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CCD measurements of visual double stars made with the 50 cm refractor of the Nice Observatory (2nd series)⋆

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Abstract. We present the measurements of 65 visual double stars made in 1998 with the 50 cm refractor of the Nice Observatory (Table 1). A CCD camera was attached to this refractor. 6 new binaries discovered by Hipparcos have been measured. The algorithm used for these measurements is based on the adjustment of a tridimensional mathematical surface.

Key words: astrometry — binaries: visual

1. Introduction

We present the results of some measurements of binaries made at the Nice Observatory, within the framework of the researches of the Commission des Étoiles Doubles of the Société Astronomique de France and with the support of the Commission scientific advisers. Our program notably included pairs rarely measured since their discovery and also double stars measured or discovered by the Hipparcos satellite. We used a CCD camera mounted on the 50 cm refractor. The reduction, made with a specific program developed by ourselves, gives impersonal measurements.

2. Image acquisition

As we did for the measurements in 1997 (Salaman et al. 1999), the images were acquired with a resultant focal length of 15.349 m obtained thanks to a Barlow lens 2×. This focal length was checked on wide pairs measured by the Hipparcos satellite. The CCD camera was a HiSIS22, already used for the measurements of binaries with the equatorials of the Nice Observatory (Gili & Couteau 1997). This camera consists of a 768 × 512 square pixels detector. The side of the pixel is 9 μm and its field on the sky is 0.12″. The theoretical resolving power of the instrument (1.22 λ/D) is 0.33″ (at the 0.68 μm wavelength, the highest sensitivity of CCD sensors). The program of acquisition was QMIPS32 (Buil et al. 1997; QuickMips32 V. 1.8). For each binary, 7 to 20 images were recorded with integration times ranging from 0.05 to 1 s. The atmospheric conditions were not very good. The seeing, expressed by the FWHM of the long exposure stellar image intensity profile, often exceeded 1″ which only allowed acquisitions of images about every 2 nights. During our two missions in 1998, from May 14th to 26th and from September 14th to 27th, the images of 65 binaries were acquired.

3. Reduction method

The acquired images are visually sorted, by eliminating those showing important distortions. The selected images are composited (shift and add) with the help of a program using the functions of MIPS (Buil et al. 1993, Mips V. 1.02). At this stage, we verify that the FWHM does not exceed a maximum of 1.2″. To make the measurements of composited images, we used a program of image reduction in C language, written for this purpose. This program was described in a former publication (Salaman et al. 1999). It calculates the position angle, the angular separation and the magnitude difference. In the few cases where the composited image does not show two components obviously separated, it is treated by the wavelet method (Wavelet function of the QMIPS32 program), whose principle consists in analysing the spatial frequencies of the image. The selective extraction of the higher frequencies allows one to separate the components.

⋆ Table 1 is also available in electronic form at the CDS via anonymous ftp to cdsarc.u-strasbg.fr (130.79.128.5) or via http://cdsweb.u-strasbg.fr/Abstract.html

Table 1.

