Neglected Double Observations for 2006 No. 5: 22nd and 23rd Hour Doubles

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Abstract: I report measures for 50 neglected (at epoch) doubles, many having a single previous observation reported in the WDS as of manuscript submission. In addition, I report measures of 26 recently measured pairs. Three new pairs are reported. Observations were made with the GRAS002 robotic telescope located at the Remote Astronomical Society Observatory, Mayhill, NM, USA (http://www.remote-astronomical-society.org/). In addition to theta and rho values (and standard deviations), I report catalog numbers and magnitude differences of pairs, some of which lack precise positional information and delta-M values.

In this paper, I report a total of 76 mean and standard deviation measures of theta (PA) and rho-(Sep) values of double stars imaged using a Takahashi Mewlon 300 Dall-Kirkham cassegrainian reflector located at the Remote Astronomical Society Observatory in Mayhill, New Mexico. The instrument, with a focal reducer, works at F9.1, with an approximate focal length of 2730 mm. It is equipped with a non-antiblooming ST8E CCD camera (9 micron pixels) and the combination has an approximate resolution of 0.68 arcseconds/pixel with a field of view of 11.5x17.3 arcminutes. The OTA is mounted on a Bisque Paramount 1100 GEM.

Methods

Methods largely follow previous methods (Wiley 2008). Observing lists were requested from the USNO (Mason, 2006). The list is processed as detailed in Wiley (2007) using the Aladin interactive sky atlas (Bonnarel et al., 2000), the Washington Double Star Catalog (Mason et al., 2006) and a number of catalogs, minimally UCAC2.0 (Zacharias et al., 2004), GSC2.3.2 (STScI, 2006), 2MASS (Skrutskie et al., 2006), and AC2000.2 (Urban, 1998).

Exposures are carried out with a clear filter and the initial image was checked by downloading a JPEG of the FITS image to insure that the correct field was imaged. Exposures ranged from 20-40 seconds. MPO Canopus (Warner, 2006) is used to reduce the images. Magnitudes reported are V-magnitudes from the GSC2.3.2 catalog or J-magnitudes from 2MASS catalog, except as noted. Delta-M was computed from catalog values. New doubles are named using recommendations in Hartkopf and Mason (2004). All proper motions reported in right ascension are corrected RA (*cos(Dec) and were taken from the UCAC2.0 catalog. Precession and theta and rho values from precessed pairs were reduced using the utilities "Precessn" and "RecToPol" derived from formulae by Greaney in Argyle (2003).

Results

Measures for all pairs, neglected and recently measured are presented in Table 1. This is followed by a discussion of selected pairs.

Discussion of Selected Measured Pairs

22430+2944CHE 393. Identity is problematic. Theta and rho are reasonable matches, but magnitudes are off.

22444+3042CHE 409. Proper motions are similar although errors are high. A: RA-9.3±5.6 mas/yr, .Dec -13.7±5.5 mas/yr; B: -9.9±5.5 mas/yr, Dec -17.9±5.6 mas/yr. UCAC2.0 catalog numbers: A, 42686160; B, 42686155.

22442+2937CHE 406. If I have identified this pair correctly, the 2006 measure reported in the WDS

