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Radial velocities and axial rotation for a sample of chemically peculiar stars*

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Abstract. — As part of a systematic project we have determined radial velocities and projected rotational velocities for a sample of 186 chemically peculiar stars which have been observed by the Hipparcos' satellite. The purpose is to provide necessary data to study the space velocities of peculiar stars.

Key words: stars: chemically peculiar — stars: kinematics — stars: rotation

1. Introduction

The Hipparcos' satellite has observed more than 100,000 stars with the purpose of measuring their proper motions with an accuracy never reached with observations from the ground. Also the space observations will provide trigonometric parallaxes for many of the objects. Kinematical studies will need the knowledge of the radial velocity of the stars observed by the satellite. In this paper we present the first results of a program started in 1989, at the national observing facility in Argentina, to provide radial velocities for samples of stars that have been targets of the Hipparcos' satellite. The first sample selected includes 186 chemically peculiar stars mostly of the CP2 class (Si, Cr, Sr, Eu) (180) and a few of the CP4 class (He weak) (6) as defined by Preston (1974).

The space velocities and kinematical properties of the Ap stars have been studied previously with small samples and less accurate data. Mouchet (1966) computed the space velocities for 227 Ap stars. Martinet (1966) using a sample of 101 stars, distinguished three groups from the appearance of the distribution of the projection of the space velocities in the galactic plane while Megessier (1974) using a sample of 21 stars found that the Ap (Si) stars behave similarly as normal B5 V to B8 V stars according with their kinematical properties and the Ap (Sr-Cr-Eu) stars behave similarly as normal B9 V to A3 V.

2. Observations and reduction

We have obtained an average of 3 spectra per star for a sample of 180 CP2 stars and 6 CP4 stars observed by Hipparcos. The stars were selected from those in the south and brighter than 8 th magnitude and included in the Hipparcos Input Catalogue (HIC) (Turon et al. 1992). The spectra were secured with the 2.1 m telescope at CASLEO using a Boller & Chivens cassegrain spectrograph, equipped with an EEV 8603 CCD of 385×578 pixels, each one of 22 μ by 22 μ, and cooled with liquid nitrogen. The chip has a coating to increase the efficiency in the UV. The 2 pix resolution of the spectra is 1.3 Å and the wavelength range recorded on the chip is a little less than 400 Å. We centered the spectrum on Hγ. We have also, for several of the program stars, one spectrum per object taken on photographic plates as described below.

Radial velocity standard stars from the IAU list and from the list provided by Feckel (1985) were observed with the same equipment. We have also obtained under the same conditions a good number of v sin i standards from

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*Tables 1 and 2 are available in electronic form at the CDS via anonymous ftp 130.79.128.5
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Slettebak's list (Slettebak et al. 1975). We did not provide an independent spectral classification for the stars in our sample due to the small spectral range recorded on the CCD detector. However as has been said above, for most of the stars observed we have in our plate files at least one spectrum taken with the same spectrograph using the photographic plate as detector. This material was taken for radial velocity measurements (dispersion 29 Å mm^{-1}) so it is not adequate for spectral classification. We used these spectrograms to verify the peculiar characteristics of the spectra of the program stars. We have indicated in the last column of Table 2 the spectral classification quoted in the Catalogue of Ap and Am Stars (Renson et al. 1991) and between brackets any discrepancy of the peculiarity that we have noted on our plates. An asterisk before the spectral classification means that no photographic plate is available and only the types quoted in Renson et al. (1991) are included in the Table. The reduction of the digital data was made with IRAF[1] version 2.10. The task *splot* was used for the determination of the wavelengths of the lines used for measuring the radial velocities. The same task was used for measuring the fwhm of Mg II λ 4481 and He I λ 4471 which are the lines measured for deriving the v sin i values (see Valdes 1992).

3. Results and discussion

3.1. *Radial velocities*

Radial velocities were derived measuring the following individual lines when possible: Ca I λ 4226, Fe II λ 4233, H I Hγ, Fe I λ λ 4405, 4415, 4383, He I λ 4471, and Mg II λ 4481. We used the *d* option in the *splot* task for the fitting of the gaussian profiles and the computation of the position of the line.

