENTS OF HD 93205

		This Paper			Conti & Walborn			Stickland & Lloyd		
P	[days]	6.0807	±	0.0001	6.0810	±	0.00066	6.0820	±	0.0003
K_1	[km s^{-1}]	135	±	3	139	±	6	141	±	3
K_2	[km s^{-1}]	339	±	9	360	±	53	324	±	10
γ	[km s^{-1}]	13	±	2	3.6	±	2	29	±	2
e		0.36	±	0.01	0.49	±	0.03	0.436	±	0.01
ω_1	[°]	49	±	3	12	±	3	16	±	2
T_{0_1}	[HJD]	2450499.1	±	0.04						
T_{m_1}	[HJD]	2450498.7	±	0.04						
$a_1 \sin i$	[$R_\odot$]	15	±	0.45	14	±	0.67	15	±	0.3
$a_2 \sin i$	[$R_\odot$]	37.2	±	0.55						
$M_1 \sin^3 i$	[$M_\odot$]	37	±	2	39			33	±	3
$M_2 \sin^3 i$	[$M_\odot$]	15	±	2	15			14	±	2
$Q(M_2/M_1)$		0.4	±	0.01	0.38			0.42		

T_{m_1} represents the time of maximun radial velocity.

Figure 1 shows the radial velocity orbit of HD 93205 as derived from our new high-resolution observations. Radial velocities for the O3 V component (represented as crosses in Fig. 1) were derived from the average of 4 He II absorption lines, namely λλ4200, 4542, 4686, and 5411 Å. Radial velocities of the secondary component (represented as diamonds in Fig. 1) were computed from He II λ 4686 Å absorption only, being this the most intense and the least affected line by pair blending.

The new value obtained for the eccentricity is somewhat lower than the previously derived values. The observed difference in systemic velocity, if representing a real variation, might be an indication of apsidal motion, as was proposed by Stickland & Lloyd (1993).

In spectra obtained at phases of maximun velocity separation, double profiles are observed for He II λ 4686 Å, Balmer lines, and (barely) in other He II, and also He I lines. This might suggest the need of a slight revision of the spectral classification of O3 V and O8 V usually assigned to the binary components, in the sense that the primary could be of spectral type O4 V and the secondary about O7 V. Further observations of HD 93205 to be

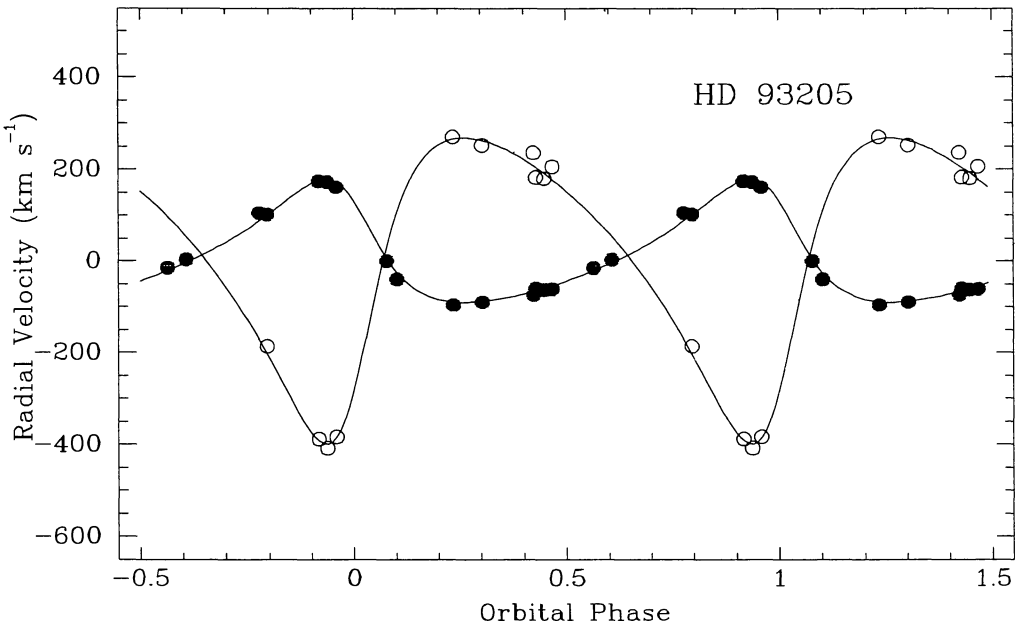

Fig. 1. Radial velocity curves of HD 93205. Filled and open symbols represent observed radial velocities of the O3 V and the O8 V components, respectively. Continuous lines represent the orbital solution derived for each component.

obtained at CASLEO will be combined with the data discussed in this paper, in order to improve our orbital solution and to derive more accurate spectral types for both binary components. With a better determined mass ratio, more reliable mass estimates for this interesting system will be possible.

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REFERENCES

Conti, P. S., & Walborn, N. R. 1976, ApJ, 207, 502
García, B., Malaroda, S., Levato, H., Morrell, N., & Grosso, M. 1998, PASP, 110, 53
Garmany, C. D., Conti, P. S., & Massey, P. 1980, ApJ, 242, 1063
Penny, L. R., Gies, D. R., Hartkopf, W. I., Mason, B. D., & Turner, N. H. 1993, PASP, 105, 588
Stickland, D. J., & Lloyd., C. 1993, The Observatory, 113, 256
Walborn, N. R. 1971, ApJ, 167, L31