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Multiplicity among solar-type stars

IV. The CORAVEL radial velocities and the spectroscopic orbits of nearby K dwarfs*,**

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ABSTRACT

Context. The statistical properties of binary stars are clues for understanding their formation process. A radial velocity survey was carried on amongst nearby G-type stars and the results were published in 1991.

Aims. The survey of radial velocity measurements was extended towards K-type stars.

Methods. A sample of 261 K-type stars was observed with the spectrovelocimeter CORAVEL (COrrelation RAdial VELocities). Those stars with a variable radial velocity were detected on the basis of the $P(\chi^2)$ test. The orbital elements of the spectroscopic binaries were then derived.

Results. The statistical properties of binary stars were derived from these observations and published in 2003. We present the catalogue of the radial velocity measurements obtained with CORAVEL for all the K stars of the survey and the orbital elements derived for 34 spectroscopic systems. In addition, the catalogue contains eight G-type spectroscopic binaries that have received additional measurements since 1991 and for which the orbital elements are revised or derived for the first time.

Key words. solar neighborhood – binaries: spectroscopic – stars: solar-type – stars: late-type

1. Introduction

The spectrovelocimeter CORAVEL (COrrelation RAdial VELocities; Baranne et al. 1979) was installed on the Swiss 1-m telescope at the Observatory of Haute-Provence (OHP) from the late 1970s until its decommissioning in 2000. Amongst other programmes, it provided the radial-velocity (RV) measurements exploited in two statistical studies of binarity among the stars in the solar neighbourhood: the study of solar–type stars until G8, and its extension towards the K-type stars. A series of articles has been devoted to these programmes. The first (Duquennoy et al. 1991; Paper I hereafter) presented the radial-velocity measurements of the sample of F-G type stars; these data led to the orbital elements of several spectroscopic binaries (SBs), and to the statistical properties of solar-type binaries (Duquennoy & Mayor 1991; DM91 hereafter). Later, Halbwachs et al. (2003; Paper III hereafter) extended the statistical investigations to the K-type binaries with periods shorter than ten years, again on the basis of CORAVEL observations. This paper presented the parameters relevant for statistics, namely the periods, the semi-amplitudes, the mass ratios, and the orbital eccentricities of the spectroscopic binaries, excluding the other orbital elements. The long period K-type binaries were eventually studied by Eggenberger et al. (2004).

The present paper completes the series by presenting the radial velocity measurements and the full set of orbital elements that gave rise to Paper III. It will give the orbits we have discovered all the visibility they deserve, so that they are henceforth taken into account in statistical studies, such as that of Raghavan et al. (2010). Moreover, they will be available for the validation of the spectroscopic orbits derived from the Radial Velocity Spectrometer of the *Gaia* satellite (Gaia Collaboration 2016). The CORAVEL programme is presented in Sect. 2, the RV catalogue is in Sect. 3, and the spectroscopic orbital elements are in Sect. 4. Section 5 is the conclusion.

2. The CORAVEL survey of nearby K-type stars

The CORAVEL survey for nearby SBs was initiated in the early 1980s, although some stars (especially among the F–G types) had been measured before. The stars were taken from the second edition of the Catalogue of Nearby Stars (CNS; Gliese 1969) and from its supplement (Gliese & Jahreiss 1979). The stars discarded from the preliminary third version of the CNS (CNS3; Gliese & Jahreiss 1991) were kept in the observing runs. All stars were observed with CORAVEL from the Haute-Provence Observatory. Due to the location of the instrument and to its characteristics, only the stars as late as F7 and northern to −15° in declination were observed. Some stars with declination below −15° were observed, but they were not taken into account in Paper III. The programme was split according to the spectral types of the stars: the search for SBs amongst 288 F-G stars ended in December 1989, but the detection of SBs amongst the

* Based on photoelectric radial-velocity measurements collected at Haute-Provence Observatory.
** Tables A.1 and A.2 are also available at the CDS via anonymous ftp to cdsarc.u-strasbg.fr (130.79.128.5) or via http://cdsarc.u-strasbg.fr/viz-bin/qcat?J/A+A/619/A81

Table 1. Sample records of the RV measurement catalogues.

GJ	epoch		RV	σ_{RV}	comp.	Remark
	yymmdd	BJD−2 400 000	km s^{-1}	km s^{-1}		
5	780213	43553.279	−5.90	0.41	1	
5	780825	43746.491	−7.00	0.32	1	
5	780914	43766.509	−6.08	0.35	1	
5	830903	45581.567	−5.92	0.33	1	
5	851219	46419.286	−6.52	0.31	1	
..	..	..	..	..	.	
53.1A	771103	43451.441	6.94	0.32	1	
..	..	..	..	..	.	
1124	870330	46885.380	−54.20	0.89	2	R
1069	970821	50681.6321	24.440	0.044	1	
..	..	..	..	..	.	
554	980109	50822.7302	−18.863	0.014	1	R

Notes. The first records refer to CORAVEL RVs, and the last records refer to the file of the Elodie RV measurements.

K-type stars was intensively performed until July 1993. After this date, the SBs were observed until 2000; at the same time, the RV of a few stars were still measured in order to confirm that it was constant.

3. Radial-velocity catalogues

3.1. CORAVEL individual measurements

The catalogue of the RV measurements provides 5413 measurements for 269 stars: 261 K-type stars and eight stars from the sample of DM91. These eight G-type stars were already in Paper I or another paper quoted in DM91, but they fulfil two conditions: they received enough additional RV measurements between 1991 and 2000 to significantly improve their spectroscopic orbit, and this new CORAVEL orbit was not published elsewhere. Moreover, the reduction of the CORAVEL observations was slightly improved, and the RV measurements are not exactly the same as in Paper I.

The format of the catalogue is presented in Table 1. Each record consists in the following data:

- The number of the star in the CNS, followed by a letter designating the component, if any.
- The epoch of the observation, given as a date with the year, the month, and the day, and also as barycentric Julian Day (BJD).
- The RV, in km s^{-1}.
- The uncertainty of the RV.
- The index of component (“1” for the primary, “2” for the secondary).
- A flag “R” indicates the measurement was discarded from the calculation of the orbital elements.

The records are sorted by stars (from the smallest to the largest right ascension), and then by observation epochs.

3.2. Elodie individual measurements

The CORAVEL observations were not sufficiently accurate to derive valuable SB orbital elements for two stars of the sample, GJ 1069 and GJ 554. The latter of these two stars is even a constant velocity star when only the CORAVEL RVs are considered. Fortunately, RV measurements were performed thanks to the spectrograph Elodie of the 193 cm telescope at the Haute-Provence Observatory, and they are provided by the Elodie archive[1]. Fifteen Elodie RVs of GJ 1069 and 58 RVs of GJ 554 are presented in a separate file, with a slightly different format due to their accuracy. The uncertainties of the Elodie RVs were estimated as explained in Sect. 4.1. Sample records are presented at the end of Table 1.

3.3. The mean RV and the detection of SBs

The RV measurements were used to derive statistical information to decide whether a star is binary or not. These data are provided in Table A.1. The content is the following:

- The identification of the star is the CNS number (GJ), as in the RV catalogue, and another identification, which is HD when it exists, otherwise BD, or HIP, or AG (Astronomische Gesellschaft catalogue). Three stars are designated only by the GJ identification; these stars are all visual secondary components, as indicated by letter “B” following their GJ number: GJ 57.1B, GJ 615.1B, and GJ 764.1B.
- The $B-V$ colour index used to derive the CORAVEL RVs of the star. For the eight stars from the G-type sample, $B-V = 0.63$ was assumed.
- The mean RV, $\overline{RV}$. When the star is a binary with known orbital elements, the RV of the barycentre is provided, as it is in Table A.2.
- ϵ is the uncertainty of $\overline{RV}$.
- σ_{RV} is the standard deviation of the RV measurements.
- E/I is the ratio of external to internal errors.
- $P(\chi^2)$ is the probability to obtain the χ^2 of the RVs of the star, assuming that the RV is constant in reality.
- N_1 is the number of observations of the star.
- N_{tot} is the number of RV measurements of the primary and of the secondary components.
- ΔT is the time span of the observation.
- The spectroscopic status is “CST” (ConStanT) when $P(\chi^2)$ is more than 1%. Otherwise, it is SB1, or SB2 when the RV of the secondary component was measured. An “O” indicates that the orbital elements were derived, as explained in Sect. 4 hereafter. One star, GJ 554, has a constant CORAVEL RV, but an SB orbit derived by adding Elodie RV; this star is flagged “CSTO”. The status of two stars (GJ 893.2B and GJ 907.1) is “?” since only one RV measurement was obtained; these stars have both declinations around −10°, and are too faint to be easily observable. However, they were

[1] http://atlas.obs-hp.fr/elodie/

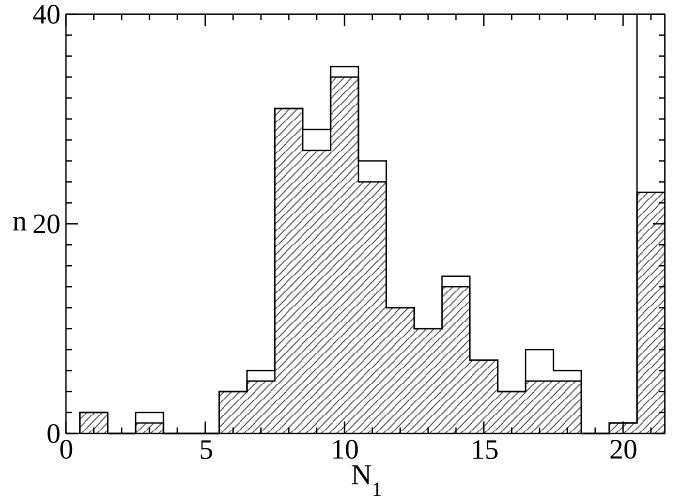

Fig. 1. Histogram of the number of observations. The shaded area refers to the stars that were not considered as variable and the white area to the spectroscopic binaries. The last bin represents all the stars with at least 21 observations; for the spectroscopic binaries, the count in this bin is 72.

