

CCD MEASUREMENTS OF DOUBLE AND MULTIPLE STARS AT NAO ROZHEN. II

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SUMMARY: Using the 2-m telescope of the Bulgarian National Astronomical Observatory at Rozhen observations of twenty multiple stars were carried out during one whole night - October 30/31, and, also, during the first half of the next one - October 31, 2005. This is the second series of CCD measurements of double and multiple stars done at Rozhen. In the paper we present the results for the position angle and separation for eleven multiple stars (35 pairs) which could have been measured.

Key words. binaries: visual

1. INTRODUCTION

The first series of observations of double and multiple stars performed by the Belgrade team at Bulgarian NAO Rozhen with a CCD camera attached to the 2-m telescope took place a year before, that is in the middle of October 2004. The results have been published in Pavlović et al. (2005).

The second series comprising observations of twenty multiple stars took place on October 30/31 and October 31, 2005. The telescope is of the Ritchey-Chretien-Coude type with the focal length of 16 m. The frames were obtained by using the CCD camera VersArray:1300B. The chip dimensions are 1300×1300 pixels, the pixel size is 20×20 micrometers. The angle corresponding to one pixel is 0.258 arcsec. For each star pair twenty frames were obtained (five frames with each of the four filters B, V, R and I).

The observational team at the NAO Rozhen that collected the frames for the measurements consisted of Z. Cvetković and B. Novaković from Belgrade Astronomical Observatory and A. Stri-

gachev from the Institute of Astronomy of Bulgarian Academy of Sciences.

For eleven double or multiple stars (35 pairs) the position angle and separation were measured, whereas in the case of the other nine the star images were not visibly separated and the measurements could not be carried out. The reasons are the proximity of the components, the limiting capabilities of the CCD camera, the exposure duration, rather poor seeing due to a high air humidity. The measurements were possible for the following stars: WDS 00057+4549, WDS 00174+0853, WDS 01214+3440, WDS 21066+3436, WDS 21182+3035, WDS 21516+6545, WDS 22044+1339, WDS 22190+4125, WDS 22281+1215, WDS 22586+0921 and WDS 23103+3229.

The frames were measured by using the programme AIP4WIN (version 1.4.21).

A total of 35 pairs was measured of which for only one the orbit has been previously calculated and the orbital elements are given in the Sixth Catalog of Orbits of Visual Binary Stars (Hartkopf and Mason 2003). In the case of this binary the measure-

ments were compared to the ephemerides. The residuals $O - C$ as computed using the orbits Pop1996b (Popović and Pavlović 1996) and Kiy2001 (Kiyaeva et al. 2001) are within the error limits. They are given in Table 2.

The results and notes are given in Tables 1 and 2, respectively. The designations used: WDS - identification in WDS Catalogue (Mason et al. 2003); Disc. -double-star name after the discoverer; Mult.

- designation for pair components; HIP - identification in Hipparcos Catalogue (ESA 1997); Epoch - observational epoch; θ [°] -position-angle in degrees; ρ ["] - separation in seconds of arc; n - number of measurements; Auth. - measurement author's name, Z. Cvetković (Cve), B. Novaković (Nov) and G. M. Popović (Pop); Notes - means that in Table 2 there is a comment (N), or the pair has an orbit (O).

Table 1. CCD Measurements of Double and Multiple Stars

WDS	Disc.	Mult.	HIP	Epoch 2005+	θ [°]	ρ ["]	n	Auth.	Notes
00057+4549	STT 547	AB	473	0.8301	183.9	5.73	21	Cve	O
					183.0	5.71	15	Nov	
					184.1	5.95	8	Pop	
00057+4549	STT 547	AC	473	0.8301	261.0	106.11	20	Cve	N
					261.2	105.85	6	Nov	
00057+4549	STT 547	AE	473	0.8301	352.4	54.58	20	Cve	N
					352.5	54.50	11	Nov	
					352.7	54.54	3	Pop	
00057+4549	STT 547	AD	473	0.8301	226.3	103.39	20	Cve	N
					226.4	103.27	11	Nov	
					226.7	104.12	1	Pop	
00057+4549	Pop 217	AP	473	0.8301	356.1	9.06	17	Cve	N
					356.2	9.55	5	Nov	
					355.3	9.64	10	Pop	
00057+4549	POP	AY	473	0.8301	79.1	197.09	20	Cve	N
					79.1	196.87	24	Nov	
					79.1	196.19	1	Pop	
00057+4549	POP	Yy	473	0.8301	189.0	9.48	11	Cve	N
					190.5	9.43	6	Nov	
					189.0	9.89	3	Pop	
00174+0853	STF 22	AB-C	1392	0.8302	234.3	3.43	15	Cve	N
					235.5	3.36	16	Nov	
					233.5	3.47	10	Pop	
00174+0853	STF 22	AB-D	1392	0.8302	149.6	65.48	40	Cve	N
					150.5	65.75	10	Nov	
					150.8	65.84	3	Pop	
00174+0853	POP	AB-E	1392	0.8302	239.2	74.22	1	Pop	N

