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Spectroscopic orbit determination of two metal-weak dwarf stars: HD 64491 and HD 141851

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Abstract. Based on high-resolution CCD spectra, radial velocity curves of HD 64491 and HD 141851 have been studied. Both stars are SB1 spectroscopic binaries with metal-weak characteristics. The PHOEBE code was used to derive the spectroscopic orbit solutions. The following parameters have been calculated for HD 64491: $P_{\mathrm{orb}} = 187.8$ days, $e = 0.5$, $a \sin i = 0.39$ AU, $q = m2/m1 \leqq 0.65$. For the other star HD 141851 we have obtained: $P_{\mathrm{orb}} = 1073$ days, $e = 0.7$, $a \sin i = 1.15$ AU, and $q = m2/m1 \leqq 0.5$.

Key words: stars: chemically peculiar – stars: binaries: orbital elements

1. Introduction

HD 64491 and HD 141851 are classified as λ Boo type stars. This small group of chemically peculiar stars represents less than 2% of stars between spectral types A0 and F0. The typical abundance pattern includes underabundances of Fe-peak elements up to a factor of 100 and solar abundances of C, N, O and S. This pattern is similar to that of the interstellar medium. A recent hypothesis (Kamp, Paunzen 2002) suggests that the observed abundances could be a result of a star passing through a diffuse interstellar cloud. Selective diffusion of gases and accretion in the stellar atmosphere are able to produce the underabundances of Fe-peak elements. The existence of a binary system with only one λ Boo component, especially if the mass-ratio is close to 1.0, can rule out this idea. Accurate orbital elements of the systems and chemical compositions of components' stellar atmospheres may help to solve the riddle of their origin.

2. The stars

HD 64491 is a main sequence star first classified as Ap (Abt, Morell 1995) and then confirmed as a kA3hF0mA3 V λ Boo star. Uesugi and Fukuda (1982) give a rotational velocity of $v \sin i = 75$ km s^{-1}, whereas Abt and Morell (1995) give 15 km s^{-1}. The first notification as an SB1 was given by Kamp *et al.* (2001).

Using speckle interferometry Marchetti *et al.* (2001) found only an upper limit of 124 mas for the separation of the components. Paunzen *et al.* (2005) derived preliminary a orbital period of the system $P = 189$ days.

HD 141851 is a close visual binary system with a separation of $0\farcs1$ between the components. This star was classified as A3vp by Abt and Morell (1995), who list the rotational velocity of the primary component to be $v \sin i = 185$ km s^{-1}

3. Observations and results

We observed at the coudé focus of the 2-m RCC telescope at the Bulgarian National Astronomical Observatory Rozhen using the Photometrics AT200 CCD camera. The spectra were obtained in the NaD region with a resolving power of $R \sim 30\,000$. Standard IRAF procedures were used for bias subtraction, flat-fielding, and wavelength calibration. The radial velocity curves were obtained by means of the PHOEBE (PHysics Of Eclipsing BinariEs) software, developed from the Wilson-Devinney code (Prša, Zwitter 2005).

HD 64491 In this system we observe the secondary component. The lines of the primary are too broad to be seen in this region. We obtain for the system mass ratio $q = m2/m1 \leqq 0.65 \pm 0.1$, where m2 is the mass of the star whose lines are detected in our spectra. The period is $P = 187.8 \pm 1.5$ days, the semi-major axis is $a \sin i = 0.39$ AU, and the eccentricity is $e = 0.5 \pm 0.1$.

HD 141851 As this star is a close visual binary system the amplitude of the radial velocity curve is small - about 12 km s^{-1}. The observed semi-major axis is quite large - $a \sin i = 1.15$ AU, and the eccentricity e is also high - $e = 0.7 \pm 0.15$. The orbital period is $P = 1073 \pm 10$ days and we estimate the mass-ratio to be $q = m2/m1 \leqq 0.5 \pm 0.1$.

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