The results of the measuring process are presented in Table 1 (available in electronic form only) where we have indicated, for the 186 stars, the HD number, the Julian Date and the heliocentric radial velocity for each measured spectrum jointly with its probable error deduced from the dispersion of the values given by the various lines, and the number of lines included in the average.

3.2. *Axial rotational velocities*

The axial rotational velocities were determined through the relation between the fwhm of the lines He I λ 4471 and Mg II λ 4481 and the v sin i values for a group of standard stars taken from Slettebak et al. (1975). For the program stars we have measured the fwhm for the same lines and using the calibration curves determined with the standard stars we have calculated the v sin i values. Figure 1 shows one of the calibration curves. In those cases in which both lines could be measured we have averaged

[1]Distributed by NOAO, Kitt Peak National Observatory, operated by AURA,Inc. under agreement with the NSF.

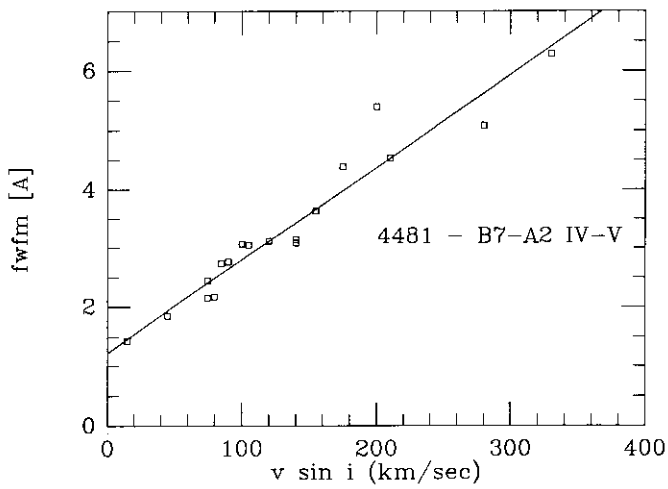

Fig. 1. v sin i vs. fwhm of MgII λ4481 calibration for the spectral range B7-A2

the resulting values. The final results (v sin i) are presented in Table 2 where we have indicated in successive columns: (1) the HD number, (2) the average heliocentric radial velocity for each program star, (3) the probable error of the average, (4) the number of spectra included in the average, (5) the external probable error (see Conti et al. 1977), (6) the internal probable error (see Popper 1974), (7) the quotient between the external and internal errors, (8) the probability that the observed sample of radial velocity measurements for each star was drawn from a random population of measurements as explained below, (9) the v sin i value, and (10) the spectral classification according to the explanation given at the end of Sect. 2.

The purpose of this paper is to publish the data but let us make some statistics with them to check the consistency of the results. There are 162 CP2 stars with values of v sin i determined in our sample of Table 2. The average projected axial rotation for this sample is 47$\pm$3 km s^{-1} (s.e. of the mean) with σ (s.e.) = 36 km s^{-1}. We have taken 15 km s^{-1} as the v sin i value for all stars with v sin i $\leq$30 km s^{-1} in order to compute this average. The latter is a little larger than the average v sin i for the 102 CP2 stars brighter than 6.5 mag. from the Bright Star Catalogue, (Hoffleit & Jaschek 1982) which have been recently measured by Abt & Morrell (1995). Their value is 32$\pm$2 km s^{-1} (s.e of the mean) with a dispersion of 24 km s^{-1}. The difference, is understandable because with our spectra we cannot resolve more than 30 km s^{-1} in the v sin i values, while Abt & Morrell (1995) could do better with 10 km s^{-1} resolution. We have not noticed statistically significant differences in the average v sin i values between the Si stars and the Sr-Cr-Eu stars.

From the 180 CP2 stars in Table 2, 136 have three spectra or more. For each of them, we have indicated in the same table the probability (P), expressed as a percentage, that the observed radial velocity sample was drawn from a random population. An analysis of variance test (Conti et al. 1977) for this sample of 136 stars, indicates that 28% of the objects will have a variable radial velocity. We consider as variable, all stars whose radial velocity measurements have a probability lower than 0.5% of being drawn from a random population. This value of the significance level listed for each star in Table 2 was derived empirically from our own data.

