A Spectroscopic Study of HD 208905

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1 Introduction

HD 208905 (SAO 19758, ADS 15466 AB, CCDM J21573+6118 AB) is a multiple system in the Cep OB2 association, (V=7.0, B1V, $B-V$=0.09, $U-B$=-0.74). The spectrum is composite showing triple absorption profiles. Based on the observed line-strengths, all the three components are believed to be early-type stars. Numerous astrometric measurements, both classical and speckle-interferometrical, can be found in the literature. These data clearly show two components, AB, separated by 300 to 400 mas. On the other hand, only very few RV data were published. Daflon in [1] presented a preliminary study of radial velocities of HD 208905 suggesting variations with a period between 13 and 27 days. Here we report new results of the RV measurements on spectra taken at McDonald, Ondřejov and Palomar Observatories from 1991 till 2005. The first orbital solution for the close pair was obtained. Twenty one spectra were successfully decomposed into three components through the use of the spectral disentangling code KOREL.

2 Spectroscopy

First observations of HD 208905 used in this study were obtained in 1991 when an echelle spectrum was secured with the 60-inch telescope at Palomar Mountain. Observations continued from 1993 till 2003 with the 2.1-m and 2.7-m telescopes at McDonald Observatory. At Ondřejov, observations started in 2003 with the 2.0-m telescope. With one exception, the spectra taken at two American observatories are from echelle spectrographs, while the Ondřejov data were secured with a classical coudé spectrograph, imaging the Hα and He I 6678 Å region on a SITe 2000 x 800-px chip. Altogether 46 spectra were used in this study. They were all measured for radial velocity. As already mentioned in the introduction, HD 208905 shows triple absorption profiles. Therefore, whenever possible, the positions of individual components were determined. The velocities of the strongest component of He I 6678 Å line measured on 21 Ondřejov spectrograms were analyzed with the PDM code

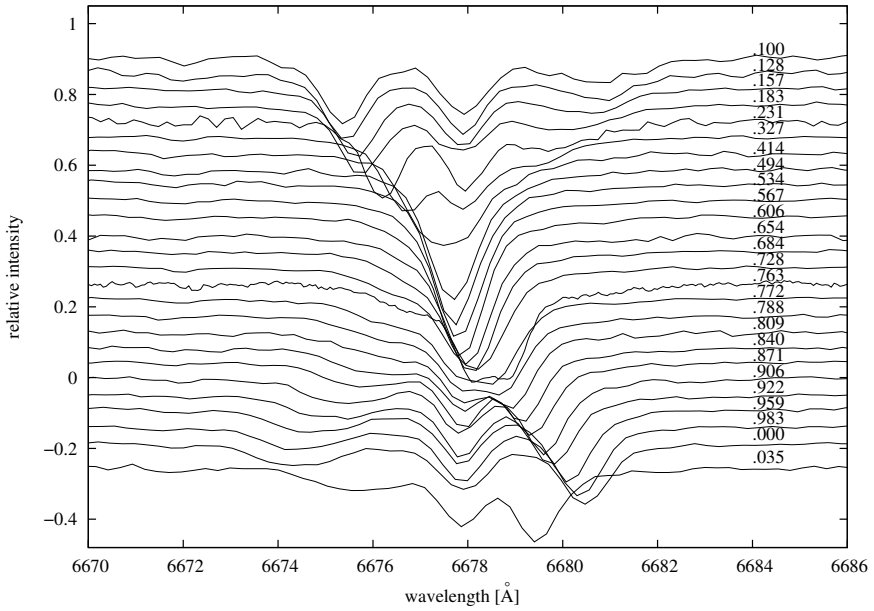

Fig. 1. Montage of helium profiles in the spectrum of HD 208905 folded with the period P=25.6606 days. Phase is shown on the right. Note the abrupt change of the profiles between phases 0.000 (maximum velocity of primary component), 0.035 and 0.100 due to high eccentricity of the orbit

[8]. A 25.7-day period was found. In Fig. 1 we show the variation of the He I 6678 Å line with the phase of the period from Table 1. Two components, Aa and Ab, one sharp and the other shallow, clearly move in anti-phase of the 25.7-day period, while the third B, also sharp, has either a constant velocity or is moving very slowly. We therefore decided to determine a preliminary orbital solution for the system A.

3 Orbital Solution

We combined 16 velocities from Palomar and McDonald spectra (based on metal lines) with 30 velocities obtained at Ondřejov (based on the He I 6678 Å line). Using the code SPEL [5] we derived the orbital solution presented in Table 1.

Fig. 2 shows the corresponding radial velocity curve. It is clear that the velocities in phases, where the component separation is small, cannot be determined very reliably. We tried therefore to decompose the spectra using the KOREL code [4] for spectral disentangling. It was applied to 18 spectra taken at Ondřejov and 3 spectra taken at McDonald and Palomar Observatories.