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WDS/Disc.Code	Primary	Secondary	Pri. Mag.	Sec Mag.	DM	PA	sdPA	Sep	sdSep	Date	N	Notes
22425+3230 CHE 381	N2VT000537	N2VT000533	10.71	12.56	1.85	8.5	0.02	32.83	0.077	2006.901	4	1,2
22426+3232 CHE 383	N2VT000510	N2VT000516	10.69	12.79	2.1	182.8	0.09	33.02	0.059	2006.901	4	1,2
22428+2947 CHE 387	N09X000051	N09X000050	11.84	12.94	1.1	277	0.04	25.4	0.077	2006.901	5	1,2
22428+3021 CHE 386	N09Z000452	N09Z000453	12.36	13.73	1.37	270.4	0.13	10.54	0.074	2006.901	4	1
22430+2944 CHE 393	N0AF000002	N0AF000003	13.34	13.60	0.26	123.7	0.15	13.72	0.053	2006.901	5	1
22432+2941 CHE 395	N0AE000019	N0AE000018	13.56	13.95	0.39	283.8	0.23	18.08	0.08	2006.901	5	1,2
22435+3813 DOB 16	N2XP000611	N2XP000610	9.48	11.48	2	78.8	0.09	23.94	0.024	2006.901	5	1,2
22435+3645 ALI 460	2M355904147	2M355904141	9.27	11.74	2.472	166.6	0.82	6.78	0.181	2006.901	4	1,2,3
22436+3811 ES 1997	2M355907613	2M355907612	11.19	11.02	0.173	89.4	0.66	3.5	0.289	2006.901	3	1,2
22438+2357 POU5739	N0MC000068	N0MC000067	14.27	14.51	0.24	244.5	0.59	11.59	0.09	2006.901	5	1,4
22439+2938 CHE 400	N0AE000034	N0AE000035	12.98	13.01	0.03	228	0.24	9.05	0.179	2006.926	3	1
22440+2358 POU5741	N0MC000063	N0MC000062	11.50	12.91	1.41	46.9	0.30	9.92	0.047	2006.901	5	1,2
22440+3047 CHE 401	N09Z000259	N09Z000260	10.27	11.91	1.64	254.5	0.05	17.22	0.044	2006.901	4	1,2
22442+2937 CHE 406	N0AE016307	N0AE000043	7.83	13.87	6.04	24.7	0.42	17.62	0.08	2006.926	2	1,2
22442+3048 CHE 405	N09Z000247	N09Z000244	12.16	13.35	1.19	54.5	0.29	14.94	0.033	2006.901	4	1,2
22443+2957 CHE 407	N09X000014	N09X000012	13.01	12.79	0.22	218.6	0.15	24.59	0.108	2006.926	4	1
22444+2937 CHE 410	N0AE000040	N0AE000039	10.87	13.81	2.94	302.1	0.62	19.27	0.106	2006.926	3	1,2
22444+3042 CHE 409	N09Z000304	N09Z000307	12.98	13.64	0.66	249.4	0.22	28.18	0.064	2006.901	4	1,2
22445+2525 POU5744	N0AG000107	N0AG000106	13.05	13.76	0.71	291	1.01	7.42	0.131	2006.926	4	1,4
22445+3717 ALI 461	2M355936152	2M355936160	10.42	10.75	0.328	0.9	0.09	10.73	0.012	2006.926	4	1,3
22448+3647 J 2707	2M355935036	2M355935040	9.27	11.06	1.793	30.4	1.44	5.26	0.176	2006.926	3	1,3
22449+3221 CHE 412	N2VT000671	N2VT000673	12.07	13.35	1.28	250.3	0.21	30.44	0.026	2006.926	3	1
22450+2430 POU5745	2M3502692O3	2M3502692O0	10.39	11.11	0.723	323.9	0.4	7.79	0.083	2006.926	4	1,3
22457+3814 DOB 17	N2XP000691	N2XP000663	10.26	10.92	0.66	354.3	0.04	84.68	0.057	2006.926	4	1
22459+3307 CHE 424	N2VX000517	N2VX000514	12.04	12.84	0.8	27.7	0.17	14.85	0.066	2006.926	4	1,2
22460+2944 CHE 426	N0AE000213	N0AE000214	11.95	13.27	1.32	96.9	0.2	19.42	0.053	2006.926	4	1
22473+2521 POU5749	N09N000132	N09N000136	13.05	14.03	0.98	176.3	0.32	12.66	0.106	2006.926	4	1
22474+3917 MLB 799	2M356001497	2M356001503	11.16	12.99	1.83	294.9	3.01	3.69	0.25	2006.926	2	1,3

Table 1. Measures of 76 double stars including 50 paris that were "neglected" at time of observation and bounded by 22 hr 42 m to 24 hr RA and +0° to +40°DEC. Primary and secondary catalog numbers are GSC2.3.2 (N) or 2MASS (M) unique identifiers. Magnitude sources noted in footnotes. DM is difference in magnitude computed from catalogue values unless noted. PA and sdPA refer to angle and standard deviation in degrees; Sep and sdSep refer to separation in seconds and standard deviation. Standard deviation in each case was computed from N measures. Date is date of observation.