Figure 2 shows the distribution of the quotient E/I for the 170 CP2 stars with 2 or more observations. Among this sample, 72% of the stars have E/I values lower than 3.0. Seventeen stars have E/I values falling in the range $3.0 \leqq E/I \leqq 4.0$. We have assumed that the stars with E/I values larger than 3.5 are radial velocity variables. With this assumption we have found that 20% may be radial velocity variables. These numbers agree with previous determinations of the incidence of spectroscopic binaries among Ap stars (Abt & Snowden 1973).

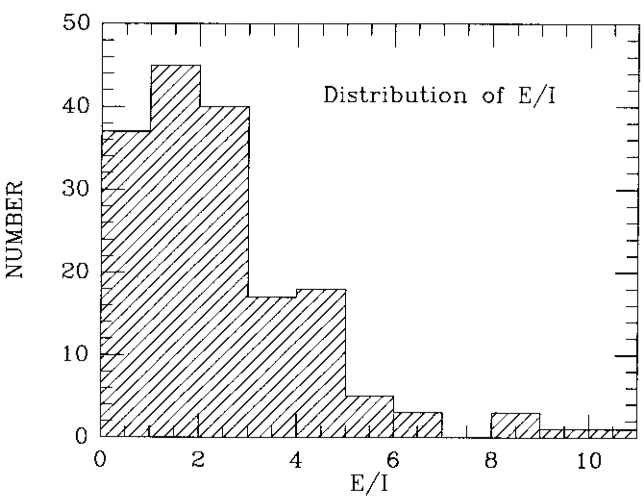

Fig. 2. Distribution of E/I for the 170 CP2 stars

Summarizing, we have presented radial velocities for a sample of 186 CP stars observed by Hipparcos, mostly of the CP2 class, and we have checked the consistency of these new data and previous statistical results. We have concluded that the incidence of radial velocity variables among CP2 stars is lower than among late B and early A type stars in agreement with previous analysis, and that the average $v \sin i$ for the CP2 stars in our program agrees also with previous determinations.

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Table 2. Statistical results