Table 1. Continued

WDS	Disc.	Mult.	HIP	Epoch 2005+	θ [°]	ρ ["]	n	Auth.	Notes
01214+3440	POP 54	AC	-	0.8303	195.5	22.00	39	Cve	N
					194.9	22.08	20	Nov	
					196.0	22.04	11	Pop	
21066+3436	POP 22	AB	-	0.8296	106.4	5.32	31	Cve	
					105.9	5.99	10	Nov	
					106.3	6.13	9	Pop	
21066+3436	POP 22	AC	-	0.8296	15.6	29.86	51	Cve	
					15.7	29.87	15	Nov	
					16.1	29.85	16	Pop	
21066+3436	POP 22	A-F	-	0.8296	303.6	55.56	2	Pop	
21066+3436	POP 22	FG	-	0.8296	319.2	7.39	9	Pop	
21066+3436	POP 22	A-D	-	0.8296	347.3	134.25	1	Pop	
21066+3436	POP 22	DE	-	0.8296	283.0	7.53	15	Pop	
21066+3436	POP 22	A-M	-	0.8296	112.9	174.14	1	Pop	
21066+3436	POP 22	MN	-	0.8296	273.9	8.21	9	Pop	
21066+3436	POP 22	A-X	-	0.8296	353.9	137.89	1	Pop	
21066+3436	POP 22	XY	-	0.8296	350.4	4.22	2	Pop	N
21182+3035	NOV	A-X	105162	0.8297	142.1	183.89	18	Nov	N
					142.4	184.22	2	Pop	
21182+3035	NOV	XY	105162	0.8297	205.4	14.05	20	Nov	N
					205.6	14.22	15	Pop	
21182+3035	NOV	AD	105162	0.8297	162.8	20.49	7	Nov	N
					162.4	21.22	4	Pop	
21182+3035	NOV	XZ	105162	0.8297	57.6	17.67	20	Nov	N
					56.1	18.01	1	Pop	
21182+3035	POP	A-N	105162	0.8297	261.6	61.60	2	Pop	N
21182+3035	POP	NK	105162	0.8297	72.7	5.87	2	Pop	N
21182+3035	NOV	XQ	105162	0.8297	135.3	28.73	7	Nov	N
21182+3035	NOV	XL	105162	0.8297	89.8	31.39	20	Nov	N

Table 1. Continued

WDS	Disc.	Mult.	HIP	Epoch 2005+	θ [°]	ρ ["]	n	Auth.	Notes
21516+6545	STF 2843	AC	107893	0.8326	277.4	54.38	38	Cve	N
					277.5	54.37	20	Nov	
22044+1339	STF 2854		108949	0.8297	85.2	1.51	2	Pop	N
					84.8	1.52	5	Cve	
22190+4125	POP 165	A-B	-	0.8299	265.5	37.17	40	Cve	N
					265.6	37.18	20	Nov	
					265.8	37.33	7	Pop	
22281+1215	BU 701	A-C	110900	0.8299	132.4	124.18	48	Cve	N
					132.5	124.19	24	Nov	
22586+0921	BU 1521	AB-D	113445	0.8300	112.1	137.41	40	Cve	N
					112.1	137.32	20	Nov	
23103+3229	HJ 5532	AB-C	114415	0.8301	76.7	57.01	40	Cve	
					76.8	57.04	19	Nov	

Table 2. Notes

WDS	Mult.	Notes
00057+4549	AB	Residual (O-C) from orbit Pop1996b (Popović and Pavlović 1996): (Cve) $-0^{\circ}7, -0''23$; (Nov) $-1^{\circ}6, -0''25$; (Pop) $-0^{\circ}5, -0''01$; Residual (O-C) from orbit Kiy201 (Kiyeva et al. 2001): (Cve) $-0^{\circ}4, -0''33$; (Nov) $-1^{\circ}3, -0''35$; (Pop) $-0^{\circ}1, -0''11$;
00057+4549	AC	Cve: Component C is in this paper identified correctly.
00057+4549	AE	Pop: In paper POP1997b (Popović and Pavlović 1997) component E erroneously identified labeled as C.
00057+4549	AP	Pop: This is a multiple of system ADS 48. First measurement from 1994.
00174+0853	AB-E	Pop: Component E is very faint.
01214+3440	AC	Pop: Component B is not visible in the frames.
21066+3436	XY	Pop: Component Y is significantly fainter than component X.
21182+3035	A-X	Nov: First measurement. AB=HO 154. Components B and C are not seen in the frames.
21182+3035	XY	Nov: First measurement.
21182+3035	AD	Nov: First measurement.
21182+3035	XZ	Nov: First measurement.
21182+3035	A-N	Pop: First measurement.
21182+3035	NK	Pop: First measurement.
21182+3035	XQ	Nov: First measurement.
21182+3035	XL	Nov: First measurement.
22044+1339		Pop: Visible in R filter only.
22190+4125	A-B	Pop: Pair BC could not be measured.
22281+1215	A-C	Cve: Component B is not visible in the frames.
22586+0921	AB-D	Nov: All θ values are around 112° ; therefore it could be an edge-on binary.

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CCD МЕРЕЊА ДВОЈНИХ И ВИШЕСТРУКИХ ЗВЕЗДА НА НАО РОЖЕН. II

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Стручни чланак

У току целе ноћи 30/31. октобра и прве половине ноћи 31. октобра 2005. године снимљено је 20 вишеструких система CCD камером на 2-метарском телескопу бугарске Националне Астрономске Опсерваторије на Рожену. Ово је друга серија CCD мерења

двојних и вишеструких звезда обављених на Рожену. За епоху посматрања дате су измерене вредности позиционог угла и растојања за укупно 35 парова у 11 вишеструких система које је било могуће измерити.