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WDS/Disc.Code	Primary	Secondary	Pri. Mag.	Sec Mag.	DM	PA	sdPA	Sep	sdSep	Date	N	Notes
22478+3241 CHE 434	N2VM000183	N2VM000182	12.81	13.35	0.54	305.1	0.27	19.1	0.093	2006.926	4	1
22501+4028 MLB1025	N2XI000860	N2XI000863	14.09	14.46	0.37	163.9	1.21	7.45	0.176	2006.926	4	1
22501+4029 WLY 14	N2XI000838	N2XI000834	12.16	12.96	0.8	338.3	0.11	12.02	0.013	2006.926	5	1
22505+3912 MLB 965	N2XQ000454	N2XQ024961	14.98	14.59	0.39	217.5	99.9	6.96	99.9	2006.926	1	1
22526+3633 ES 2075	2M356141064	2M356141066	9.47	12.74	3.268	260.8	0.35	9.36	0.062	2006.928	4	1,3
22569+2910 MLB 625	2M1284186204	2M1284186201	9.42	11.17	1.749	246.6 /66.6	0.26	9.89	0.039	2006.928	4	1,2,3,4
22569+3945 MLB 801	2M356234705	2M356234715	12.88	12.25	0.625	358.1	1.02	5.62	0.215	2006.928	4	1
22580+0132 HJ 5530	N055000125	N055000126	12.24	12.81	0.57	136.3	0.22	15.73	0.042	2006.928	4	1,2
22582+1306 HJ 3156	N0QZ000158	N0QZ000156	12.20	13.23	1.03	294.9	0.16	22.4	0.038	2006.928	4	1,2
23067+0639 HJ 3168	N04Q000037	N04Q000034	10.74	14.23	3.49	307.2	99.9	33.36	99.9	2006.811	1	1,2,3,4
23087+3627 HJ 5531	2M750623659	2M750623654	11.195	11.27	0.077	271.7	33.42	19.47	13.044	2006.811	7	1,3
23097+2343 POU5783	N0PC000039	N0PC000038	10.44	13.00	2.56	293.8	0.42	11.67	0.106	2006.811	4	1
23113+0459 BAL2988	UCAC33501722	UCAC33501720	11.77	12.63	0.86	201.2	0.49	9.01	0.057	2006.811	4	1,5
23121+2853 J 2379	2M340776170	2M340776171	10.999	11.74	0.741	78	0.29	7.68	0.103	2006.811	6	1,2,3
23135+3854 MLB 909AB	2m750763684	2M750763689	11.729	12.30	0.57	333.8	0.82	5.58	0.616	2006.811	4	1,3
23135+3854 WLY 15AC	2M750763684	2M750763680	11.729	14.14	2.407	105.7	1.74	11.71	0.069	2006.811	4	1,3
23143+0015 HJ 3179AB	2M1103948365	2M1103948380	9.69	11.95	2.262	7.2	0.2	21.9	0.097	2006.811	4	1,3
23143+0015 WLY 16BC	2M1103948380	2M1103948382	11.853	11.95	0.099	169.6	NA	2.85	NA	2000.650		1.3
23150+2439 POU5795	N0BN000297	N0BN000299	11.88	13.25	1.37	231.1	0.19	19.88	0.077	2006.811	4	1
23223+2521 POU5805	2M118494685	2M118494684	11.295	12.10	0.801	126.8	1.05	9.25	0.334	2006.811	2	1.3
23250+3918 MLB 803	N07S000069	N07S004387	10.88	13.27	2.39	334	0.23	10.28	0.226	2006.811	4	1
23253+3907 MLB 804	N07S000229	N07S000224	12.70	13.05	0.35	314	0.1	11.17	0.024	2006.991	4	1
23291+2951 ES 399	2M130555596	2M130555593	9.183	11.17	1.985	206.4	1.96	4.88	0.163	2006.991	4	1,3
23292+0049 HJ 3195	N01A000137	N01A000139	11.63	12.68	1.05	99.5	0.32	14.93	0.048	2006.991	4	1,6
23299+2211 LDS1068	2M89879600	2M811919902	8.323	9.82	1.496	313.6	0.19	9.58	0.111	2006.991	4	1,3
23299+3910 MLB 805	N08R000001	N08R000002	11.84	13.51	1.67	260.6	0.19	9.61	0.023	2006.991	4	1
23329+2223 ELS 6	2M458620121	2M458620124	10.297	10.66	0.358	4.3	0.5	5.73	0.074	2006.991	4	1,3
23330+2206 HLM 41AB	2M458619981	2M458619983	10.157	10.35	0.192	290.3	0.27	7.5	0.033	2006.991	4	1,3
23330+2206 HLM 41AC	2M458619981	2M458619991	10.157	11.42	1.258	34.8	0.14	23.83	0.054	2006.991	4	1,3
23354+3441 ES 2207	2M936374983	2M936374990	7.66	10.81	3.148	242.2	0.38	6.65	0.138	2006.991	4	1,3