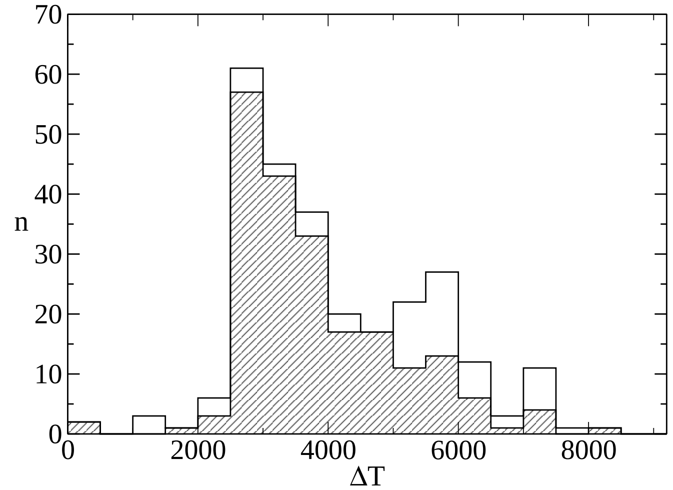

Fig. 2. Histogram of the time span of the observations. The shaded area refers to the stars that were not considered as variable and the white area to the spectroscopic binaries.

only in the so-called "extended sample" of Paper III, and they were not relevant in the statistical investigations.

– A flag indicates that the SB orbital elements of the star are in Table A.2, "*" when they are derived for the first time, and "+" otherwise. The velocity curves of the flagged stars are in Figs. 3–5.

The efficiency of the detection of the SBs depends on the time spans of the RV survey and on the numbers of RV measurements per star. The histograms of N_1 and of ΔT are presented in Figs. 1 and 2, respectively. The stars with variable RV are counted apart from the others, since they received more observations when their variability was detected.

It appears from Fig. 1 that a few stars received much less observations than the others. In addition to the two stars with only one observation already mentioned above, two stars have three observations, although one of them have a variable RV. This star is GJ 142, which was not taken into account in the binarity statistics because its declination is close to −20°. The other star is GJ 764.1B; it is difficult to observe since it is 5 arcsec away from its brighter companion GJ 764.1A, and it is only in the "extended" sample.

Half of the 209 constant RV stars received 11 observations or less. For the 269 stars in Table A.1, the median number of observations is 12.

The distribution of the time span, Fig. 2, also indicates that a few stars seem to have been less well observed than others. In addition to the two stars with one measurement and $\Delta T = 0$, 3 stars were observed during less than 1500 days, although their RVs were variable. In fact, these stars are GJ 1124, GJ 343.1, and GJ 870, three short-period binaries, and their observations were completed in a few years; they received enough RV measurements to derive their orbital elements, which are listed in Table A.2. The median time span is 3689 days for all the 270 stars, and 3410 days for the 209 constant RV stars.

4. Orbital elements of the spectroscopic binaries

4.1. *Taking into account the Elodie RV measurements of GJ 1069 and GJ 554*

The accuracy of the CORAVEL RVs precludes the derivation of relevant orbital elements for GJ 1069 and GJ 554, and it was necessary to take into account RVs provided by the Elodie archive. For that purpose, the uncertainty of the Elodie RVs must be estimated in order to assign them a reliable weight with respect to the CORAVEL RVs. For each star, the same weight was assigned to all the Elodie RV measurements and the SB orbital elements were derived from Elodie alone. The residuals of the RVs were calculated and the uncertainty of the RVs was then chosen so that the F_2 estimator of the goodness-of-fit is zero. According to Stuart & Ord (1994), F_2 is derived from theRV formula

$$F_2 = \left(\frac{9\nu}{2}\right)^{1/2} \left[\left(\frac{\chi^2}{\nu}\right)^{1/3} + \frac{2}{9\nu} - 1\right], \tag{1}$$

where ν is the number of degrees of freedom and χ^2 is the weighted sum of the squares of the differences between the predicted and the observed RVs, normalised with respect to their uncertainties. It was thus found that the uncertainty is 44 m s^{-1} for GJ 1069 and 14 m s^{-1} for GJ 554. The final elements were then derived taking into account simultaneously the RVs from Elodie and those of CORAVEL. A systematic offset between the two sets of measurements was derived with the SB solution. It is worth noticing that, although the CORAVEL RVs have weights much smaller than those of Elodie, they slightly improve the accuracy of the solution terms.

4.2. *Presentation of the orbital elements*

We used the RV measurements to derive the SB orbital elements for all stars sufficiently observed. The number of these stars is 45; they are flagged "O" in Table A.1. An SB orbit based on our CORAVEL RV measurements has already been published for three of them: GJ 1064B, GJ 692.1, and GJ 765.2; the orbits of the last two stars are even SB+VB orbits, since interferometric observations were also taken into account; the references of these three orbits are given in the footnotes of Table A.1. The SB orbital elements of the remaining 42 stars are listed in Table A.2. Since two stars are triple spectroscopic systems, this table contains 44 orbits.

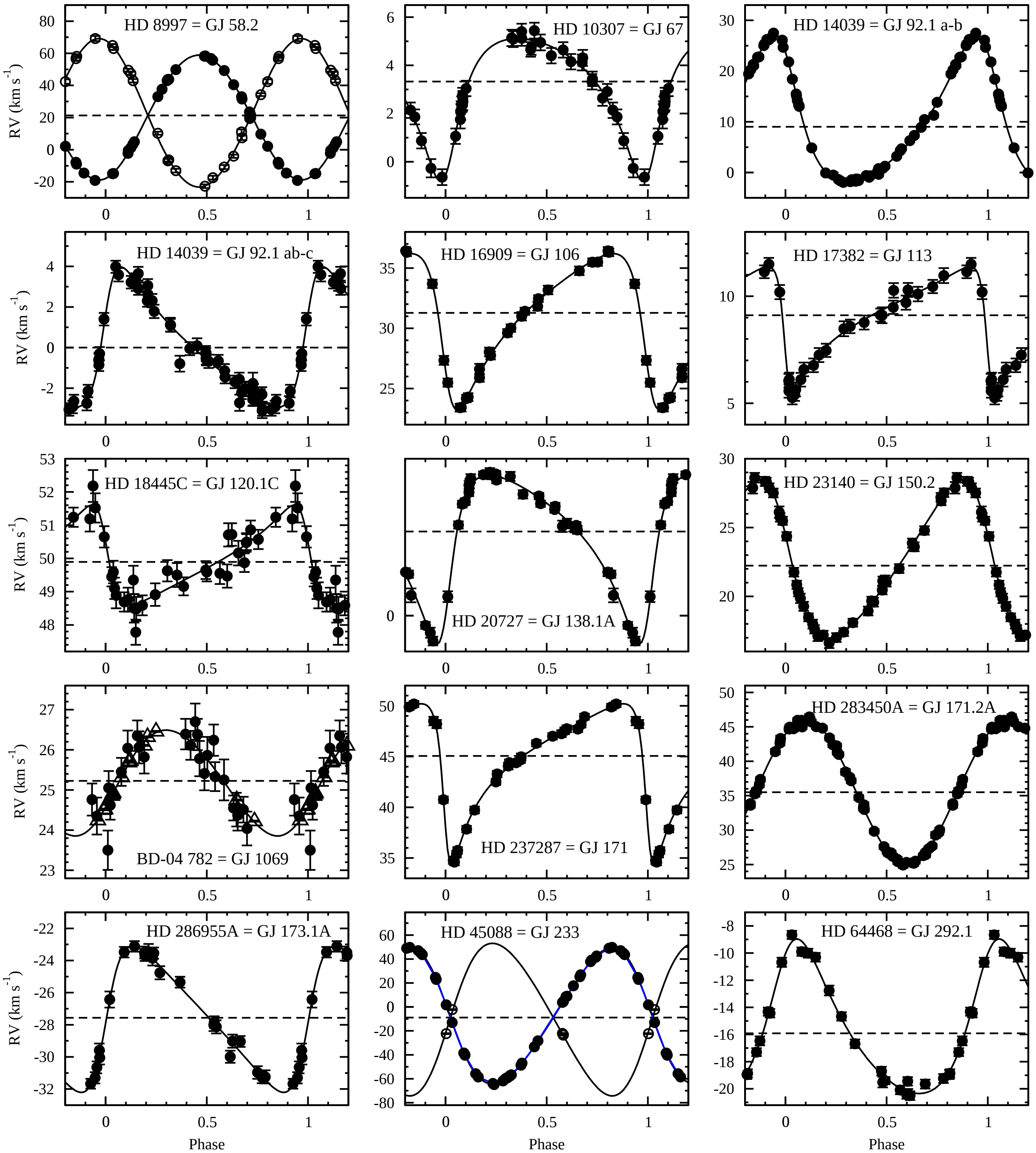

Fig. 3. Spectroscopic orbits of the first 15 SBs in Table A.2; the circles refer to the non-rejected CORAVEL RV measurements and, for GJ 1069, the open triangles refer to the measurements obtained with Elodie; the Elodie RVs are shifted to the zero point of the CORAVEL measurements.

