Measurement of Neglected Double Stars with a Mintron Video Camera

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Abstract: This report contains the theta/rho measurements from 60 neglected double stars systems. For this I used a 28-cm Schmidt-Cassegrain telescope and a Mintron video camera. To use this camera for astronomical intentions first it was necessary to adapt the software to the special size of his detector.

At the beginning of 2007 I decided to do a specific program of doubles that needed updates. To do this, I downloaded the latest version of the Washington Double Star catalog (WDS) and filtered it to show systems with an angular separation greater than 1" and less than 15", that had not been measured since 1991; that is, they had been studied neither by the Hipparcos mission nor by Tycho. A little over fourteen thousand entries were selected; that would be my new observational program.

I used an f/10 Schmidt-Cassegrain telescope with a 28 cm aperture and a Mintron video camera. The video camera uses a Sony ICX249AL monochrome (black-and-white) sensor, and is very sensitive. The maximum exposure time was 2.56 seconds, though depending on the magnitude of each system, shorter exposure times were sometimes used. A video capture (frame grabber) card was used with the camera to produce 768 x 576 pixel still images. Unfortunately, this combination of the 795 x 596 pixel sensor and the 768 x 576 pixel frame - grabber produces a rescaled image This rescaling must be corrected for using post processing in order for measurements to be correct.

The capture of images was first produced at the primary focus, which yielded a resolution of 0.65 as/pixel. Also, in most of the cases, images were taken with a 2X Barlow. This configuration resulted in a focal length of 5870mm at a resolution of .30 arcseconds/pixel.

For the reduction of information I primarily used *Astrometrica* version 4.4. With this program, using the UCAC2 catalog when possible, I calculated the absolute astrometry of each star. Later, the program *Dobles*, developed by Julio Castellano, calculated theta and rho depending on the absolute astrometry. In addition, *Astrometrica* also calculated the resolution per pixel and the orientation of the image, both necessary in order to perform measurements with the Reduc software. Due to the fact that there were not always sufficient stars to refer to, not all the systems were measured using this method. In these cases, *Reduc* turned out to be a fundamental tool. However, when possible, every system was measured using both types of software. I want to express my gratitude for the work Florent Losse carried out to make *Reduc* work despite the re-scaling previously mentioned.

Description of the Table

When the magnitude appears with two decimals, it is extracted from catalogs, principally from the Tycho-2 Catalog, although I have also used Nomad Catalog, and on occasions I have transformed the aerial map-making of the photometry of the USNOB1.0 to magnitude V. The others, included only for orientation, are calculated by *Astrometrica* according to the images measured on the basis of the USNOA2.0 catalog in R band without any filter.

The number of the Tycho catalog or GSC is given, as well as the coordinates in J2000.0 epoch, calculated with *Astrometrica* for the main star.

The spectral classes were calculated primarily on

the basis of JHK photometry of the 2MASS catalog, according to a routine developed by Francisco M. Rica. In many cases, the spectrum is given depending on whether the stars are presumed to be giants or on the main sequence.

All the systems were observed on one single night.

Acknowledgments

I thank Florent Losse for his work on the *Reduc* software. Thanks also to Francisco M. Rica Romero for his help. I also want to thank Juan Luis González Carballo for his help in the translation of this article and his constant encouragement.

References

Mason, B.D. et al., *The Washington Double Star Catalog* (WDS) 2006.5, U.S. Naval Observatory.