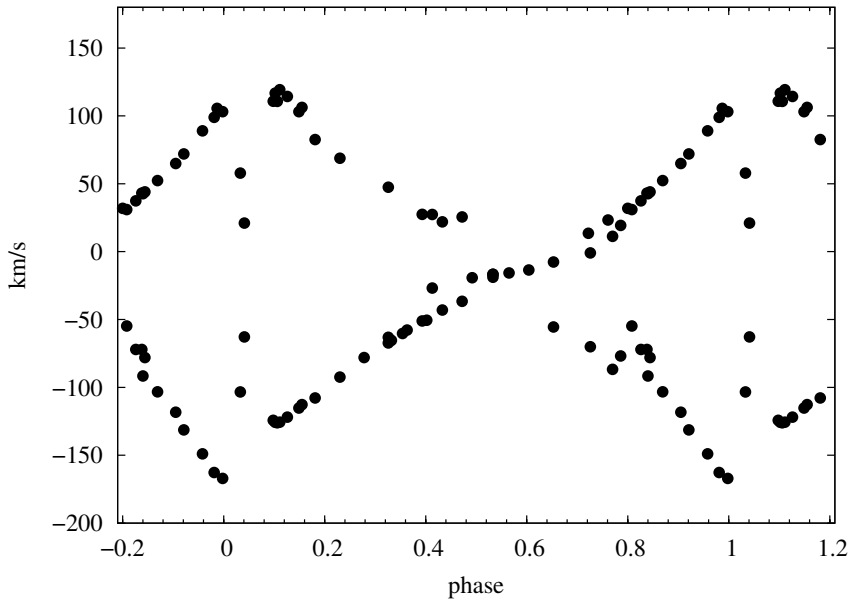

Fig. 2. Radial velocity curve of HD 208905 based on measurements of 46 spectra taken between 1991 and 2005. Velocities are phased with the period and RV max given in Table 1

Table 1. Orbital elements of HD 208905

P (d)	25.66060 ±0.00027
$T_{\rm periastron}$ J.D.	48542.73 ±0.10
e	0.684 ±0.013
ω (deg)	84.53 ±1.32
K_1 (km.s^{-1})	114.34 ±2.30
K_2 (km.s^{-1})	140.55 ±2.99
γ (km.s^{-1})	-16.92 ±0.93
rms (km.s^{-1})	7.799
Number of spectra	46

The profiles of individual components in He I 6678 Å line are presented in Fig. 3. The velocity of the third component determined by KOREL varied within few km.s^{-1} during the time span of the observations. It seems that its velocity has been constant or nearly constant over more than 5000 days. This might suggest a very long period for the pair AB. Interestingly enough, this pair has been observed and measured by many observers since 1930's [6]. In modern time, speckle interferometry measurements from 1980 [7] till 1994 [3] give separation of A and B between 400 and 420 mas and a position angle around 170 deg. The only measurement from 1997 [2] states slightly different

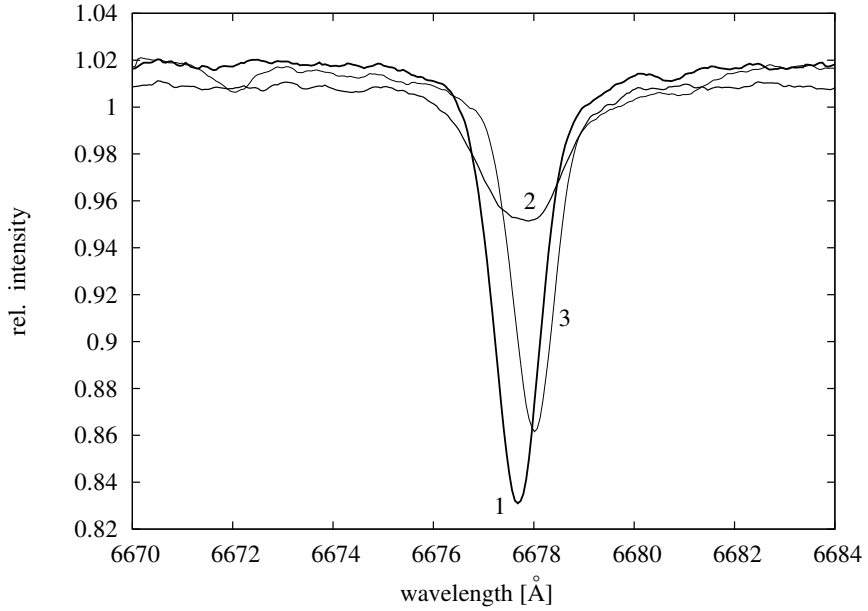

Fig. 3. Disentangled components of He I 6678 Å using KOREL code. The components of the close pair, 1 and 2, show small velocity shift, while the component 3 is shifted by about 15 km.s^{-1}

values (440 mas, 168 deg). One can thus speculate if the pair AB (CCDM J21573+6118) is not a mere coincidental pair.

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