The footnotes of Table A.2 indicate that 23 of these orbits were previously published on the basis of a part of our measurements or from RVs measured with a different instrument than CORAVEL. The 21 other orbits refer to new SBs.

The orbits of eight G-type stars mentioned in DM91 are included in Table A.2. DM91 provided a preliminary orbit for six of these stars, but the orbital elements are significantly improved there, thanks to additional RV measurements. The 44 SB orbits in Table A.2 are presented in Figs. 3–5.

5. Conclusion

We have drawn up a catalogue of 5413 RV measurements obtained with CORAVEL for 269 stars, 261 K-type dwarfs, and

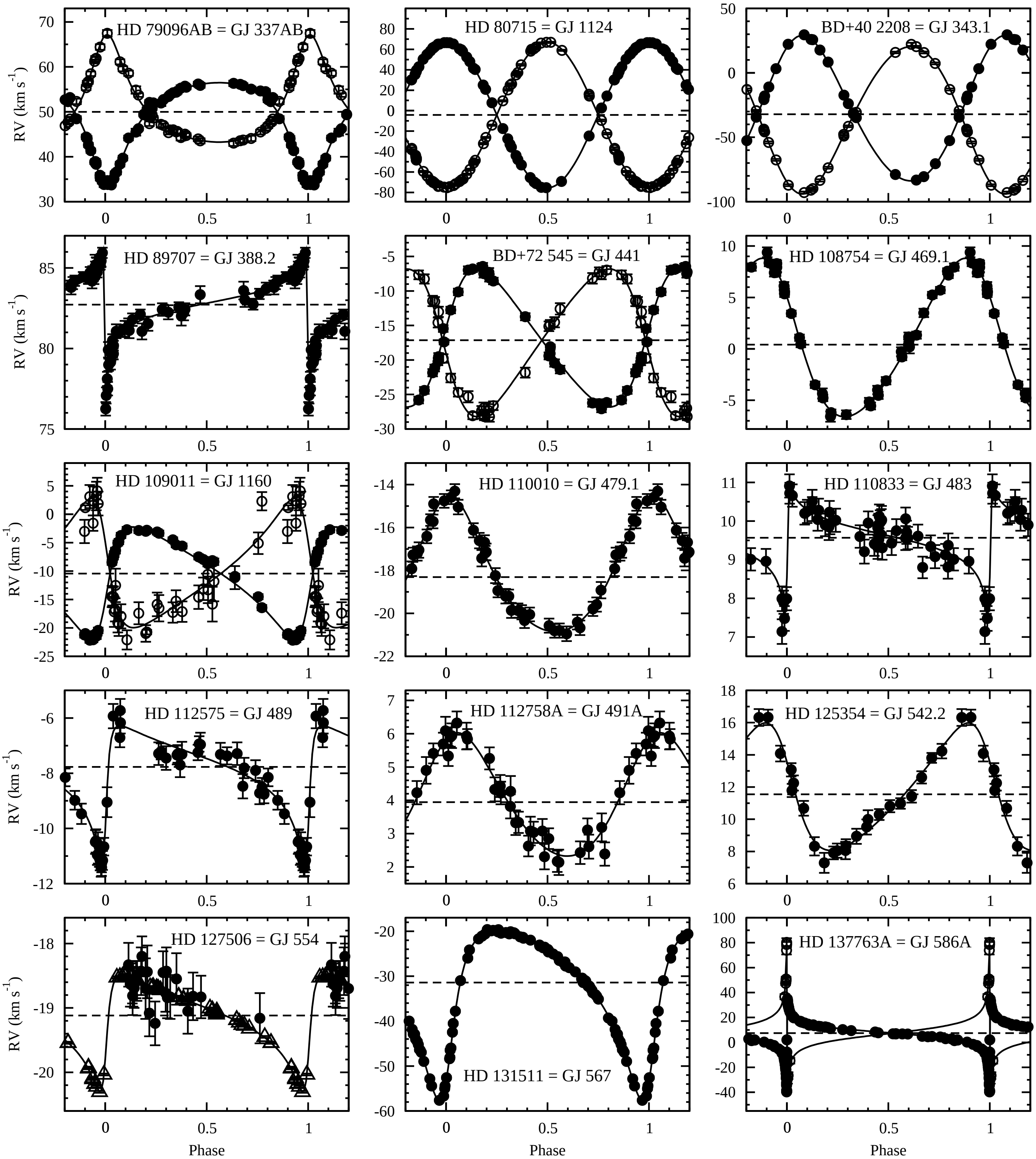

Fig. 4. Spectroscopic orbits of the second set of 15 SBs in Table A.2; the circles refer to the non-rejected CORAVEL RV measurements and, for GJ 554, the open triangles refer to the measurements obtained with Elodie; the Elodie RVs are shifted to the zero point of the CORAVEL measurements.

eight G-type dwarfs of the solar neighbourhood. These measurements were used to detect the SBs on which were based the statistical investigations of Paper III. We calculated the elements of 44 SB orbits, corresponding to 42 stellar systems. Twenty-one orbits, corresponding to 20 stellar systems, are the first orbits ever published for these stars.

All these data will be available through the VizieR service of the Centre de Donnée astronomique de Strasbourg (CDS). The

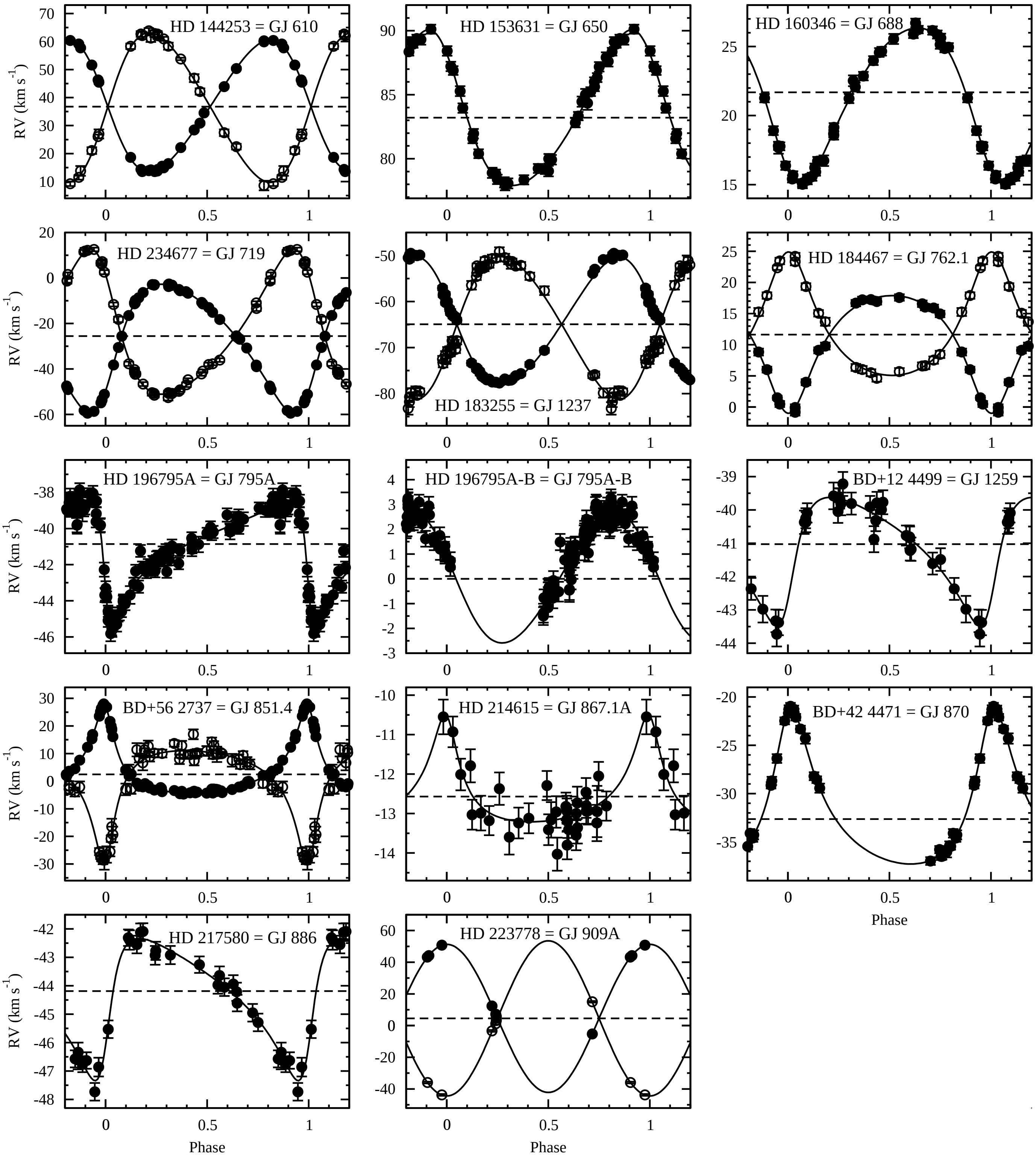

Fig. 5. Spectroscopic orbits of the 14 last SBs in Table A.2; the circles refer to the non-rejected CORAVEL RV measurements.