Table 1 continued on next page

WDS/Disc.Code	Primary	Secondary	Pri. Mag.	Sec Mag.	DM	PA	sdPA	Sep	sdSep	Date	N	Notes
23365+2423 POU5831	N0C4000114	N0C4000110	13.04	13.08	0.04	15	0.07	19.54	0.036	2006.991	4	1,2
23362+2421 POU5829	N0C4000125	N0C4013782	12.01	14.81	2.8	110	0.41	9.75	0.078	2006.991	4	1
23362+3439 ES 2397?	2M936375038	2M936375035	9.471	12.25	2.776	300.5	1.11	4.83	0.384	2006.991	4	1
23376+2335 POU5833	N0AW000067	N0AW000064	13.70	13.81	0.11	31.1	0.23	18.74	0.049	2006.991	4	1
23417+3542 ES 2137	2M768139705	2M768139707	9.67	11.67	2.001	138.4	0.65	6.52	0.078	2006.991	4	1,3
23424+3308 ES 2398	N0DA000479	N0DA000480	11.41	12.47	1.06	262.1	0.1	12.98	0.026	2006.991	4	1
23427+3504 ES 2399	N089000322	N089012308	-9.60	-8.00	1.6	75.5	0.14	8.8	0.038	2006.991	4	1,7
23435+2352 POU5847	N0AZ000305	N0AZ000306	12.20	14.26	2.06	147.6	0.2	16.64	0.06	2006.991	4	1
23449+2404 POU5852	N0AZ000198	N0AZ000202	9.82	11.37	1.55	114.7	0.03	28.39	0.015	2006.991	4	1
23457+2404 POU5854	N0AX000023	N0AX000024	12.42	13.36	0.94	47.2	0.17	16.02	0.046	2006.991	4	1
23516+2502 POU5865	2M356318114	2M356318118	10.694	11.065	0.371	352.8	0.19	5.53	0.134	2006.991	4	1,2,3
23516+2502 POU5863	N0B3000411	N0B3009719	11.88	13.85	1.97	232.3	0.5	8.03	0.045	2006.991	4	1,2
23550+2530 POU5872	N0AU000453	N0AU000457	13.01	13.28	0.27	145.7	0.25	9.33	0.035	2006.991	4	1,2
23516+0841 CHE 506	2M1179517368	2M1179531538	8.713	9.921	1.208	79.3	0.19	8.82	0.025	2006.991	4	1,3
23554+2404 POU5874	2M936280873	2M936280874	11.975	12.524	0.549	172.1	1.58	4.65	0.361	2006.991	4	1,3
23558+2359 POU5875	N0AR000037	N0AR000038	12.45	13.46	1.01	90.7	0.15	14.64	0.034	2006.991	4	1,2
23597+3748 ES 2443AB	N086015278	N086000634	7.88	12.23	4.35	233.3	0.01	77.15	0.012	2006.991	5	1
23597+3748 ES 2443BC	N086000634	N086013672	12.23	13.41	1.18	131.9	0.16	9.92	0.047	2006.991	5	1,2