CCDM	NAME	HIP	Magnitudes	MEASUREMENTS					
				Date	θ°	ρ″	Δm	Imag. Nb.	Notes
00057+4548	STT 547 AB	473	9.0 – 9.1	1998, 726	181.5	6.08	0.2	12	(1)
00059+1805	STF 3060 AB	495	9.3 – 9.6	1998, 707	132.3	3.39	0.3	14	
00202+2130	J 630 AB		10.1 – 10.8	1998, 740	113.5	2.77	1.0	10	
00209+3259	AC 1 AB	1669	7.3 – 8.3	1998, 712	288.6	1.81	1.0	13	
00220+2711	HDS 48 AB	1740	8.8 – 11.7	1998, 740	242.4	8.80	3.2	14	(2)
00310+3406	STF 33 AB	2429	8.9 – 8.9	1998, 729	211.7	2.80	0.2	12	
00442+4614	STF 52 AB	3454	7.9 – 9.1	1998, 729	5.0	1.39	1.1	12	
00455+4324	BU 865 AB	3558	8.7 – 9.3	1998, 740	191.2	1.30	0.7	10	
00553+2310	HDS 122 AB	4322	10.9 – 12.5	1998, 740	109.3	10.99	2.4	14	(2)
01052+4354	A 1810 AB		9.3 – 9.8	1998, 723	182.8	2.87	1.1	12	
01119+4748	BU 398 AB	5604	9.4 – 9.4	1998, 723	44.7	1.84	0.0	13	
01201+3638	WEI 3 AB	6240	9.0 – 9.9	1998, 740	186.7	4.73	1.0	13	
01354+2641	HDS 212 AB	7406	8.1 – 10.8	1998, 723	147.5	2.17	2.9	14	(2) (3)
01377+1836	COU 254 AB		9.3 – 9.3	1998, 723	24.8	1.73	0.0	9	
01467+3310	STF 158 AB	8283	9.0 – 9.5	1988, 726	270.3	2.15	0.5	10	
01579+3310	A 1920 AB		8.9 – 9.2	1998, 723	233.7	1.71	0.5	14	
02262+2105	COU 258 AB		9.6 – 9.6	1998, 723	122.8	2.29	0.3	14	
02446+2928	STF 300 AB	12808	7.8 – 8.2	1998, 726	314.0	3.23	0.3	11	
13356+4939	AG 190 AB		9.4 – 9.6	1998, 381	12.2	2.62	0.3	15	
14170+2412	STF 1828 AB		10.1 – 10.1	1998, 386	159.5	2.08	0.2	15	
14222+4831	BU 615 AB		9.6 – 10.6	1998, 384	234.8	3.02	2.3	15	
14337+4300	COU 1586 AB	71206	6.9 – 10.3	1998, 384	142.2	1.74	3.4	15	
14533+3427	ES 311 AB		10.3 – 11.3	1998, 370	291.0	3.95	1.6	14	
15094+1806	J 441 AB		9.3 – 9.8	1998, 400	153.9	3.78	0.8	15	
15126+2041	COU 190 AB		9.9 – 10.0	1998, 381	274.5	1.34	0.1	15	
15141+1809	COU 65 AB		9.6 – 10.6	1998, 370	151.8	7.94	2.3	20	
15205+2206	COU 104 AB		9.4 – 10.4	1998, 375	114.1	5.73	2.0	16	
15540+1936	COU 67 AB		9.8 – 9.8	1998, 370	213.5	1.62	0.1	20	
16226+3819	COU 1280 AB		10.0 – 10.4	1998, 400	31.4	2.45	1.1	15	
16289+1825	STF 2052 AB	80725	7.8 – 8.0	1998, 386	124.7	2.00	0.2	15	(1)
16311+3849	COU 1282 AB		9.9 – 10.3	1998, 400	272.9	2.53	1.1	15	
16396+2344	COU 414 AB		9.6 – 9.6	1998, 384	18.0	1.72	0.1	15	
17067+2225	COU 110 AB		9.7 – 10.0	1998, 384	92.2	1.43	0.5	15	
17253+2513	COU 416 AB		9.5 – 10.2	1998, 400	150.7	2.23	1.1	15	
17339+1747	COU 627 AB		9.7 – 10.3	1998, 386	144.8	2.16	1.2	15	
17490+2511	COU 501 AB		9.6 – 9.7	1998, 386	317.2	1.92	0.2	15	
17566+3045	COU 999 AB		9.5 – 9.9	1998, 386	311.1	1.45	0.6	15	
20072+2611	A 2996 AB	99106	8.5 – 11.7	1998, 710	250.3	2.94	3.2	10	
20080+4223	A 382 AB	99170	7.3 – 9.5	1998, 715	96.1	1.70	2.4	10	
20096+3325	HJ 1485 AB	99324	8.3 – 9.1	1998, 729	276.3	4.71	1.0	14	
20118+3108	COU 1474 AB		9.3 – 10.5	1998, 715	58.8	2.99	2.5	9	
20229+2708	STF 2676 AB	100510	8.3 – 10.0	1998, 723	170.1	2.89	1.7	9	
20412+2703	COU 1038 AB		8.8 – 9.1	1998, 715	78.1	1.05	0.5	7	
20548+4508	HDS 2979 AB	103222	7.8 – 9.7	1998, 710	332.7	2.61	1.9	14	(2) (4)
21001+4004	KUI 103 AB	103655	10.4 – 12.4	1998, 723	99.5	0.89	2.1	12	(1)