SB orbits and the corresponding RV measurements will also be included in the on-line SB9 catalogue[2].

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[2] `http://sb9.astro.ulb.ac.be/`, Pourbaix et al. 2004

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Appendix A: Tables of mean RVs and of orbital elements

Table A.1. Average RV and the variability status.

Identifications			$B-V$	$\overline{\mathrm{RV}}$	ϵ	σ_{RV}	E/I	$P(\chi^2)$	N_1	N_{tot}	ΔT	spect.	Table
GJ	HD/BD/HIP/AG			km s^{-1}	km s^{-1}	km s^{-1}					days	status	A.2
5	HD	166	0.75	−6.57	0.07	0.33	1.13	0.195	21	21	5410	CST	
27	HD	3651	0.85	−32.99	0.06	0.32	1.11	0.198	25	25	4043	CST	
28	HD	3765	0.93	−63.28	0.02	0.25	0.82	1.000	183	183	8037	CST	
30	BD	+33 99	1.13	−36.29	0.10	0.31	0.94	0.540	10	10	2884	CST	
31.4	HD	4256	0.99	9.40	0.09	0.24	0.77	0.838	12	12	3262	CST	
33	HD	4628	0.88	−10.33	0.08	0.34	1.11	0.242	17	17	5132	CST	
39	HD	4913	1.21	6.56	0.10	0.32	0.90	0.666	14	14	3266	CST	
44	BD	−02 129	0.83	−48.00	0.11	0.26	0.72	0.863	10	10	3261	CST	
50	BD	−10 216	1.25	−1.16	0.09	0.52	1.19	0.075	33	33	5588	CST	
52	BD	+63 137	1.30	2.73	0.13	0.41	1.06	0.350	10	10	2994	CST	
53.1A	HD	6660	1.12	6.58	0.08	0.28	0.87	0.719	15	15	4838	CST	
53.2	BD	+16 120	1.27	−57.42	0.14	0.39	0.93	0.579	9	9	2623	CST	
55.2	HIP	5957	1.36	−23.66	0.13	0.28	0.70	0.868	9	9	2629	CST	
56	HD	7808	1.00	−7.31	0.13	0.30	0.71	0.896	11	11	2968	CST	
56.3A	HD	7895	0.82	16.37	0.09	0.24	0.76	0.870	13	13	3603	CST	
56.4	BD	+79 38	1.29	−20.61	0.13	0.37	0.94	0.529	9	9	2626	CST	
56.5	HD	7924	0.82	−22.63	0.10	0.26	0.81	0.727	9	9	2621	CST	
57.1A	HD	8389	0.91	34.55	0.08	0.25	0.81	0.811	14	14	2955	CST	
57.1B			1.38	34.78	0.12	0.43	0.95	0.573	13	13	2955	CST	
58.2	HD	8997	0.96	21.35	0.10	27.50	60.04	0.000	31	54	2662	SB2O	+
1040	HIP	7655	1.20	32.30	0.15	0.52	1.23	0.134	12	12	5229	CST	
67	HD	10307	0.63	3.33	0.05	1.59	4.90	0.000	32	32	7416	SB1O	+
68	HD	10476	0.84	−33.67	0.08	0.24	0.80	0.844	15	15	5846	CST	
69	HD	10436	1.22	−50.94	0.10	0.31	0.88	0.680	13	13	2958	CST	
74	HD	10853	1.04	21.56	0.10	0.36	1.00	0.462	13	13	3249	CST	
75	HD	10780	0.81	2.82	0.08	0.28	0.90	0.642	14	14	4711	CST	
90	HD	13579	0.92	−12.58	0.10	0.17	0.58	0.950	9	9	2621	CST	
91.1A	HD	13959	1.10	−0.17	0.11	0.54	1.42	0.004	23	23	7428	SB1?	
91.2A	HD	14001	1.02	2.89	0.12	0.24	0.65	0.922	10	10	5427	CST	
92.1	HD	14039	0.92	9.02	0.05	11.14	34.47	0.000	52	52	5588	SB1O	*
98 A	HD	15285	1.39	6.57	0.14	4.71	3.95	0.000	27	54	7410	SB2	
105 A	HD	16160	0.97	25.53	0.06	0.28	0.95	0.603	24	24	6837	CST	
106	HD	16909	1.07	31.28	0.06	4.41	13.32	0.000	23	23	3604	SB1O	+
112	HD	17190	0.84	14.00	0.08	0.28	0.92	0.631	15	15	2891	CST	
112.1	HD	17230	1.28	11.01	0.10	0.32	0.91	0.623	12	12	3303	CST	
113	HD	17382	0.82	9.11	0.06	2.07	6.47	0.000	26	26	5592	SB1O	+
114	HD	17660	1.27	−29.02	0.12	0.28	0.81	0.731	9	9	2615	CST	
117	HD	17925	0.87	17.92	0.06	0.30	1.02	0.422	24	24	4851	CST	
118.2A	HD	18143	0.93	32.06	0.11	0.17	0.54	0.959	8	8	2950	CST	
120.1C	HD	18445	0.63	49.90	0.07	0.93	2.85	0.000	32	32	5929	SB1O	*
138.1A	HD	20727	0.63	7.51	0.08	4.07	12.17	0.000	31	31	3982	SB1O	+
141	HD	21197	1.16	−13.22	0.10	0.29	0.94	0.546	10	10	2959	CST	
142	HD	21531	1.34	34.35	0.58	1.00	3.04	0.000	3	3	2039	SB1	

Notes. A flag in the last column indicates that the orbital elements are presented in Table A.2; it is "*" when the orbital elements are derived for the first time, and "+" otherwise. (1) Our measurements were taken into account in the SB orbit of Tokovinin et al. (1994). (2) The RV is constant when the measurement of 13 April 1987 is discarded. (3) The SB nature of the star was inferred from Elodie observations. (4) The RV is constant when the measurement of 22 May 1983 is discarded. (5) Our RV measurements were used by Duquennoy et al. (1996) to derive a combined spectroscopic and interferometric orbit. (6) Combined spectroscopic and visual orbit by Berman (1932), Batten & van Dessel (1976), Batten et al. (1984), Heintz (1988), Batten & Fletcher (1991), and Pourbaix (2000). Griffin & Griffin (1983) and Griffin (1991) pointed out the risk that the RV measurements are distorted due to contamination by the secondary component. (7) Our RV measurements were used by Balega et al. (2007) to derive a combined spectroscopic and interferometric orbit.

Table A.1. continued.