HD	<VR>	pe	n	Ext.pe	Int.pe	E/I	P%	v sin i	Spectral Type
3580	+12.0	5.4	(4)	10.8	3.8	2.8	0.5	90	Si
6783	+5.6	1.3	(3)	2.3	4.6	0.5	>25	<30	*B8 Si
8783	-4.3	12.8	(3)	22.2	3.4	6.5	<0.1	<30	A2 SrCrEu
10840	19.4	2.1	(6)	5.1	2.1	2.4	1	<30	B9 Si (SiCr:)
22488	15.2	4.0	(5)	8.9	2.1	4.2	<0.1	125	A3 CrSrEu
23207	6.9	3.1	(4)	6.2	2.8	2.2	10-5	<30	*A2 SrCr
24188	6.9	1.6	(3)	2.8	2.9	1.0	>25	<30	A0 Si
24825	5.0	10.6	(2)	15.0	1.8	8.3	-	-	B9 CrEu (CrSrEu)
27463	26.5	2.4	(4)	4.8	2.6	1.8	10-5	40	A0 EuCr (SrCrEu)
28299	22.6	3.9	(4)	7.8	2.4	3.2	1	<30	B8 Si
29435	14.5	1.2	(1)	-	-	-	-	-	B9 Si (normal spectrum)
30612	3.7	4.1	(5)	9.2	1.9	4.8	<0.1	<30	B9 Si
31225	5.7	5.5	(4)	11.0	2.2	5.0	<0.1	<30	A3 SrCrEu (SrCr:)
34060	17.1	5.4	(4)	10.8	2.2	4.9	<0.1	65	B9 SiCr (SiCrSr)
34631	6.3	1.5	(2)	2.1	2.0	1.0	-	<30	*B9 Si
34797	17.3	2.0	(2)	2.9	0.6	4.8	-	30	B8 He weak
36916	6.9	2.8	(2)	4.0	2.2	1.8	-	35	B8 He weak
37808	17.9	1.3	(3)	2.2	1.7	1.3	>25	45	B9 Si
38471	12.7	2.2	(3)	3.9	1.3	3.0	0.5-0.1	30	B9 Si
38719	11.3	1.8	(2)	2.6	1.6	1.6	-	50	A0 SrCrEu
39353	25.6	3.9	(3)	6.7	2.8	2.4	2.5	95	B8 Si
40071	13.1	0.9	(1)	-	-	-	-	-	B9V Si
41089	16.1	1.3	(2)	1.9	2.2	0.9	-	-	B9 SrCrEu (Si)
42326	18.0	3.9	(2)	5.5	3.4	1.6	-	75	A0 CrEu (CrSrEu)
42536	16.0	12.4	(2)	17.6	2.2	8.0	-	60	A0 SrCr (SrCrEu:)
42695	1.5	5.1	(3)	8.8	2.4	2.2	0.5	70	B9 Si
44293	22.2	4.3	(3)	7.4	3.3	1.4	2.5	<30	A0 Cr (SrSiCr)
44953	20.4	0.9	(9)	2.7	1.8	1.5	10	<30	B8 He weak
45439	28.5	3.3	(3)	5.8	2.9	2.0	10	105	B9 Si
46462	23.3	2.8	(3)	4.8	2.9	1.6	25-10	<30	B9 Si (B9 V)
47116	4.7	0.4	(2)	0.6	2.6	0.2	-	<30	B9 Si
49333	15.1	1.1	(8)	3.0	1.7	1.8	2.5	60	B9 Si (He weak)
52993	14.3	6.7	(3)	11.7	1.7	6.9	<0.1	145	B9 Si
56273	9.9	0.1	(2)	0.2	2.9	0.1	-	60	B9 Si
56350	22.4	1.5	(3)	2.6	2.0	1.3	25	40	A0 EuCrSr
56455	27.6	1.7	(3)	3.9	1.7	2.3	5-25	-	A0 Si
56809	-7.3	2.0	(3)	3.5	2.3	1.5	10-5	80	B9 SrCr
56907	21.7	1.2	(3)	2.1	1.9	1.1	<25	<30	A0 Si
58292	12.6	0.2	(3)	0.3	2.2	0.2	>25	<30	A0 Si
58448	20.0	4.9	(3)	8.4	2.3	3.6	0.5-0.1	65	B8 Si
60559	-2.8	12.0	(3)	20.8	2.4	8.9	<0.1	<30	B8 Si
61966	-0.1	4.3	(2)	6.1	4.0	1.5	-	65	B8 Si
62317	24.2	1.3	(3)	2.2	1.7	1.3	>25	<30	A0 Si
62530	6.8	4.4	(1)	-	-	-	-	60	*B9 EuCr
62535	30.8	5.6	(3)	9.8	0.9	10.9	<0.1	<30	A0 Si (SiCr:Sr:)
62553	13.5	6.4	(3)	11.1	2.7	4.1	<0.1	55	A0 Sr (SrCr)