www.projectpluto.com

http://webviz.u-strasbg.fr/viz-bin/VizieR

WDS	Designation	Mag A	Mag B	Tycho/GSC A	Tycho/GSC B	PA	Sep	Epoch	Coordinates	Notes
00016+3714	ALI 472	12.2	12.2	2271 1913		249.6	9.04	2007.764	00 01 37.01 +37 14 40.7	1
00118+3608	BU 1340	10.22	13.5	2272 1536 1		232.7	5.06	2007.764	00 11 56.47 +36 08 54.8	2
00139+6023	STI 25	13.0	13.9	4014 1173		218.8	3.42	2007.737	00 13 54.73 +60 23 19.3	
00156+5910	STI1308	11.41	12.9	3665 326 1		223.6	3.41	2007.737	00 15 40.13 +59 10 15.6	3
00163+1537	J 1321	11.02		1179 1731 1		105.8	2.63	2007.795		4
00214+6135	ES 1937	9.90	16	4015 32 1		314.0	5.52	2007.737	00 21 21.43 +61 33 30.1	5
00248+6114	STI 53	13.0	12.9	4015 1342		119.5	6.07	2007.737	00 24 50.19 +61 14 25.3	6
00530+6358	STI 135	11.00	14.8	4025 1466 1		162.0	4.13	2007.740	00 53 00.32 +63 57 33.2	7
00581+3944	MLB 972	13.3	14.5	2802 1074		286.2	5.41	2007.732	00 58 03.05 +39 44 55.4	8
01013+3704	TDS1720	11.55	11.63	2289 342 1		244.9	2.48	2007.732		9
01024+3958	MLB 811	12.52	13.3	2803 1842		202.1	7.18	2007.732		10
01040+6325	STI 170	11.87	13.9	4021 989 1		184.9	7.72	2007.740	01 03 56.32 +63 25 17.5	11
01051+3814	J 1804	11.06	12.8	2799 1018 1		309.7	5.22	2007.732	01 05 05.95 +38 14 27.4	12
01076+2354	POU 102AB	11.85		1747 648		110.8	4.37	2007.833		13
01185+4018	MLB 736	12.95	14.2	2804 1875		65.6	8.10	2007.923	01 18 31.28 +40 17 46.0	14
01248+6222	STI 211	12.2	12.24		4034 1444 1	279.0	13.13	2007.740	01 24 42.15 +62 22 27.4	15
01254+3938	MLB 812AB	12.64	13	2817 1107		237.5	5.34	2007.923	01 25 25.29 +39 37 37.9	16
01270+3742	ES 2449	11.74	13	2813 1132		186.1	6.56	2007.923	01 27 02.72 +37 43 06.7	17
01288+6318	MLB 328	11.94	13.5	4035 785 1		109.0	2.94	2007.740	01 28 48.08 +63 18 22.6	18
01295+6317	MLB 329AB	11.46	12.5	4035 571		347.1	3.10	2007.740	01 29 23.04 +63 16 58.8	
02045+3137	SEI 23	12.78	13.15	2308 151 1		255.8	28.08	2007.765	02 04 40.50 +31 38 09.9	19
02115+3102	MLB1034	10.80	13.7	2309 1093 1		285.2	11.56	2007.765	02 11 28.98 +31 02 37.7	20

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Measurement of Neglected Double Stars with a Mintron Video Camera

