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HD 150136: towards one of the most massive systems?

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Abstract. We present the preliminary results of an intensive monitoring devoted to HD 150136. Already quoted as an O3+O6 binary, we detected a third O-type component physically linked to the system, making it one of the nearest (1.3 kpc) most massive systems known until now ($\sim 134 M_{\odot}$). To determine the physical parameters of this system, we applied a disentangling program to study individually the three components. It allows us to constrain their spectral types and to derive a new orbital solution for the short-period system.

Keywords. stars: individual (HD 150136), binaries: spectroscopic, stars: fundamental parameters

1. Overview on HD 150136

HD 150136 was classified by Niemela & Gamen (2005) as an O3V+O6V binary system. This system has an orbital period of about 2.66 days and presents variability in the X-ray domain on a one-day time scale (Skinner *et al.* 2005).

Sixty-four spectra of HD 150136 were collected from 1999 to 2006 and 14 others in 2009 with the 1.5m and 2.2m telescopes, at La Silla, equipped with FEROS. These high-resolution spectra allowed us to detect a third component and to derive spectral types of O3, O6 and O6.5–O7 for the primary, the secondary and the third star, respectively.

2. Orbital solution of the short-term binary and properties of the third star

We used a disentangling program, based on the method of González & Levato (2006) and adapted to triple systems, which also measures the radial velocities (RVs) by cross-correlation even at phases where the spectra are heavily blended. We applied a Fourier method (Heck *et al.* 1985) to the differences of these RVs to refine the orbital period of the short-term system. This yields a period of 2.67±0.01 days, i.e., similar to the previous one (Niemela & Gamen 2005). The RV curve is given in Fig. 1 (left panel) whilst the orbital parameters are listed in Table 1 (T_0 refers the time of the primary conjunction). We fitted the primary and the secondary by using the CMFGEN atmosphere code (Hillier & Miller 1998). The stellar parameters were constrained as in Mahy *et al.* (2010) but we were not able to estimate the wind parameters because the wind diagnostic lines, in the optical domain, present variations impossible to disentangle. We derived $T_{\rm eff}$ of about

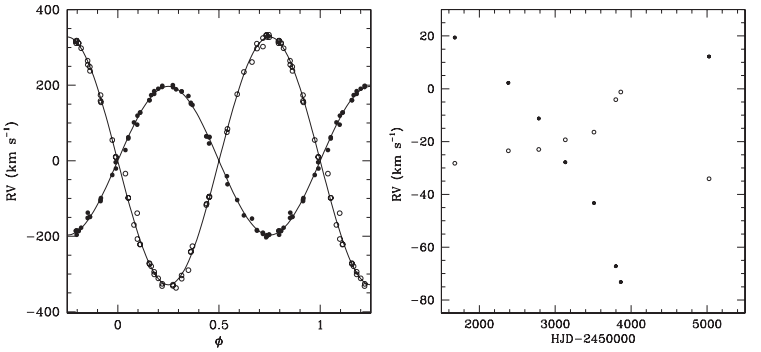

Figure 1. *Left:* RV curve of the short-term binary system. Full circles indicate the primary, the open ones represent the secondary star. *Right:* Evolution of the RVs of the third component and the mean systemic velocity of the short-period binary (full/open circles) as a function of time.

Table 1. Orbital parameters of the short-term binary system.

Parameters	Primary	Secondary
P(days)	2.67 ± 0.01	
e	0.0 (fixed)	
T_0 (HJD)	2 451 318.518 ± 0.002	
K (km s^{-1})	196.9 ± 1.0	328.3 ± 1.7
a sin i ($R_\odot$)	10.4 ± 0.1	17.3 ± 0.1
M sin^3 i ($M_\odot$)	25.1 ± 0.3	15.0 ± 0.2
Q (M_1/M_2)	1.667 ± 0.009	
rms (km s^{-1})	9.75	

45.7 and 39.8 kK, $\log(L/L_\odot)$ of 5.85 and 5.43 and $\log g$ of 4.0, for the primary and the secondary, respectively, suggesting respective masses of 67 and 40 $M_\odot$.

The evolution with time of the RVs of the third component and of the mean systemic velocity of the short-period binary (Fig. 1, right panel) reveals, for the first time, that the three components are physically linked. The expected period of this long-term system is certainly larger than 10 years and the orbit is clearly eccentric.

3. Future works and conclusions

The high-resolution of our data allowed us to show the existence of a 3rd component in the HD 150136 system. However, we are not yet able to constrain with high accuracy the parameters of this 3rd star. The short-term binary system is composed of O3V and O6V stars, probably in contact (Skinner *et al.* 2005), with an inclination close to 46°. This system also likely features a wind interaction zone, as revealed by the complex profile variations of the He II 4686 and H_α lines. This will be investigated in a future paper.

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