Table 2. continued

HD	<VR>	pe	n	Ext.pe	Int.pe	E/I	P%	v sin i	Spectral Type
62556	23.8	3.4	(3)	5.9	3.2	1.8	10	35	A0 EuCr (Cr Sr)
62640	29.7	3.4	(3)	5.9	2.3	2.6	2-1	45	B9 Si
62714	-7.2	2.0	(12)	7.0	2.3	3.0	<0.1	<30	B8 He weak
63401	16.3	6.3	(3)	10.9	3.2	3.4	0.5	50	B9 Si
64784	28.1	2.7	(2)	3.8	3.7	1.0	-	25	B9 Si
65836	9.1	2.2	(3)	3.8	4.9	0.8	>25	30	A2 SrCrEu
66605	23.4	4.2	(2)	6.0	2.1	2.9	-	-	SiII, CrII, SrII A0
66698	16.8	10.5	(2)	14.9	3.8	3.9	-	<30	A0 Eu (Sr Si:)
67835	18.1	2.9	(3)	5.1	3.2	1.6	25-10	30	B8 Si
68292	5.9	2.0	(3)	3.4	2.2	1.5	25-10	<30	B9 Si
68561	15.0	5.2	(3)	9.1	2.0	4.5	<0.1	<30	B9 Si
70507	18.2	1.2	(3)	2.1	2.8	0.7	>25	30	B9 SiCr
71491	22.0	3.0	(3)	5.2	1.7	3.0	1-0.5	40	B8 Si
72303	10.1	4.0	(3)	6.9	2.2	3.1	1	<30	B9 Si (SiCrSr)
72634	6.8	1.7	(3)	2.9	1.5	1.9	2.5	-	*A0 CrEuSr
72881	13.7	0.7	(3)	1.3	3.2	0.4	>25	<30	B9 Si (SiCr)
72976	24.8	0.9	(3)	1.5	3.7	0.4	>25	<30	A0 Si
74168	2.4	6.4	(3)	11.0	3.9	2.8	2.5-1	55	B9 Si (SiSr)
74388	21.9	5.3	(3)	9.1	2.6	3.5	0.1	40	B8 Si
74888	41.6	0.5	(3)	0.9	1.9	0.5	>25	60	B9 Si
75445	7.2	1.7	(4)	3.0	0.7	4.3	25-10	95	A3 SrEu
75989	-18.1	4.3	(3)	7.5	2.5	3.0	<0.1	<30	B9 Si (SiSrCr)
76614	6.6	1.3	(3)	2.3	3.6	0.6	>25	30	A0 Si
76897	23.4	0.9	(3)	1.6	2.4	0.7	>25	35	B9 Si (SiSr)
77653	20.3	1.9	(4)	3.8	2.5	1.5	10	45	B9 Si (SiSr)
78568	18.0	4.3	(3)	7.5	3.0	2.5	2.5-1	50	B9 Si
80282	23.5	3.3	(4)	6.5	2.2	2.9	1	45	A0 Si
81009	12.9	11.0	(2)	15.5	2.7	5.7	-	85	A3 CrSrSi (SrCrEuSi)
81141	-0.8	5.6	(3)	9.7	3.3	2.9	1	155	B9 Si
82093	-15.1	5.9	(3)	10.2	2.6	3.9	5-2.5	45	A2 SrCrEu (SrCr)
82567	12.8	4.0	(3)	6.9	3.2	2.2	0.1	<30	B9 Si
83368	-9.3	2.0	(3)	3.5	2.8	1.2	25	110	A8 SrCrEu
83625	12.5	5.3	(3)	9.2	2.3	4.0	0.5-0.1	70	A0 SiSr
85892	17.5	11.1	(2)	15.7	2.9	5.4	-	45	*B8 Si
86199	7.1	0.3	(2)	0.4	7.0	0.1	-	<30	B9 Si (SiCr)
86216	10.9	15.9	(2)	22.5	5.2	4.3	-	420	B9 He weak
87653	5.8	5.1	(1)	-	-	-	-	-	*B9 Si
88158	16.4	0.9	(3)	1.6	1.6	1.0	>25	60	B8 Si (SiCrSr)
89103	2.0	1.5	(3)	2.6	3.1	0.8	>25	<30	B9 Si (SiSrCr)
89192	-2.7	4.2	(3)	7.3	3.4	2.1	5	80	A0 CrSrEu
90044	22.9	2.7	(4)	5.4	2.4	2.2	0.5	30	B9 SiCrSr (SiCrSrEu)
90763	-20.5	1.7	(3)	2.9	1.9	1.5	25-10	65	A1 Sr (SrCr)
91089	-3.5	3.6	(3)	6.2	3.3	1.9	10	<30	B9 Si
91239	23.0	2.5	(3)	4.3	2.4	1.8	25	<30	A0 EuCrSi (SrCrSi)
91590	-0.1	4.8	(3)	8.3	2.0	4.1	0.1	<30	B9 Si
92106	-27.7	8.1	(3)	14.1	2.2	6.4	<0.1	<30	A0 CrSrEu (SrCrEu:)
92379	1.1	12.6	(3)	21.8	2.4	9.1	<0.1	80	B8 Si (Si-Sr?)
93821	-10.2	7.7	(2)	11.0	2.7	4.1	-	<30	B9 Si (SiCr:Sr:)
94660	23.4	2.3	(3)	4.0	2.1	1.9	10-5	<30	A0 EuCrSr (SiCrSrEu)