WDS	Designa-tion	Mag A	Mag B	Tycho/GSC A	Tycho/GSC B	PA	Sep	Epoch	Coordinates	Notes
02157+2957	MLB 738	11.56	13.8	1777 447 1		274.1	8.83	2007.765	02 15 40.91 +29 57 00.0	21
02160+2940	MLB 740	11.71	14.0	1777 1458 1		338.3	6.39	2007.765	02 16 01.65 +29 40 06.7	22
02160+3044	MLB 739	11.58	13.1	2310 1354 1		129.7	15.36	2007.765	02 16 01.64 +30 44 06.6	23
03068+3918	MLB 818	12.70	14.5	2847 450		328.6	6.71	2007.926	03 06 47.24 +39 18 37.1	24
03074+4004	MLB1027	11.63	14.5	2851 534		14.0	7.35	2007.926	03 07 21.98 +40 04 45.0	25
03084+4020	BRT2204	12.07		2851 1928		190.5	3.86	2007.926	03 08 22.83 +40 19 53.8	26
03381+2503	POU 299	11.88		1803 226		69.8	6.72	2007.937	03 38 03.17 +25 02 27.7	27
03482+2235	LOH 1	10.97	12.49	1800 2103		131.8	9.33	2007.937	03 48 08.10 +22 33 31.9	28
03562+2415	POU 323	12.3	13.2	1813 35		346.7	4.41	2007.803	03 56 11.29 +24 14 22.6	29
03570+2359	POU 326	13.0	13.3	1813 309		153.6	5.73	2007.803	03 57 00.43 +23 59 10.8	30
03579+2322	POU 333	13.13	14.6	1813 871		230.2	3.99	2007.803	03 57 59.31 +23 22 09.2	31
04015+2443	POU 345	12.74	13.26	1817 527	1817 497	214.4	14.48	2007.929	04 01 33.14 +24 42 26.9	32
04019+2358	POU 350	13.96	14.6	1813 173	1813 220	31.8	3.86	2007.929	04 01 53.69 +23 57 50.3	33
05350+3648	SEI 338		12.39	2416 1034	2416 1111	62.5	7.07	2007.943	05 34 59.04 +36 47 39.9	34
05464+3659	MLB 824	13.08	14.44	2417 1102		15.8	9.29	2007.937	05 46 27.21 +36 59 25.6	35
05468+3606	COU1730	11.53		2417 771		174.6	1.84	2007.937		36
05468+3658	MLB 825	11.64	13.6	2417 726		97.6	6.16	2007.937	05 46 45.50 +36 57 46.0	37
18463+3745	ES 2484	13.1	12.7			332.4	6.65	2007.663	18 46 17.10 +37 45 40.9	38
18466+3853	ES 2021AB	11.22	12.6	3118 1777 1		253.94	20.49	2007.663	18 46 37.26 +38 52 24.2	39
18466+3853	ES 2021BC	12.7	13.8	3118 1743		297.9	3.66	2007.663	18 46 35.58 +38 52 18.6	40
18477+4159	ES 1560	10.46	12.9	3126 1088 1		346	9.88	2007.663	18 47 03.01 +41 55 24.1	41
18484+3612	ES 2023	8.64	12.5	2650 1010		244.4	6.17	2007.663	18 48 24.10 +36 11 41.9	
18546+3656	ELS 7AB	13.0	13.1			338.9	8.51	2007.663	18 54 37.56 +36 55 48.5	
18546+3656	ELS 7AC	13.0	15.5			120.1	10.09	2007.663	18 54 37.56 +36 55 48.5	
20212+3304	MLB 772	12.71	14.17	2676 865		133.3	8.32	2007.671	20 21 12.00 +33 04 06.7	42
20242+3456	POP 94	11.81		2693 994 1		150.4	2.69	2007.671	20 24 12.18 +34 56 58.4	
20243+3507	POP 80	12.6	13.8	2693 702		328.3	2.81	2007.671	20 24 16.37 +35 08 08.0	43
21285+3636	ALI 443	11.40	13.0	2716 1139		298.1	4.27	2007.642	21 28 31.74 +36 36 29.0	44
21296+3625	ES 258AB	10.84	11.08	2716 2656 1	2716 1017 1	33.7	10.94	2007.643	21 29 35.76 +36 26 09.0	45
21296+3625	ES 258BC	11.08	12.3	2716 1017 1		9.7	18.44	2007.643	21 29 36.26 +36 26 18.0	46