144	HD	22049	0.88	16.31	0.06	0.28	1.02	0.407	21	21	3989	CST	
150.2	HD	23140	0.86	22.24	0.04	3.94	12.38	0.000	38	38	5585	SB1O	*
153 A	HD	23189	1.30	2.58	0.14	0.20	0.48	0.986	9	9	3984	CST	
1063	BD	+11 514	1.18	83.73	0.13	0.10	0.28	0.999	8	8	2889	CST	
1064 A	HD	23439	0.78	50.66	0.12	0.40	1.03	0.388	11	11	6113	CST	
1064 B	AG	+41 397	0.90	51.19	0.06	7.08	18.94	0.000	29	29	3344	SB1O[1]	
155.2	HD	24238	0.83	38.95	0.12	0.23	0.70	0.842	8	8	2265	CST	
156.2	HD	24451	1.15	17.69	0.10	0.20	0.62	0.945	10	10	3245	CST	
157 A	HD	24916	1.12	3.64	0.11	0.29	0.85	0.687	9	9	3405	CST	
158	HD	25329	0.88	−25.89	0.13	0.53	1.16	0.173	17	17	5564	CST	
161	HD	25665	0.91	−13.57	0.10	0.30	0.94	0.552	10	10	3245	CST	
165.1	HD	26581	1.00	23.99	0.12	0.25	0.74	0.804	8	8	3136	CST	
165.2	HD	26794	0.97	56.51	0.11	0.36	1.00	0.448	10	10	3410	CST	
1069	BD	−04 782	1.22	25.23	0.02	0.85	2.15	0.000	25	25	5223	SB1O	*
166 A	HD	26965	0.82	−42.52	0.07	0.35	1.16	0.131	22	22	5913	CST	
168	BD	+47 977	1.17	−78.60	0.13	0.37	0.97	0.480	8	8	3248	CST	
171	HD	237287	0.89	45.06	0.09	4.86	15.09	0.000	26	26	5517	SB1O	+
171.2A	HD	283750	1.12	35.51	0.04	7.70	22.48	0.000	54	54	2492	SB1O	+
173.1A	HD	286955	1.02	−27.57	0.08	3.23	8.65	0.000	24	24	3306	SB1O	*
174	HD	29697	1.19	1.01	0.06	0.32	1.00	0.482	30	30	5840	CST	
176.2	HD	29883	0.92	17.67	0.10	0.24	0.74	0.845	10	10	3245	CST	
2035	HD	30973	1.01	26.24	0.13	0.29	0.80	0.721	8	8	2891	CST	
183	HD	32147	1.06	21.45	0.07	0.24	0.82	0.839	18	18	4164	CST	
200 A	HD	34673	1.04	87.84	0.09	0.22	0.71	0.886	11	11	2628	CST	
1076	BD	+54 886	1.30	53.71	0.14	0.57	1.55	0.002	17	17	5409	SB1?	
204	HD	36003	1.10	−55.72	0.11	0.36	1.16	0.211	10	10	2628	CST	
211	HD	37394	0.84	1.35	0.09	0.35	1.15	0.186	14	14	4802	CST	
217	HD	38230	0.83	−29.17	0.09	0.27	0.84	0.768	14	14	3140	CST	
221	BD	−06 1339	1.32	22.87	0.18	0.50	1.10	0.302	8	8	3425	CST	
223	HD	39715	1.01	−33.80	0.13	0.33	0.92	0.560	8	8	3399	CST	
226.2	HIP	29067	1.25	−1.90	0.13	0.20	0.52	0.977	9	9	3256	CST	
227	HD	41593	0.81	−9.75	0.09	0.24	0.78	0.816	11	11	4815	CST	
233	HD	45088	0.94	−8.92	0.08	42.25	139.71	0.000	41	46	5603	SB2O	+
241	HD	47752	1.02	−44.29	0.10	0.12	0.36	0.999	11	11	3072	CST	
249	HD	49601	1.24	19.44	0.14	0.46	1.27	0.107	11	11	2943	CST	
250 A	HD	50281	1.05	−7.20	0.11	0.39	1.29	0.076	12	12	3238	CST	
254	HD	266611	1.36	−14.95	0.15	0.40	0.90	0.603	9	9	4410	CST	
256	HD	51849	1.13	−5.84	0.39	1.47	3.45	0.000	14	14	5416	SB1	
257.1	HD	51866	0.99	−21.51	0.11	0.28	0.86	0.664	9	9	3071	CST	
1094	HD	52919	1.08	−30.81	0.12	0.30	0.85	0.688	9	9	2561	CST	
267	HD	54359	0.96	26.44	0.12	0.33	0.93	0.553	9	9	4611	CST	
273.1	BD	+32 1561	0.95	−3.98	0.09	0.24	0.82	0.776	12	12	2601	CST	
276	HD	59582	1.10	66.03	0.12	0.26	0.71	0.860	9	9	2615	CST	
282 A	HD	61606	0.96	−18.21	0.09	0.31	1.02	0.418	11	11	4760	CST	
282 B	BD	−03 2002	1.33	−19.02	0.14	0.43	1.10	0.289	10	10	4760	CST	
292.1	HD	64468	0.95	−15.91	0.10	3.97	12.55	0.000	24	24	6124	SB1O	*
293.1A	HD	65277	1.04	−4.34	0.13	0.37	1.10	0.294	8	8	2958	CST	
295.1	BD	+14 1802	1.28	20.35	0.19	0.55	1.33	0.103	8	8	3984	CST	
301.1	BD	+31 1781	1.14	13.47	0.10	0.31	0.97	0.499	10	10	2617	CST	
313	HD	73583	1.12	20.22	0.13	0.22	0.61	0.925	8	8	3277	CST	
315	HD	73667	0.82	−12.03	0.11	0.25	0.75	0.808	9	9	3591	CST	
1113	HD	73554	1.08	54.61	0.13	0.19	0.53	0.962	8	8	3303	CST	
321	HD	74377	0.94	−23.63	0.15	0.41	1.22	0.182	7	7	3593	CST	
325 A	HD	75632	1.39	43.52	0.97	2.92	3.27	0.000	9	18	5516	SB2	
330.1	BD	+21 1949	1.11	−50.36	0.14	0.14	0.35	0.997	8	8	3936	CST	
334.1	BD	+73 447	1.26	−27.09	0.16	0.46	1.03	0.409	8	8	5056	CST	
337 A	HD	79096	0.73	49.99	0.07	8.50	11.27	0.000	56	101	5391	SB2O	+
338.1A	BD	+77 361	1.38	−11.34	0.19	0.56	1.25	0.149	9	9	4050	CST	

Table A.1. continued.

339	HD	79555	1.02	6.74	0.22	0.70	2.18	0.000	10	10	3991	SB1	
340 A	HD	79969	1.02	−20.52	0.06	0.23	0.72	0.983	27	27	5796	CST	
340.2	HD	80367	0.87	50.95	0.11	0.31	0.93	0.549	9	9	4091	CST	
340.3	HD	80632	1.17	36.55	0.13	0.30	0.77	0.800	9	9	3703	CST	
1124	HD	80715	0.99	−4.23	0.08	48.85	90.03	0.000	48	100	1462	SB2O	*
341.1	BD	+81 297	1.23	−18.02	0.17	0.44	1.23	0.183	7	7	3598	CST	
342	HD	80768	1.19	−6.32	0.10	0.27	0.69	0.938	14	14	3613	CST	
343.1	BD	+40 2208	1.32	−32.13	0.13	36.78	53.52	0.000	21	44	1129	SB2O	*
349	HD	82106	1.00	29.97	0.10	0.19	0.60	0.955	10	10	3694	CST	
355	HD	82558	0.91	7.58	0.27	0.81	1.17	0.211	9	9	2140	CST	
365	HD	84035	1.15	−12.30	0.11	0.32	1.01	0.421	8	8	3598	CST	
378.1	HD	86856	1.07	30.35	0.11	0.32	0.94	0.551	9	9	5073	CST	
379 A	BD	+75 403	1.40	−55.35	0.20	0.50	1.12	0.306	6	6	3563	CST	
380	HD	88230	1.36	−26.21	0.09	0.22	0.70	0.898	11	11	3568	CST	
388.2	HD	89707	0.63	82.70	0.09	2.34	6.26	0.000	64	64	6144	SB1O	+
389.1	BD	−09 3063	1.23	−3.97	0.30	0.90	2.20	0.000	9	9	5145	SB1[2]	
394	HD	237903	1.36	8.84	0.15	0.23	0.63	0.856	6	6	3663	CST	
396	HD	90343	0.82	9.80	0.10	0.30	0.95	0.520	9	9	3691	CST	
397	BD	+46 1635	1.33	20.62	0.10	0.35	1.02	0.434	13	13	3979	CST	
402.1	BD	+00 2709	0.90	−48.33	0.13	0.30	0.72	0.873	10	10	4769	CST	
1139	BD	+76 404	1.10	−25.82	0.15	0.43	1.02	0.402	8	8	3037	CST	
414 A	HD	97101	1.35	−16.63	0.11	0.27	0.75	0.846	11	11	3984	CST	
418	HD	97503	1.18	16.41	0.11	0.31	0.89	0.626	10	10	3988	CST	
420 A	HD	97584	1.04	9.12	0.12	0.31	0.97	0.467	7	7	3602	CST	
426 A	HD	98736	0.89	−3.37	0.11	0.23	0.74	0.798	8	8	3960	CST	
429 A	HD	99491	0.80	4.14	0.09	0.26	0.85	0.727	13	13	4754	CST	
429 B	HD	99492	1.00	3.59	0.13	0.29	0.96	0.469	6	6	3607	CST	
435.1	BD	+05 2529	1.24	19.48	0.45	2.48	3.43	0.000	31	57	5759	SB2	
439	BD	+31 2290	1.13	29.88	0.12	0.17	0.50	0.973	8	8	3229	CST	
441	BD	+72 545	1.17	−17.13	0.10	7.08	8.75	0.000	29	56	5453	SB2O	*
444 A	HD	102392	1.12	18.99	0.11	0.28	0.77	0.814	10	10	3689	CST	
454	HD	104304	0.76	0.28	0.08	0.28	0.96	0.523	12	12	4774	CST	
469.1	HD	108754	0.63	0.40	0.07	5.11	14.71	0.000	39	39	3692	SB1O	+
1160	HD	109011	0.93	−10.45	0.15	6.99	11.73	0.000	35	70	5475	SB2O	*
479.1	HD	110010	0.63	−18.31	0.05	2.12	6.30	0.000	36	36	6141	SB1O	+
481	HD	110315	1.12	24.90	0.10	0.24	0.71	0.873	10	10	3292	CST	
483	HD	110833	0.94	9.52	0.15	0.79	2.63	0.000	48	48	6129	SB1O	*
488.2	BD	−05 3596	1.34	−12.84	0.14	0.49	1.15	0.224	12	12	3297	CST	
489	HD	112575	1.12	−7.77	0.06	1.80	5.02	0.000	41	41	5892	SB1O	*
491 A	HD	112758	0.79	3.95	0.01	1.38	4.02	0.000	32	32	7413	SB1O	*
498	HD	113827	1.17	−6.51	0.13	0.32	0.83	0.707	9	9	3568	CST	
505 A	HD	115404	0.92	7.51	0.08	0.25	0.81	0.817	14	14	3244	CST	
509 A	HD	116495	1.33	−39.18	0.12	0.44	1.07	0.338	13	13	3981	CST	
511	HD	116858	0.93	−12.61	0.13	0.43	1.08	0.325	11	11	2956	CST	
2102	HD	117936	0.80	−6.00	0.15	0.41	1.26	0.136	8	8	2958	CST	
517	HD	118100	1.18	−22.47	0.11	0.48	1.15	0.186	18	18	4012	CST	
1176	HD	119291	1.19	−43.17	0.13	0.23	0.62	0.917	8	8	2903	CST	
521.1	HD	118926	1.39	27.27	0.20	0.64	1.33	0.071	10	10	4189	CST	
523	BD	+39 2675	1.10	1.24	0.13	0.34	0.93	0.542	8	8	2905	CST	
528 A	HD	120476	1.12	−20.18	0.15	0.36	1.04	0.375	6	6	5577	CST	
529	HD	120467	1.27	−38.34	0.13	0.27	0.78	0.732	7	7	4008	CST	
542.2	HD	125354	1.30	11.55	0.51	2.44	5.76	0.000	23	23	6151	SB1O	*
544 A	HD	125455	0.84	−9.93	0.10	0.21	0.65	0.929	10	10	3282	CST	
546	BD	+30 2512	1.26	−37.18	0.08	0.30	0.89	0.699	17	17	3688	CST	
554	HD	127506	1.13	−18.69	0.07	0.26	0.76	0.946	24	24	5893	CSTO[3]	*
556	HD	128165	0.99	11.46	0.08	0.22	0.76	0.880	14	14	4040	CST	

Table A.1. continued.