Table 2. continued

HD	<VR>	pe	n	Ext.pe	Int.pe	E/I	P%	v sin i	Spectral Type
95198	13.8	0.4	(3)	0.7	3.1	0.2	>25	45	B9 Si
96451	-26.4	3.1	(4)	6.2	3.1	2.0	5-2.5	80	A0 Sr
96910	1.8	2.7	(1)	-	-	-	-	40	*B9 SiCrEu
97986	-3.2	2.9	(3)	5.0	2.3	2.2	10-5	<30	B8 Si (SiCr:)
98340	3.6	1.4	(3)	2.5	1.8	1.4	25	110	B9 Si (CrSi)
98457	11.9	5.0	(3)	8.7	1.9	4.6	<0.1	<30	A0 Si
101410	1.9	3.5	(3)	6.1	2.6	2.3	2.5	85	*A0 EuCr
103962	-27.5	2.6	(5)	5.7	2.5	2.3	1	-	B9 Si (normal spectrum)
104810	-20.5	2.0	(4)	4.0	1.7	2.3	10	120	B8 Si
105770	-13.1	10.7	(2)	15.2	3.5	4.3	-	<30	B9 Si
105999	-0.1	6.1	(3)	10.5	3.9	2.7	2.5-1	-	F1 SrCr
112381	5.4	1.3	(3)	2.3	2.3	1.0	>25	-	A0 SiCr (SiCrSr)
114365	2.9	4.1	(4)	8.2	2.0	4.1	<0.1	<30	A0 Si
116114	3.6	3.5	(3)	6.0	2.0	3.0	0.5	65	F0 SrEuCr
116458	-5.3	3.7	(3)	6.4	2.1	3.1	<0.1	<30	A0 SiEuCr (CrSrEu?))
118242	-4.1	7.1	(2)	10.1	2.6	3.9	-	93	B9 Si (normal spectrum)
118473	-20.0	0.9	(3)	2.7	3.1	0.9	>25	150	B9 Si (SiCr:)
118816	-35.9	1.6	(3)	2.7	3.0	0.9	>25	<30	B9 Si (Si:)
118913	-4.8	1.7	(3)	3.4	3.6	0.9	>25	40	*A0 EuCrSr
119308	-4.6	1.2	(3)	2.1	2.9	0.7	>25	40	B9 SrCrEu (SrCr)
122208	8.2	0.6	(3)	0.9	3.2	0.3	>25	105	*A2 SrCrEu
123112	-8.4	9.8	(4)	19.6	4.1	4.8	<0.1	205	A0 SiCr (A0V)
125630	-9.2	5.8	(3)	10.1	3.8	2.7	1	45	A2 SiCrSr (CrSrEu:)
127453	11.3	1.1	(3)	2.0	2.5	0.8	>25	30	*B8 Si
127575	7.0	2.9	(2)	4.0	3.2	1.2	-	<30	*B9 Si
128775	5.0	4.0	(3)	6.9	2.7	2.6	2.5	<30	B9 Si (SiCr:)
128974	-24.4	3.2	(4)	6.3	2.6	2.4	1	60	A0 Si (Si:)
129750	4.5	2.9	(3)	5.0	4.4	1.1	25-10	<30	*B9 Si
129899	2.5	0.4	(2)	0.6	2.0	0.3	-	40	*A0 Si
130335	-15.2	1.0	(2)	1.4	3.4	0.4	-	<30	A2 Si
132322	-13.3	2.4	(2)	3.3	3.5	0.9	-	85	A7 SrCrEu
133652	2.5	2.9	(3)	4.9	4.9	1.0	>25	40	B9 Si (SiCr:)
133792	6.5	1.2	(4)	2.3	2.6	0.9	>25	<30	A0 SrCr
134214	-7.7	4.9	(3)	8.5	3.5	2.4	2.5-1	-	*F2 SrCrEu
134874	-29.0	5.8	(3)	10.1	3.3	3.1	0.5	<30	B9 Si (Si:)
135415	-21.4	4.2	(2)	6.0	4.2	1.4	-	<30	B8 Si
137193	-18.0	2.2	(2)	3.1	2.8	1.1	-	30	*B9 Si
137607	5.6	4.3	(3)	7.4	3.2	2.3	2.5-1	40	*A0 Si
138497	-40.0	4.8	(3)	8.4	2.8	3.0	0.5-1	75	B9 SrCrEu
138758	2.2	0.5	(3)	0.8	3.4	0.2	25	50	B9 Si (A0V)
138773	-4.7	0.4	(2)	0.6	3.0	0.2	-	50	*A0 Si
139525	-27.3	0.03	(2)	0.1	2.3	0.04	-	<30	B8 Si
143473	0.3	3.0	(4)	6.1	3.0	2.0	1	30	B9 Si (SiCr)
144231	-9.2	4.9	(3)	8.5	3.0	2.8	0.5	<30	B9 Si
145102	-2.8	3.5	(3)	6.1	4.3	1.4	25-10	90	B9 Si
147890	-28.5	3.3	(2)	4.7	4.4	1.1	-	45	*A0 SiSr
148199	-28.1	3.7	(3)	6.3	2.9	2.2	2.5	40	B9 SiSr (SiCr:)
149764	13.0	5.8	(2)	8.2	4.5	1.8	-	70	*A0 Si
150486	-36.4	3.1	(3)	5.4	2.7	2.0	10	55	B9 Si