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WDS	Desig-nation	Mag A	Mag B	Tycho/GSC A	Tycho/GSC B	PA	Sep	Epoch	Coordinates	Notes
21400+3605	ES 2129	12	11.60	2729 1268		311.2	5.14	2007.643	21 40 18.97 +36 02 53.5	47
21407+3612	ES 2130	12.5	13.5	2729 1208		120	3.17	2007.643	21 40 42.99 +36 12 48.3	48
22156+3811	ES 2530	11.09	12.1	3199 364 1		304.7	5.22	2007.732	22 15 34.15 +38 10 58.7	49
22178+3857	MLB 795	11.48	13.1	3199 629		81.1	6.72	2007.732	22 17 46.89 +38 57 07.5	50
22189+3807	ALI 701	11.6	11.27	3199 1581	3199 2167 1	13.7	14.13	2007.732	22 18 48.57 +38 06 51.2	51
23298+2451	POU5816	12.59		2250 154		209.9	3.22	2007.923		52
23358+2432	POU5828	13.42	13.79	2250 824	2250 560	55.3	11.02	2007.828	23 35 46.07 +24 32 27.8	53
23583+0132	BVD 10	12.29	12.40	587 699		249.5	7.58	2007.836	23 58 20.43 +01 32 07.0	54

Table Notes

1. Spect. G7 V/G1 III and A7 V. Different proper motion of each component. Optical double star.
2. A-component Spect. F7 V.
3. A-component Spect. F1 V.
4. Only measured with Reduc. Primary, with F7 V Spect., has proper motion in RA: 40.3 mas/yr and in Dec: -43.3 mas/yr. Practically without movement in all the 20th century, so they must have some physical relation.
5. Spect. G5 V and G1 V/F9 III. Small proper motions.
6. Spect. A6 V and G6 V. I see slightly bright the B component.
7. Spect. A9 V and F4 V. Sep. increasing.
8. Spect. F9 V and G3 V.
9. Only measured with Reduc. A-component Spect. K3 V/ K0 III and it has a proper motion in RA: -10.9 mas/yr and in DEC: -21.7 mas/yr.
10. A-component have Spect. M4 III and it has a proper motion in RA: 21.8 mas/yr and in Dec: 2.7 mas/yr. B component is F9 V. Sep. increasing.
11. Very similar Spect., both G7 V/G1 III. Sep. decreasing.
12. A-component's Spect. G1 V/ F9 III and it has a proper motion in RA: -20.6 mas/yr and in Dec: -13.4 mas/yr. B component's Spect. G9 V/ G3 III.
13. Only measured with Reduc. A-component's Spect. K1 V/G5 III and it has a proper motion in RA: 0.0 mas/yr and in Dec: -9.5 mas/yr.
14. Spect.: A-component K3 V / G9 III and B component G5 V/ F9 III.
15. Spect. F3 V and F1 V. In this case Theta should have an inverse character, B component must be brighter.
16. Red stars, Spect. M4 III and K2 V/G9 III respectively.
17. Optical system. Spect. G6 V and F8 V respectively.
18. A-component has the next proper motion: -8.8 mas/yr and in Dec: -5.4 mas/yr.
19. Evident optical system. In UCAC2 catalogue proper motion of A-component in RA is -11.4 mas/yr and in Dec -7.8 mas/yr. B component has proper motion in RA -3.1 mas/yr and in Dec -3.8 mas/yr. Spect. F9 V/ F8 III and G7 V/G0 III respectively.
20. Optical couple, they split each other. A-component has a proper motion in RA 21.2 mas/yr and in Dec -7.9 mas/yr. Spect. K4 V/ K1 III and G1 V/F8 III respectively.
21. Optical double star. A-component has a proper motion in RA 26.6 mas/yr and in Dec -34.9 mas/yr. Spect. G5 V/ F9 III and K1 V/ G4 III respectively.
22. Spect. F6 V and G6 V.