561		BD	+27 2411	0.80	−77.89	0.12	0.35	0.88	0.676	11	11	2904	CST	
562		BD	+17 2785	1.26	42.47	0.07	0.35	0.93	0.720	34	34	5721	CST	
563.3		HD	130871	0.97	−32.32	0.11	0.25	0.68	0.916	11	11	3291	CST	
567		HD	131511	0.84	−31.42	0.04	11.19	38.02	0.000	82	82	6669	SB1O	+
569.1		HD	132142	0.79	−14.59	0.09	0.28	0.87	0.719	14	14	4025	CST	
570	A	HD	131977	1.10	26.73	0.05	0.29	1.00	0.465	41	41	7364	CST	
573		HD	132950	1.04	−1.73	0.08	0.36	0.97	0.563	21	21	7272	CST	
576		BD	+06 2986	1.30	−84.79	0.12	0.43	0.80	0.806	12	12	5092	CST	
579		BD	+25 2874	1.36	−69.43	0.09	0.52	1.17	0.100	32	32	5500	CST	
1189		BD	+24 2824	1.06	−53.64	0.32	1.33	3.63	0.000	17	17	5161	SB1	
579.3		HD	134985	0.78	−61.49	0.14	0.45	1.10	0.290	10	10	3689	CST	
580	A	HD	135204	0.77	−69.54	0.06	0.23	0.74	0.962	23	23	7337	CST	
1190		BD	−03 3746	1.13	−112.42	0.13	0.22	0.50	0.992	11	11	4091	CST	
583		BD	−04 3873	1.30	−19.10	0.15	0.32	0.77	0.783	8	8	2676	CST	
1192		HD	136834	1.00	−26.65	0.07	0.28	0.85	0.816	22	22	4892	CST	
586	A	HD	137763	0.81	7.47	0.20	21.20	66.80	0.000	110	120	6013	SB2O	+
586	B	HD	137778	0.90	7.56	0.07	0.31	0.98	0.507	18	18	6014	CST	
591		HD	139323	0.95	−67.15	0.09	0.13	0.47	0.992	10	10	5830	CST	
593	A	HD	139341	0.92	−65.10	1.00	5.37	11.08	0.000	29	58	6651	SB2	
610		HD	144253	0.97	36.76	0.09	19.12	32.80	0.000	25	47	2973	SB2O	*
612		HD	144872	0.96	23.43	0.11	0.35	1.00	0.452	11	11	2991	CST	
614		HD	145675	0.87	−13.88	0.09	0.26	0.90	0.614	10	10	6291	CST	
615.1A		HD	145958	0.77	18.37	0.11	0.37	1.01	0.424	11	11	5812	CST	
615.1B				0.80	18.50	0.19	0.63	1.81	0.000	11	11	5812	SB1[4]	
621		HD	147776	0.95	7.08	0.10	0.32	0.87	0.699	13	13	5225	CST	
626		HD	148467	1.22	−36.54	0.13	0.13	0.34	0.998	8	8	2994	CST	
627	A	HD	148653	0.86	−31.13	0.10	0.28	0.85	0.704	11	11	4849	CST	
631		HD	149661	0.81	−12.95	0.09	0.18	0.62	0.952	11	11	3803	CST	
632.1		HD	149957	1.20	−11.16	0.13	0.27	0.72	0.824	8	8	2963	CST	
632.2A		BD	+76 614	1.17	−9.37	0.12	0.33	0.82	0.759	11	11	4546	CST	
637.1		HD	151541	0.77	9.57	0.11	0.20	0.61	0.934	9	9	3339	CST	
638		HD	151288	1.37	−32.07	0.09	0.26	0.79	0.855	15	15	3619	CST	
639		HD	151877	0.82	2.33	0.12	0.29	0.86	0.639	8	8	2674	CST	
640		HD	151995	1.02	−5.61	0.14	0.31	0.87	0.620	7	7	3033	CST	
649.1A		HD	153557	0.99	−6.65	0.09	0.33	1.02	0.404	15	15	4847	CST	
649.1C		HD	153525	1.00	−7.15	0.09	0.27	0.83	0.790	15	15	4847	CST	
650		HD	153631	0.63	83.21	0.09	4.10	11.36	0.000	38	38	5246	SB1O	+
653		HD	154363	1.16	34.02	0.08	0.30	0.86	0.779	18	18	6307	CST	
658		HD	155456	0.87	−59.79	0.12	0.11	0.34	0.997	8	8	2655	CST	
659	A	HD	155674	1.16	3.15	0.13	0.21	0.55	0.952	8	8	2643	CST	
659	B	BD	+54 1862	1.26	2.23	0.15	0.32	0.77	0.768	8	8	2643	CST	
663	A	HD	155886	0.86	0.44	0.10	0.25	0.81	0.751	10	10	3273	CST	
663	B	HD	155885	0.86	0.10	0.13	0.40	1.27	0.113	10	10	3273	CST	
664		HD	156026	1.16	−0.09	0.08	0.28	0.93	0.620	15	15	3694	CST	
673		HD	157881	1.36	−23.89	0.07	0.26	0.74	0.958	22	22	4477	CST	
675		HD	158633	0.76	−38.56	0.08	0.28	0.87	0.727	16	16	4821	CST	
688		HD	160346	0.96	21.68	0.05	4.27	14.16	0.000	38	38	4436	SB1O	+
689		HD	160964	1.10	−24.41	0.12	0.36	1.02	0.410	9	9	2561	CST	
692.1		HD	161198	0.77	23.88	21.35	6.23	18.63	0.000	105	105	4369	SB1O[5]	
697		BD	+21 3245	0.95	−13.14	0.17	0.47	1.29	0.114	8	8	2618	CST	
698		BD	+18 3497	1.18	−29.78	0.17	0.48	1.24	0.152	8	8	2226	CST	
700.2		HD	164922	0.80	20.14	0.07	0.22	0.75	0.911	17	17	3717	CST	
702	A	HD	165341	0.86	−9.73	0.52	2.16	7.03	0.000	17	17	5911	SB1[6]	
706		HD	166620	0.87	−19.47	0.07	0.22	0.74	0.911	16	16	4092	CST	

Table A.1. continued.