Table 2. continued

HD	<VR>	pe	n	Ext.pe	Int.pe	E/I	P%	v sin i	Spectral Type
150500	-2.5	3.7	(3)	6.4	2.4	2.7	1	75	B9 Si
150549	-2.6	3.6	(3)	6.2	4.1	1.5	25	75	A0 Si
151363	-10.9	1.0	(3)	1.7	4.4	0.4	>25	105	*B9 Si
151965	-2.9	0.1	(2)	0.1	2.9	0.03	-	105	B9 Si (SiSr:)
152273	-3.1	9.2	(3)	16.0	3.3	4.8	<0.1	160	A0 Si (A0 V)
152564	-6.0	4.5	(3)	7.7	4.3	1.8	10	75	A0 Si
153201	0.2	1.6	(3)	2.7	2.1	1.3	25	45	B9 Si (SiCr:)
155778	-21.9	1.7	(3)	2.9	2.2	1.3	>25	65	*B8 Si
156853	-24.0	1.7	(3)	5.9	4.3	1.4	25	40	B8 Si
156869	-29.3	2.5	(4)	4.9	2.7	1.8	10	50	*A0 SrCrEu
157678	20.6	3.2	(2)	4.5	6.4	0.7	-	130	*B9 Si
157751	-15.7	0.6	(1)	-	-	-	-	30	*B9 SiCr
158128	4.6	1.9	(1)	-	-	-	-	35	*B9 Si
158175	-12.2	6.0	(2)	8.5	2.8	3.0	-	<30	B8 Si (SiCrSr:)
158819	-17.0	3.2	(1)	-	-	-	-	-	B9 Si (B9/A0 normal)
159286	25.0	3.3	(1)	-	-	-	-	100	*B9 SiCr
159846	-7.2	0.4	(2)	0.6	2.6	0.2	-	<30	B9 Si (SiCr)
160468	40.4	3.0	(1)	-	-	-	-	100	*F2 SrCr
161277	-23.8	4.1	(2)	5.8	1.7	3.4	-	<30	B9 Si (SiSr)
166427	-25.5	0.7	(3)	1.3	2.9	0.4	>25	35	B9 SiCr
166953	1.1	2.4	(4)	4.9	3.1	1.6	25-10	30	A0 Si
169594	-1.3	2.7	(3)	4.7	5.2	0.9	>25	60	A2 Si (CrSrSi)
172690	-2.3	3.6	(3)	6.3	2.8	2.2	25	<30	*A0 SiCrSr
174779	3.3	2.0	(4)	4.0	2.7	1.5	<25	45	A0 Si (SiCrSr)
176196	3.0	6.5	(3)	11.3	2.8	4.0	<0.1	<30	*B9 EuCr
181018	1.6	3.6	(4)	7.3	2.6	2.8	1	<30	B9 Si (CrSr:EuSi)
185183	-16.1	5.1	(4)	10.1	2.1	4.8	<0.1	50	B9 Si
186117	-18.8	8.2	(3)	14.3	2.7	5.3	<0.1	<30	*A0 SrCrEu
187473	-1.3	7.0	(3)	12.1	2.1	5.8	<0.1	<30	B9 SrEuSi
191507	-7.3	8.2	(3)	14.2	4.9	2.9	0.5-0.1	125	B9 Si
191796	-6.9	2.4	(3)	4.2	5.3	0.8	>25	75	A0 EuCr (CrEuSr)
192674	2.4	2.0	(3)	3.4	4.8	0.7	>25	55	B9 CrEuSr
197417	-10.8	1.8	(4)	3.6	3.0	1.2	25-10	65	*A0 CrEu
199728	-11.2	4.9	(6)	12.0	2.8	4.3	<0.1	<30	B9 Si
206653	-0.5	6.0	(3)	10.3	3.6	2.9	1	<30	B9 Si
207188	-13.9	2.2	(4)	4.5	3.4	1.3	25	30	A0 Si
208217	3.1	1.3	(4)	2.6	3.7	0.7	>25	55	*A0 SrCrEu
212385	0.2	3.6	(5)	8.1	3.2	2.5	0.1	<30	A3 SrCrEu
212432	20.3	3.1	(4)	6.2	3.1	2.0	5-2.5	<30	B9 Si
215966	25.7	3.7	(4)	7.3	3.2	2.3	2.5-1	60	B9 EuCr (Sr)
217522	34.0	2.2	(2)	3.1	2.2	1.4	-	45	A5V CrEuSr (SrSi:)
223967	8.5	3.7	(4)	7.4	3.0	2.5	2.5-1	90	B9 Si (B9 V)