Table Footnotes

1. Measures taken with a Takahashi Mewlon 300 Dall-Kirkham, F9.1, focal length 2730mm, equipped with ST8E CCD camera (9 micron pixels): approximate resolution is 0.68 arcseconds/pixel.
2. Recently measured
3. 2MASS J magnitude
4. PA reversed based on magnitude
5. UCAC2.0 magnitudes
6. similar but small proper motions
7. raw instrument magnitude, clear filter

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probably refers to CHE 410.

22501+4028MLB1025 and 22501+4029WLY 14. MLB1025 was measured on three nights, in 1936 (Milburn, 1937) and does not contain precise coordinates in the WDS.

Two candidate pairs are found in the field when the 1900.00 coordinates are precessed to J2000.00 (no proper motions applied, see Table 2). Neither candidate pair reported herein is a good match in all respects. MLB1025 as reported here matches fairly well in theta and rho but not in magnitude as the pair is some two magnitudes fainter than reported by Milburn. Jawarski (2006, 2007) noted that some of the pairs he recovered for sky survey plates were reasonable matches except for magnitude differences. Other Milburn pairs reported herein, based on WDS precise coordinates, also differ significantly in GSC V-magnitudes from data reported by Milburn. For example, the primary of 22507+4005MLB966 has a V-magnitude of 13.6 compared to Milburn's (1935) report of 10.0. Thus, I do not think it unreasonable to identify the pair reported as MLB1025.

WLY 14 agrees better in magnitude if primary and secondary are reversed, but is more widely separated and 12 degrees off in theta (158º versus the original 171º). If the J2000 coordinates for components of WLY 14 are "recessed" to the date of observation (1936.984; Milburn, 1935), with reported proper motions, the theta and rho values are still mismatched, including those at the extremes of the errors of proper motion (Table 2). WLY 14 is recorded to avoid confusion with MLB1025; it is of doubtful astrophysical interest as proper motions are small.

23113+0459BAL2988. This pair has similar albeit small PMs. A: pmRA = -8.3±2.1 mas/yr, pmDec= 15.3±2.1 mas/yr. B: pmRA = -5.4±2.1 mas/yr, pmDec = 15.0±2.1 mas/yr. UCAC2.0 catalog numbers: A, 33501722; B, 33501720.

23135+3854MLB 909AB and 23135+3854WLY 15AC. Proper motions are available only for A and C. They are small, but similar. A, pmRA = -10.3±1.9 mas/yr, pmDec = -7.7±1.9 mas/yr. B. pm = -13.1±5.6mas/yr;