715	HD	170493	1.10	−55.20	0.09	0.24	0.76	0.836	11	11	2617	CST	
718	HD	171314	1.12	38.25	0.10	0.20	0.58	0.971	11	11	2612	CST	
719	HD	234677	1.22	−25.53	0.08	19.30	48.35	0.000	47	88	7096	SB2O	+
722.1	HD	172393	0.82	32.24	0.11	0.28	0.80	0.764	10	10	2620	CST	
725.1	HD	173701	0.84	−45.55	0.07	0.31	1.05	0.352	18	18	5204	CST	
727	HD	174080	1.08	−7.17	0.09	0.17	0.55	0.986	12	12	3020	CST	
747.2	BD	+33 3339	1.25	8.78	0.64	2.99	3.34	0.000	22	38	5561	SB2	
753	BD	+87 183	1.06	−5.74	0.14	0.29	0.73	0.843	9	9	2569	CST	
758	HD	182488	0.81	−21.56	0.06	0.20	0.69	0.971	20	20	3026	CST	
1237	HD	183255	0.93	−64.95	0.11	10.65	23.46	0.000	48	96	2259	SB2O	+
761 A	BD	+12 3917	1.10	−18.35	0.13	0.38	1.01	0.415	9	9	2642	CST	
762.1	HD	184467	0.87	11.63	0.08	7.14	7.43	0.000	18	36	4105	SB2O	+
764	HD	185144	0.80	26.64	0.09	0.35	1.14	0.202	14	14	4426	CST	
764.1A	HD	184860	1.01	63.19	0.23	0.75	2.08	0.000	11	11	5564	SB1	
764.1B			1.20	64.68	0.49	0.85	1.92	0.027	3	3	3698	CST	
765.2	HD	186922	0.88	−5.21	0.80	5.81	6.95	0.000	53	103	5516	SB2O[7]	
773.2	HD	189087	0.80	−29.68	0.06	0.24	0.81	0.873	21	21	5557	CST	
775	HD	190007	1.12	−30.51	0.10	0.32	1.06	0.350	10	10	3272	CST	
778	HD	190404	0.82	−2.55	0.06	0.30	0.90	0.777	30	30	7337	CST	
779.1	HD	190470	0.91	−7.33	0.09	0.12	0.41	0.999	12	12	3023	CST	
781.2	HD	191285	1.12	−18.55	0.14	0.44	1.00	0.449	10	10	3008	CST	
783.2A	HD	191785	0.85	−49.52	0.08	0.29	0.94	0.583	14	14	3369	CST	
791.3	BD	+33 3936	1.13	−27.05	0.11	0.15	0.44	0.995	10	10	3008	CST	
795	HD	196795	1.22	−40.86	0.14	2.27	6.49	0.000	99	99	7660	SB1O	+
1255 D	HD	199476	0.71	−30.23	0.13	0.36	1.02	0.397	8	8	1772	CST	
808.2	HD	198550	1.06	−8.48	0.10	0.44	1.42	0.005	21	21	5127	SB1?	
1259	BD	+12 4499	1.05	−41.03	0.06	1.19	3.57	0.000	29	29	5177	SB1O	*
816.1A	HD	200560	0.97	−14.11	0.09	0.21	0.69	0.920	12	12	2961	CST	
818	HD	200779	1.22	−66.81	0.09	0.31	0.94	0.584	14	14	3340	CST	
819 A	HD	200968	0.90	−32.72	0.09	0.15	0.48	0.996	12	12	2967	CST	
820 A	HD	201091	1.17	−65.82	0.06	0.34	1.11	0.179	30	30	6226	CST	
820 B	HD	201092	1.37	−64.67	0.06	0.30	0.91	0.725	29	29	6226	CST	
824	HD	202575	1.02	−18.24	0.09	0.27	0.83	0.760	13	13	2964	CST	
825.3	HD	202751	0.99	−27.65	0.09	0.20	0.65	0.957	13	13	3349	CST	
828.4	HD	204417	0.86	−14.63	0.09	0.33	0.99	0.476	14	14	3639	CST	
836.8	BD	+40 4631	1.34	9.75	0.13	0.21	0.53	0.973	9	9	2966	CST	
838.1A	HD	207491	1.04	−11.22	0.10	0.21	0.66	0.933	11	11	3338	CST	
838.2	HD	207795	0.83	−29.29	0.10	0.32	0.94	0.569	11	11	3342	CST	
840	HD	208313	0.92	−13.42	0.07	0.21	0.72	0.934	16	16	2976	CST	
850	HD	210667	0.82	−19.55	0.07	0.18	0.64	0.982	17	17	2976	CST	
851.4	BD	+56 2737	0.72	2.45	0.15	11.38	19.42	0.000	76	131	7440	SB2O	*
854	BD	+67 1424	1.15	−4.44	0.11	0.33	0.91	0.611	10	10	2951	CST	
857.1A	BD	+21 4747	1.19	−7.15	0.10	0.32	0.96	0.516	11	11	4063	CST	
867.1A	HD	214615	0.63	−12.57	0.11	0.67	1.76	0.000	35	35	7389	SB1O	*
870	BD	+42 4471	1.11	−32.64	0.15	6.17	15.98	0.000	25	25	1392	SB1O	*
1272 A	BD	+10 4812	1.13	−1.60	0.12	0.24	0.63	0.941	10	10	2583	CST	
871.2	HD	215704	0.80	−51.46	0.10	0.27	0.83	0.715	10	10	2912	CST	
886	HD	217580	0.95	−44.19	0.04	1.78	5.75	0.000	25	25	2891	SB1O	+
892	HD	219134	1.00	−18.58	0.07	0.26	0.92	0.633	16	16	4057	CST	
893.2B	HD	219430	1.05	−24.29	0.34	0.05	0.10	0.919	1	1	0	?	
894.4	HD	220182	0.80	3.32	0.06	0.23	0.78	0.923	23	23	4435	CST	
894.5	HD	220339	0.89	33.77	0.10	0.22	0.69	0.898	10	10	2888	CST	
895.4	HD	221354	0.83	−25.02	0.09	0.14	0.46	0.993	10	10	2886	CST	
904.1A	HD	222474	1.11	−19.24	0.12	0.44	1.33	0.046	14	14	5135	CST	
907.1	BD	−13 6464	1.26	−9.04	0.45	0.45	1.00	9.999	1	1	0	?	
908.1	BD	+29 5007	1.26	−3.92	0.11	0.27	0.75	0.831	10	10	2887	CST	
909 A	HD	223778	0.98	4.54	0.37	22.54	29.97	0.000	7	13	2853	SB2O	+
909.1	HD	223782	1.08	−29.26	0.12	0.29	0.73	0.874	11	11	5048	CST	

Table A.2. Orbital elements of the SBs.

HD/BD GJ	P (d)	T_0(JD) 2400000+	e	V_0 (km s^{-1})	ω_1 (°)	$K_{1,2}$ (km s^{-1})	$m_{1,2}\sin^3 i$ or $f_1(m)$ ($M_\odot$)	$a_{1,2}\sin i$ (Gm)	N_1 N_2	σ(O-C) (km s^{-1})
HD 8997[8]	10.98358	46482.39	0.0358	21.35	192.86	38.87	0.3809	5.867	31	0.74
GJ 58.2	0.00012	0.17	0.0036	0.10	5.44	0.17	0.0056	0.025		
						46.21	0.3203	6.976	23	
						0.36	0.0042	0.054		
HD 10307[9]	7206.	43259.	0.437	3.329	203.71	2.966	0.0142	264.3	32	0.24
GJ 67 (G)	42.	75.	0.024	0.050	4.51	0.110	0.0017	10.5		
HD 14039[10]	80.0342	46773.64	0.3325	9.021	40.24	14.488	0.02120	15.037	52	0.35
GJ 92.1 a-b	0.0029	0.16	0.0051	0.050	0.99	0.079	0.00037	0.087		
HD 14039	4570.	48277.0	0.4731		288.68	3.454	0.01338	191.27	52	0.34
GJ 92.1 ab-c	106.	27.3	0.0246		3.48	0.100	0.00135	7.67		
HD 16909[11]	1227.77	46638.50	0.492	31.281	119.35	6.476	0.0228	95.18	23	0.24
GJ 106	3.35	4.66	0.014	0.064	1.60	0.096	0.0012	1.66		
HD 17382[12]	5954.	48024.2	0.663	9.111	110.74	2.957	0.00671	181.3	26	0.25
GJ 113	294.	25.2	0.021	0.065	3.59	0.080	0.00081	11.2		
HD 18445 C	553.89	47489.9	0.528	49.896	74.7	1.50	0.000119	9.72	32	0.38
GJ 120.1 C (G)	1.37	8.7	0.067	0.070	9.1	0.13	0.000035	0.96		

Notes. The G-type stars with an orbit in DM91 are included in this table when their elements are significantly improved thanks to additional observations; they are indicated by "(G)" following the GJ identification. (8) First orbit by Griffin (1987); other orbit by Scarfe (1988). (9) Preliminary orbit in DM91; first orbit with ΔT longer than the period. (10) Triple system. (11) First orbit by Griffin et al. (1985). (12) Preliminary orbit by Latham et al. (2002). (13) We improve the orbit of DM91. (14) First SB orbit; the star was already a VB with known orbital elements (Al-Wardat et al. 2014). (15) Orbit derived taking into account 15 Elodie measurements found in the Elodie Archive; the offset of the Elodie RVs is −0.193 km s^{-1}. (16) First orbit by Tokovinin et al. (1994); other orbit by Latham et al. (2002). (17) First orbit by Griffin et al. (1985); other orbit by Tokovinin (1990). (18) First orbit by Griffin & Emerson (1975). (19) First orbit by Griffin & Griffin (1982); combined VB+SB2 orbits by Mason et al. (1996) and by Pourbaix (2000). (20) We improve the orbit of DM91; high precision orbit by Sahlmann et al. (2011). (21) We improve the CORAVEL orbit of Jasniewicz & Mayor (1988). (22) We improve the preliminary orbit of DM91; first orbit with ΔT longer than the period. (23) The period of the interferometric orbit by Tokovinin et al. (2015) is assumed. (24) The orbital elements were derived taking into account Elodie RV measurements; the offset of the Elodie RVs is −0.028 km s^{-1}. (25) First orbit by Kamper & Lyons (1981); other orbit by Beavers & Salzer (1983); high precision orbits by Nidever et al. (2002) and by Katoh et al. (2013, 2016). (26) First orbit by Tokovinin (1991); we improve the orbit of Duquennoy et al. (1992). (27) We improve the orbit of Duquennoy & Mayor (1988). (28) First orbit by Tokovinin (1991); high precision orbit by Katoh et al. (2013). (29) The BY Dra variable star; first orbit by Bopp & Evans (1973); other orbit by Vogt & Fekel (1979). (30) First orbit by Tokovinin (1991); high precision orbit by Kiefer et al. (2018). (31) First orbit by McClure (1983); combined VB+SB2 orbit by Pourbaix (2000). A high precision VB+SB2 orbit was derived by Kiefer et al. (2018). (32) Triple system; first orbit by Duquennoy (1987). (33) The period and the semi-amplitude were fixed to the results of the SB+VB solution derived by Tokovinin & Latham (2017). (34) Preliminary orbit based on observations that do not completely cover the orbital period. (35) First orbit by Tokovinin et al. (1994), based on CORAVEL observations; other orbit by Latham et al. (2002) (36) First orbit by Christie (1934).

Table A.2. continued.