Notes to Table 2:

HD 3580: Three radial velocities were published by McFadzean et al. (1987). The average is +5.7 km s^{-1}.

HD 27463: Three radial velocities were published by Nordstrom & Andersen (1985). The average is +22.3± 0.3 km s^{-1}.

HD 37808: Three radial velocities were published by Andersen & Nordstrom (1983). The average is +20.1± 0.9 km s^{-1}.

HD 42536: Three radial velocities were published by Nordstrom & Andersen (1985). It is variable with a range of 58 km s^{-1}.

HD 44953: Three radial velocities were published by Andersen & Nordstrom (1983). The average is +24.2± 0.9 km s^{-1}.

HD 61966A: Three radial velocities were published by Andersen & Nordstrom (1983). The average is +12.0± 1.4 km s^{-1}.

HD 80282: There is one radial velocity (+55 km s^{-1}) from objective prism published by Donoyelle (1987).

HD 81009: Three radial velocities were published by Nordstrom & Andersen (1985). The average is +23.3± 0.8 km s^{-1}.

HD 83368: Four radial velocities were published by Nordstrom & Andersen (1985). The average is −3.2± 1.2 km s^{-1}.

HD 87653: Donoyelle (1987) published one radial velocity (+4 km s^{-1}) from objective prism plates.

HD 90763: Three radial velocities were published by Nordstrom & Andersen (1985). The average is −25.7± 0.8 km s^{-1}.

HD 94660: One radial velocity measurement is in Mathys (1990): +25.4 km s^{-1}.

HD 101410: Four measurements of the radial were published by Nordstrom & Andersen (1985). The average is +0.25± 0.2 km s^{-1}.

HD 116458: Three radial velocity measurements are available by Nordstrom & Andersen (1985) and 25 measurements were published by Dworetsky (1982), who computed an orbit classified as class c in Batten et al. (1989). The baricentric radial velocity is 2.5 km s^{-1}, and the amplitude 14.7 km s^{-1}, with a period of 126.18 days.

HD 128974: Three radial velocities were published by Nordstrom & Andersen (1985). The average is −22.9± 0.8 km s^{-1}.

HD 133792: Three velocities in Nordstrom & Andersen (1985). The average is +11.6±0.7 km s^{-1}. Mathys (1990) provided one measure : +13.2 km s^{-1}.

HD 145102: Levato et al. (1987) provided 7 radial velocity measurements with an average of −1.0 km s^{-1}.

HD 147890: Levato et al. (1987) provided 5 radial velocities. The average is −0.5 km s^{-1}.

HD 150846: Zentelis (1983) published one measurement of the radial velocity: −86.4 km/s.

HD 151965: There is one measurement (+8 km/s) in Perry et al. (1990).

HD 152564: Three measurements in Nordstrom & Andersen (1985). The average is −1.4±1.5.

HD 155778: Zentelis (1983) published one measurement: −25.6.

HD 157751: Zentelis (1983) provided one measurement of the radial velocity: −15.6 km/s.

HD 199728: Three measurements in Nordstrom & Andersen (1985). The average is −10.2±0.5.