Table 1. continued

CCDM	NAME	HIP	Magnitudes	MEASUREMENTS					
				Date	θ°	ρ''	Δm	Imag. Nb.	Notes
21068+3408	STF 2760 AB	104210	7.9 – 8.7	1998, 712	30.6	3.48	0.6	12	
21319+2628	COU 731 AB		9.9 – 10.1	1998, 723	105.0	1.25	0.5	10	
21495+2205	COU 135 AB		9.8 – 10.6	1998, 726	304.8	8.92	1.1	14	
21496+3006	HO 169 AB	107746	8.4 – 11.3	1998, 712	139.0	3.61	3.0	14	
22040+3841	COU 1341 AB		9.7 – 10.3	1998, 715	271.5	1.61	1.9	12	
22300+2556	A 309 AB	111067	8.5 – 11.1	1998, 710	76.5	5.53	2.8	12	
22419+2126	STF 2934 AB	112063	8.7 – 9.7	1998, 715	62.1	1.26	0.9	10	(1)
22537+4445	BU 382 AB	113048	6.0 – 7.8	1998, 729	222.4	0.97	2.0	12	(1)
22557+1547	HU 987 AB	113220	9.3 – 9.9	1998, 723	81.9	1.02	0.5	10	(1)
23011+2647	STF 2969 AB	113654	8.5 – 9.9	1998, 707	35.7	3.92	1.3	17	
23035+4123	HDS 3286 AB	113862	9.3 – 10.6	1998, 740	353.1	17.91	0.7	12	(2)
23212+4219	COU 1647 AB		9.3 – 10.3	1998, 723	185.8	1.03	2.1	15	
23225+3553	COU 1345 AB		9.7 – 11.4	1998, 715	227.0	2.44	2.8	14	
23260+2344	COU 337 AB		9.0 – 11.5	1998, 723	334.6	3.81	3.2	15	
23284+2251	COU 242 AB		9.1 – 11.8	1998, 715	324.6	1.93	2.2	14	
23324+2159	HDS 3354 AB	116175	10.5 – 12.8	1998, 740	39.2	4.16	2.1	12	(2)
23409+2022	HO 303 AB	116838	8.5 – 10.8	1998, 723	183.2	1.30	2.3	14	(1)
23415+3247	ES 2327 AB		10.6 – 10.8	1998, 726	55.7	3.32	0.6	13	
23439+2340	COU 442 AB		10.0 – 12.0	1998, 723	60.4	1.50	1.5	14	
23513+1758	COU 72 AB		10.0 – 12.2	1998, 715	181.0	3.63	1.9	15	

Notes:
- All the pairs were observed one night only.
- All the measurements were made by the team R. Gili, G. Morlet and M. Salaman (GMS code).

(1) - Orbital.
(2) - HDS stars are double stars discovered by Hipparcos (Annex DMSA/C of the Catalogue).
(3) - HDS 212 (HIP 7406): May be BU 507. with very similar position angle, angular separation and Δm.
(4) - HDS 2979 (HIP 103222): May be STT 422. with very similar position angle, angular separation and Δm.

4. Table

The data given in Table 1 are in the following order:

- *Column 1:* CCDM identifier.
- *Column 2:* Name of the pair.
- *Column 3:* HIP identifier.
- *Column 4:* Magnitudes of the two components in the CCDM or Hipparcos catalogues, rounded up to decimal place.
- *Column 5:* Date of the observation.
- *Column 6:* Position angle in degrees.
- *Column 7:* Angular separation in arc seconds
- *Column 8:* Magnitude difference measured with no filter.
- *Column 9:* Number of acquired images.
- *Column 10:* Notes.

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* The catalogues are available from the CDS at Strasbourg.
** Currently updated by the authors at the Royal Observatory of Belgium.