HD 20727[13]	325.07	46515.6	0.499	7.507	228.1	7.53	0.00939	29.17	31	0.40
GJ 138.1 A (G)	0.39	1.6	0.020	0.080	1.9	0.20	0.00083	0.86		
HD 23140[14]	5121.	48636.9	0.275	22.238	72.30	5.745	0.08967	389.02	38	0.23
GJ 150.2	45.	25.7	0.010	0.044	2.16	0.056	0.00284	5.29		
BD−04 782[15]	716.80	49992.2	0.090	25.226	242.9	1.318	0.000168	12.93	25+15	0.42, 0.034
GJ 1069	2.01	27.8	0.018	0.023	15.0	0.041	0.000016	0.42		
HD 237287[16]	330.45	46785.14	0.649	45.057	122.58	7.91	0.00748	27.35	26	0.30
GJ 171	0.26	2.63	0.016	0.086	1.36	0.25	0.00082	1.00		
HD 283750 A[17]	1.787992	46999.42	0.0022	35.505	323.77	10.454	0.0002121	0.2570	54	0.29
GJ 171.2 A	0.000004	0.74	0.0052	0.040	149.67	0.056	0.0000034	0.0014		
HD 286955 A	610.02	47474.27	0.399	−27.565	266.96	4.55	0.00461	35.01	24	0.36
GJ 173.1 A	1.02	5.96	0.023	0.078	4.75	0.13	0.00042	1.08		
HD 45088[18]	6.991849	48991.973	0.1475	−8.917	79.65	56.86	0.651	5.407	41	0.51
GJ 233	0.000016	0.021	0.0019	0.080	0.85	0.11	0.011	0.011		
						63.70	0.581	6.06	5	
						1.40	0.015	0.13		
HD 64468	161.119	46586.84	0.273	−15.91	323.98	5.69	0.00275	12.13	24	0.42
GJ 292.1	0.079	2.01	0.021	0.10	5.36	0.13	0.00020	0.29		
HD 79096 AB[19]	987.82	47197.82	0.4431	49.989	170.41	11.52	0.487	140.29	56	0.65
GJ 337 AB	1.06	3.04	0.0097	0.070	1.00	0.12	0.018	1.63		
						11.95	0.469	145.56	45	
						0.21	0.016	2.70		
HD 80715	3.804067	47456.2383	0.0000	−4.23	0.0	71.18	0.5691	3.7236	48	0.70
GJ 1124	0.000008	0.0025	0.0032	0.08		0.14	0.0025	0.0072		
						71.13	0.5696	3.7208	51	
						0.14	0.0025	0.0075		
BD+40 2208	8.490697	46494.695	0.0993	−32.13	326.68	56.45	0.6412	6.559	21	0.81
GJ 343.1	0.000066	0.047	0.0033	0.13	2.01	0.27	0.0069	0.032		
						57.17	0.6332	6.642	23	
						0.27	0.0069	0.032		
HD 89707[20]	298.295	48517.20	0.946	82.723	108.9	4.98	0.000131	6.63	64	0.32
GJ 388.2(G)	0.122	0.50	0.012	0.051	4.8	0.41	0.000053	0.90		

Table A.2. continued.

BD+72 545	632.56	49608.41	0.249	−17.13	278.33	10.05	0.274	84.67	29	0.77
GJ 441	0.57	4.93	0.018	0.10	3.31	0.20	0.013	1.73		
						10.69	0.258	90.03	27	
						0.22	0.012	1.95		
HD 108754[21]	25.93115	45956.44	0.1759	0.403	59.0	7.713	0.001179	2.707	39	0.39
GJ 469.1 (G)	0.00100	0.30	0.0117	0.069	4.2	0.100	0.000046	0.036		
HD 109011	1284.38	47513.68	0.501	−10.45	250.84	9.82	0.443	150.13	35	1.20
GJ 1160	2.34	7.58	0.017	0.15	2.98	0.24	0.035	4.07		
						11.38	0.382	173.99	35	
						0.41	0.029	6.61		
HD 110010[22]	4118.	46030.	0.199	−18.312	350.60	3.156	0.01265	175.1	37	0.27
GJ 479.1 (G)	26.	63.	0.020	0.046	6.05	0.069	0.00085	4.0		
HD 110833	270.33	49797.0	0.902	9.568	251.6	1.72	0.0000115	2.77	47	0.24
GJ 483	0.54	1.0	0.044	0.047	7.4	0.31	0.0000028	0.23		
HD 112575	3572.1	49872.95	0.766	−7.773	238.51	2.48	0.00151	78.42	41	0.34
GJ 489	34.5	9.04	0.021	0.063	3.93	0.10	0.00025	4.45		
HD 112758 A	103.226	49672.0	0.141	3.945	333.	1.850	0.0000659	2.60	32	0.33
GJ 491 A	0.042	5.7	0.044	0.061	20.	0.083	0.0000089	0.12		
HD 125354[23]	6819.	45990.	0.306	11.55	67.1	3.96	0.0379	353.	23	0.49
GJ 542.2		117.	0.039	0.11	7.6	0.18	0.0054	17.		
HD 127506[24]	2669.5	52527.29	0.7086	−19.117	244.01	0.9051	0.0000720	23.44	24+56	0.24
GJ 554	17.7	1.52	0.0046	0.004	0.45	0.0057	0.0000012	0.21		0.013
HD 131511[25]	125.3939	44936.898	0.5096	−31.425	219.48	18.913	0.05612	28.06	82	0.31
GJ 567	0.0020	0.082	0.0026	0.036	0.39	0.076	0.00074	0.12		
HD 137763 A[26]	889.813	47967.519	0.9733	7.47	252.64	36.42	0.4716	102.29	110	0.74
GJ 586 A	0.017	0.015	0.0006	0.20	0.73	0.38	0.0146	0.70		
						52.90	0.3247	148.57	10	
						1.73	0.0083	2.18		
HD 144253	105.947	48948.02	0.1514	36.759	85.28	23.55	0.7176	33.92	25	0.56
GJ 610	0.017	0.90	0.0055	0.088	2.04	0.13	0.0118	0.19		
						26.72	0.6323	38.48	22	
						0.22	0.0097	0.32		
HD 153631[27]	386.64	46161.5	0.186	83.208	46.1	6.080	0.00856	31.76	38	0.32
GJ 650 (G)	0.30	4.3	0.018	0.088	4.9	0.085	0.00037	0.46		

Table A.2. continued.

HD 160346[28]	83.714	46972.20	0.210	21.680	145.5	5.644	0.001460	6.351	38	0.26
GJ 688	0.012	0.57	0.012	0.045	2.7	0.057	0.000046	0.067		
HD 234677[29]	5.975114	49996.375	0.3050	−25.533	229.43	28.43	0.06225	2.225	47	0.69
GJ 719	0.000007	0.012	0.0032	0.075	0.77	0.13	0.00078	0.011		
						31.90	0.05548	2.496	41	
						0.19	0.00067	0.015		
HD 183255[30]	166.83	46415.94	0.141	−64.95	69.0	13.91	0.2252	31.60	48	1.01
GJ 1237	0.18	1.85	0.012	0.11	4.5	0.18	0.0074	0.41		
						15.49	0.2022	35.18	48	
						0.24	0.0064	0.55		
HD 184467[31]	494.77	46662.73	0.339	11.632	177.49	9.44	0.1583	60.41	18	0.48
GJ 762.1	0.50	2.18	0.013	0.083	2.31	0.17	0.0068	1.13		
						9.90	0.1510	63.35	18	
						0.18	0.0065	1.19		
HD 196795[32]	918.59	48082.70	0.6872	−40.860	116.5	3.394	0.001430	31.14	99	0.41
GJ 795 a-b	0.56	1.80	0.0122	0.045	2.0	0.068	0.000109	0.79		
HD 196795[33]	14128.	50796.	0.089		72.	2.66	0.0273	514.70	99	0.41
GJ 795 ab-c		555.	0.035		14.		0.0026	1.61		
BD+12 4499	2173.3	47551.2	0.459	−41.029	233.58	1.93	0.00113	51.14	29	0.28
GJ 1259	36.4	56.1	0.044	0.060	8.33	0.10	0.00021	3.20		
BD+56 2737	650.19	47572.66	0.5971	2.447	12.63	15.56	0.938	111.61	74	1.12
GJ 851.4	0.26	0.91	0.0077	0.105	1.03	0.17	0.039	1.44		
						20.59	0.709	147.65	53	
						0.38	0.027	2.90		
HD 214615[34]	7725.	45741.	0.54	−12.57	11.43	1.36	0.00122	122.	35	0.43
GJ 867.1A (G)	952.	221.	0.13	0.11	12.49	0.22	0.00070	27.		
BD+42 4471	374.57	47098.21	0.440	−32.64	343.33	8.03	0.01455	37.11	25	0.32
GJ 870	0.62	1.92	0.012	0.15	2.68	0.13	0.00077	0.66		
HD 217580[35]	453.90	49162.2	0.518	−44.186	239.78	2.501	0.000426	13.36	25	0.27
GJ 886	1.78	8.5	0.041	0.058	3.90	0.097	0.000067	0.65		
HD 223778[36]	7.753470	47000.4492	0.0000	4.54	0.00	46.74	0.3609	4.983	7	0.32
GJ 909 A	0.000065	0.0094	0.0061	0.37	60.	0.75	0.0045	0.025		
						48.95	0.3446	5.219	6	
						0.93	0.0041	0.031		