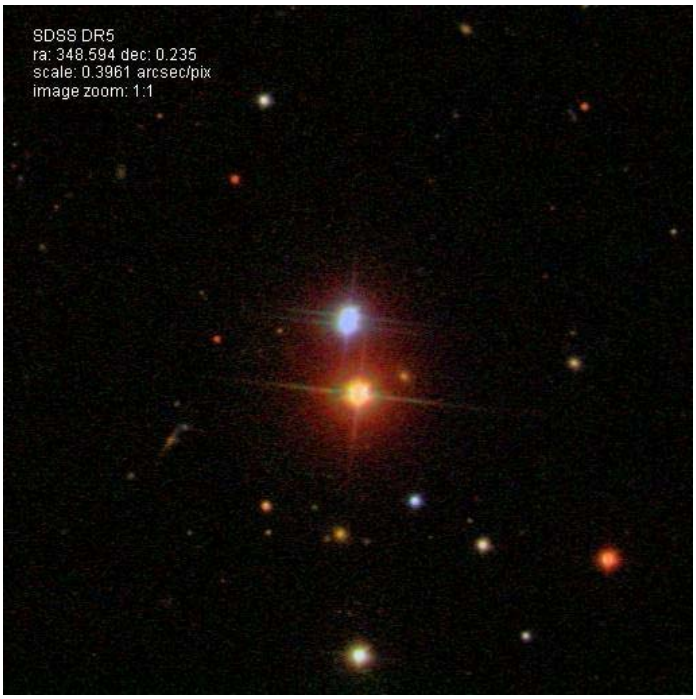

Figure 1: Sloan Digital Sky Survey image of 23143+0015HJ 3179AB and WLY 17BC. Used with permission.

Pair	J2000.000 RA	J2000.000 Dec	pmRA(*cos(Dec)	pmDec	1936.984 RA	1936.984 Dec	PA	Sep
WLY 14A	22 50 08.747	+40 29 09.02	0.6 ± 1.5	-2.7 ± 1.5	22 47 16.784	+40 09 05.92		
WLY 14B	22 50 08.341	+40 29 20.23	-1.1 ± 5.4	1.3 ± 5.4	22 47 16.389	+40 09 16.89	338 (336-339)	11.9 (11.6-12.2)
MLB1025A	22 50 08.69	+40 27 56.8	NA	NA	22 47 16.714	+40 07 53.54		
MLB1025B	22 50 08.85	+40 27 49.5	NA	NA	22 47 16.872	+40 07 46.23	166	7.531

Table 2. Results of precession study of two candidates for the double star 22501+4028MLB1025. J2000.000 RA and Dec are processed positions reported in either the UCAC2.0 or GSC2.2.3 catalogs returned by Vivier. Proper motions (pmRA and pmDec are UCAC2.0 proper motions with errors; 1936.948 RA and Dec are "recessed" positions for both candidate pairs processed with the utility Precessn with proper motion parameters added when available. PA is theta for epoch of original observation (1935.949) as calculated with the RecToPol utility; WLY14AB PA is followed in parentheses by extreme values derived by maximizing and minimizing the proper motion errors. Sep is the calculated from the positions given by Precessn for the epoch of 1936.948 using RecToPol.

pmDec = -7.7±5.4as/yr. UCAC2.0 catalog numbers: A,45433247; B, 45433248.

23143+0015HJ 3179AB and 23143+0015WLY 16BC. The C component is a star of similar blue color, clearly shown in my CCD images. Sloan Digital Sky Survey plates also clearly show this pair (Figure 1).

23330+2206HLM 41. Components A and B have similar proper motions. A: pmRA -17.2±1.3mas/yr, pmDec -28.6±1.6 mas/yr; B, pmRA -16.4±1.3mas/yr,, pmDec -30.0±1.3mas/yr. Component C has a smaller proper motion in RA; pmRA -11.2±1.3mas/yr,, pmDec -30.8±1.6mas/yr. UCAC2.0 catalog numbers: A, 39779234; B, 39779232; C, 39779237.

23365+2423POU5831. Proper motions are similar: A, pmRA -9.0±2.0mas/yr, pmDEC -9.0±2.0mas/yr; B pmRA -9.7±2.0mas/yr, pmDec -14.1±2.0mas/yr. UCAC2.0 catalog numbers: A, 40452082; B, 40452083.

23449+2404POU5852. Proper motions are similar. A: pmRA -14.1±0.7mas/yr; pmDec -20.8±0.6 mas/yr. B: pmRA -14.7±0.9 mas/yr; pmDec -20.6±0.6 mas/yr. UCAC2.0 catalog numbers: A, 40452605; B, 40452609. The GSC2.3 star N0AZ000203 (V magnitude 14.29) is closer to the original measure in position angle, but not separation; it does not have similar proper motions. An even fainter star of unknown relationship to the primary lies at 317º, 10.2", estimated 15th magnitude.

23516+2502POU5865. WDS notes: "23516+2502 POU5865 J 1800. Same as POU5866?" There is no other likely pair in the vicinity.

Acknowledgements

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