23. Optical pair, the split each other quickly. A-component has a proper motion in RA 14.4 mas/yr and in Dec -0.3 mas/y and Spect. F3 V. Deducing: B component, a red star (Spect. M3 V/ K4 III), presents a bigger proper motion.
24. Spect. G5 V/ F9 III and G0 V /F8 III.
25. Spect. K3 V/ K0 III and F6 V.
26. Spect. F9 V and F8 V.
27. Similar Spect.: G7 V / G1 III.
28. Proper motions according to the UCAC2 catalogue: A-component in RA: -33.6 mas/yr and in Dec: -18.4 mas/yr, and B: in RA: -35.1 mas/yr and in Dec: -19.9 mas/yr. Common proper motion stars. Spect. F7 V and G6 V.
29. Proper motion of A-component according UCAC2: RA: 11.7 mas/yr and Dec: -63.1 mas/yr. Spect.: G9 V/ G2 III and K1 V/ G5 III.
30. Spect.: G8 V/ G2 III and K1 V/ G5 III.
31. Proper motion of A-component according to UCAC2: RA 32.7 mas/yr and Dec: 24.5 mas/yr. Spect.: G5 V/ F9 III and K0 V/ G3 III.
32. Optical pair, probably. Spect.: G7 V/ G1 III and K6 V/ K2 III.
33. Spect.: F8 V and G3 V. Insignificant proper motions.
34. Spect.: F6 V and F4 V. Different proper motions. Optical pair.
35. Spect.: F6 V and M0 V/ K4 III.
36. According to Tycho-2, proper motion of A-component: RA: -20.1 mas/yr and Dec: -67.8 mas/yr. Spect.: K0 V. Physical system.
37. The A-component has the next proper motion: RA: 6.8 mas/yr and en Dec: -10.6 mas/yr. Spect.: G3 V/ F9 III.
38. AP should be invert. According Nomad Catalog the proper motion of B component is: RA: -45.8 mas/yr and Dec: 85.1 mas/yr.; Spect.: G9 V/ G2 III. A-component Spect.: G0 V/ F8 III.
39. Proper motions very different, optical double star. Spect.: F6 V and F9 V.
40. According to UCAC2 catalogue, proper motion of A-component is 32.4 mas/yr and Dec: -2.7 mas/yr, Spect. F9 V.
41. Main component Spect.: K9 V with the next proper motion: RA 1.2 mas/yr and Dec: -11.3 (Tycho 2). B component Spect.: G5 V/ G0 III.
42. A-component Spect.: G4 V/ F9 III and has the next proper motion: RA: -4.5 mas/yr and Dec: -6.1 mas/yr. B component Spect.: K1 V/G5 III.
43. A-component has proper motion: RA: -0.2 mas/yr and Dec: -9.2 mas/yr.
44. Spect.: K1 III and F3 V respectively. A-component proper motion: RA 51.1 mas/yr and Dec: -32.8 mas/yr. The B component should have the same p.m. Probably physical system.
45. Spect.: F1 V and K0 V. Optical couple.
46. Proper motion of A-component: RA: -36.0 mas/yr and Dec: -157.3 mas/yr. Proper motion of B component: RA: 5.1 mas/yr and en Dec: 87.4 mas/yr. Optical double star with high displacement. Spect.: K0 V and G3 V respectively.
47. AP should be invert. Spect.: K and K5 III. Proper motion of B component: RA: 3.6 mas/yr and Dec: 12 mas/yr.
48. Proper motion: RA: 20.8 mas/yr and Dec: 1.2 mas/yr.
49. Spect.: F3 V and G5 V. Proper motion of A-component: RA: 9.7 mas/yr and Dec: -10.3 mas/yr.
50. Spect.: F7 V and G2 V. A-component has the next p.m.: RA: -10.2 mas/yr and Dec: -1.2 mas/yr.
51. Different proper motions, optical double star. A-component = RA: 4.5 mas/yr and Dec: -1.7 mas/yr. B-component: RA: 9.6 mas/yr and en Dec: -5.7 mas/yr. AP should be invert.
52. A-component Spect. K has proper motion: RA: 20.4 mas/yr and Dec: 29.1 mas/yr.

53. Optical pair. A-component Spect. G and has p.m.: RA: -8.2 mas/yr and Dec: -31.1 mas/yr. B component has Spect.: K.
54. Not cataloged in WDS. Spect. G6 V (both). Possibility that it's a physical system.

The author is an active observer of double stars, comets and asteroids who is working from home in Spain. He is also a member of the LIADA's Double Star Section.