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ON THE ORBITAL PERIODS OF TWO BONA-FIDE λ BOOTIS STARS HD 64491 AND HD 141851

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We report about the first estimation of the orbital periods for two apparent spectroscopic binary (SB hereafter) systems: HD 64491 ($V = 6\overset{\rm m}{.}22$, HR 3083, HIP 38723) and HD 141851 ($V = 5\overset{\rm m}{.}10$, HR 5895, HIP 77660). Both stars were classified as bona-fide λ Bootis candidates in the literature because at this time they were believed to be apparent single objects. This group is characterized as comprise of late B to early F-type, Population I objects which exhibit a nearly solar abundance of C, N, O and S whereas the Fe-peak elements are significantly sub-solar. There are two SB systems in which both components are true λ Bootis type objects established via a detailed abundance analysis, namely HD 84948 and HD 171948 (Paunzen et al. 1998a).

No detailed abundance analysis which takes the binarity nature into account has been published for our two program stars up to now. Until such an analysis has been done, a question mark has to be set behind the apparent λ Bootis classification. Let us now discuss the two objects in more detail.

HD 64491 was first classified as A9 Vp (λ Boo) by Abt & Morrell (1995) and confirmed as kA3hF0mA3 V (λ Boo) by Paunzen & Gray (1997). Note that Uesugi & Fukuda (1982) give a projected rotational velocity of 75 kms^{-1} whereas Abt & Morrell (1995) list 15 kms^{-1}. Marchetti et al. (2001) performed speckle interferometry for this star and found only an upper limit of 124 mas for the separation of possible components. The first notification of the SB nature for this object is given by Kamp et al. (2001) who investigated high resolution spectra centered at 8670 Å. Paunzen et al. (1998b) reported δ Scuti type pulsation for this object with a period of 71 minutes and an amplitude of 9 mmag in Strömgren b which makes it especially interesting for further studies applying the tools of asteroseismology.

HD 141851 is known as close visual binary with a separation of $0\overset{''}{.}1$ but without data about the luminosity of the components (Faraggiana & Bonifacio 1999). Abt (1984) classified this star as A3 Vnp (Mg wk) whereas Abt & Morrell (1995) and Paunzen et al.

(2001) list A3 Vp (4481 wk) and A2 Va, respectively. Abt & Morrell (1995) give a $v \sin i$ value of 185 kms^{-1}. This system consists probably of a hot and a very cool component since it was identified as a X-ray source by Hünsch et al. (1998). No variability with an upper limit of 4.2 mmag in Strömgren b was found (Paunzen et al. 1998b).

Table 1: The observations for HD 64491 (upper section) and HD 141851 (lower section)

HJD	RV [kms^{-1}]	σ(RV) [kms^{-1}]	Obs.
2450925.6351	+22.2	0.6	KPNO; 0.9 m; Coudé
2451238.4985	+6.3	0.8	BNAO; 2.0 m; Coudé
2451238.5257	+7.5	0.7	BNAO
2451888.5126	+40.2	0.7	BNAO
2451891.4220	+36.1	1.1	BNAO
2451913.3713	+22.3	1.2	BNAO
2451914.4005	+19.6	0.8	BNAO
2451920.4512	+22.6	0.6	BNAO
2451921.3880	+21.5	0.7	BNAO
2451971.3864	+11.9	0.9	BNAO
2451973.3791	+12.6	0.6	BNAO
2451977.2216	+11.7	1.0	BNAO
2452003.2919	+7.4	0.8	BNAO
2452004.2442	+8.9	0.8	BNAO
2452152.5931	+15.4	0.7	BNAO
2449885.5946	−95	7	LNA; 1.6 m, Coudé
2449885.5946	−115	15	LNA
2450495.6312	−26	10	ASIAGO; 1.8 m, Echelle
2450664.4413	−39	5	CASLEO; 2.15 m, Echelle
2451234.5377	−10	3	BNAO
2451236.4845	−8	3	BNAO
2451238.5538	−12	3	BNAO
2451284.4546	−17	3	BNAO
2451296.4247	−20	5	BNAO
2451307.4360	−19	4	BNAO
2452003.4438	−12	2	BNAO
2452069.3324	−9	2	BNAO
2452090.2856	−7	3	BNAO
2452123.2754	−9	2	BNAO
2452150.2469	−9	2	BNAO

Table 1 lists the Heliocentric Julian Dates, the average radial velocity, its mean error and the observatories where the measurements were done. The average radial velocities were calculated from individual measurements of several lines with the correction for the mean heliocentric velocity. The errors are much larger for HD 141851 than for the moderate rotator HD 66491 because there is one hot, fast rotating, component superposed with a very cool slow rotating one with very weak lines in the used spectral domain (mainly the Na D doublet). Figure 1 shows the measurements graphically.

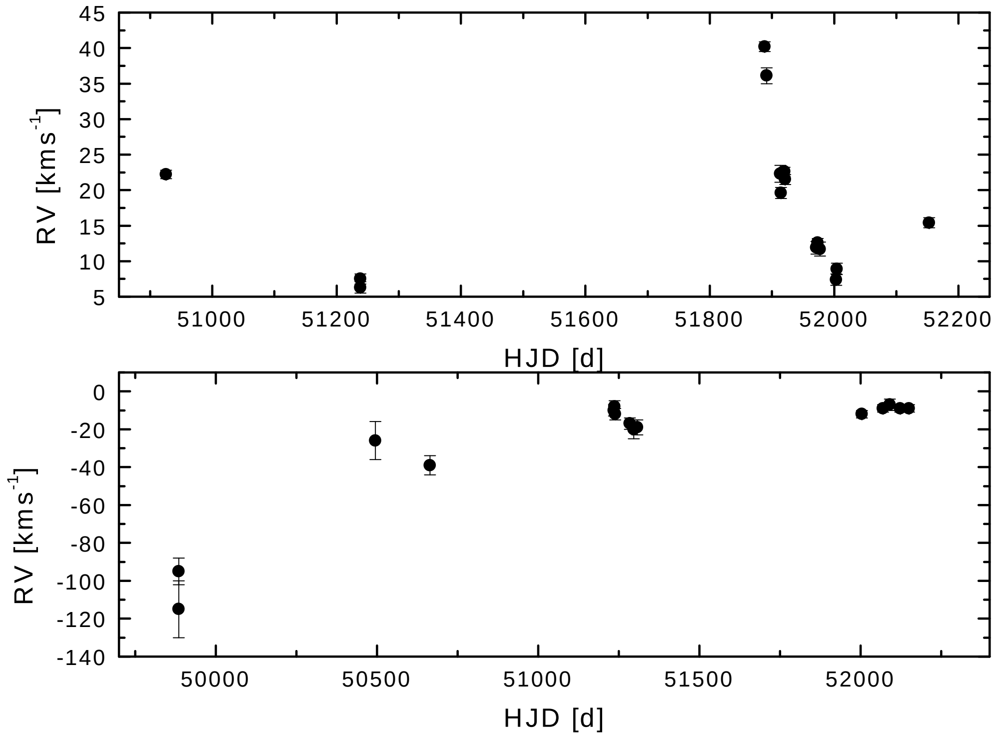

Figure 1. The radial velocity curves for HD 64491 (upper panel) and HD 141851 (lower panel) as listed in Table 1

Due to the temporal distribution of our observations, classical time series algorithm such as Fourier techniques, sine fits or the Phase-Dispersion-Minimization does not result in a reasonable solution. From an examination of Table 1 we are able to conclude that the orbital period for HD 64491 is between 230 days (taking the measurements at HJD 2451888.5126 and 2452003.2919 as half the period) and 760 days (taking the two "minima" at HJD 2451238.4985 and 2452003.2919 as hypothetical real period).

The orbital period for HD 141851 is significant longer than the time base of our available observations (2265 days). Due to the shape of the radial velocity curve (Figure 1) we think that the period is at least ten times longer than the actual time base of our observations.

Further radial velocity measurements and a detailed abundance analysis for both objects taking into account the binarity are needed to shed more light on the true nature of these systems.

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