

# Neglected Double Star Observations at Kitt Peak Advanced Observer Program 2010

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**Abstract:** I report the measures of 77 double stars, many of them “neglected” WDS doubles, between 0859.3 and 1551.1 hrs RA and +58 and -07 DEC. The observations were conducted with a 50.8 cm f/8.4 Ritchey-Chretien reflector. I report on seven WDS doubles that were not located. Twelve new doubles are reported. The observing run was conducted at the National Optical Observatory's Kitt Peak Visitor's Center Advanced Observer Program. Information about instrumentation, methodology, results and notes is included.

## Introduction and Instrumentation

This observing run was my second use of the Kitt Peak Visitor's Center Advanced Observer Program (AOP) run by the National Optical Observatory, AZ [noao.edu]. The observing run was conducted on 2010.206 and 2010.209.

The equipment used was a 50.8cm f/8.4 RC Optical Systems carbon truss reflector and a SBIG STL-6303E non-ABG CCD on a Paramount ME equatorial mount. Details of the instrumentation were identical to that described in my previous article [Smith 2009].

## Methods

The observing run was culled from the USNO “Neglected Doubles” list [Mason, 2006].

When I do an observing run, I like to include at least one double per session that has a recent, high quality measure. Those stars function as a “sanity check” and quality control. Measures from Jim Daley [Daley, 2006] were chosen for this report.

An unguided CCD exposure of 10 seconds gave

good S/N and little trailing. 44 star fields were imaged resulting in 77 doubles available for measurement. Back home, each image was examined and any that were trailed, or any image that the plate reduction software could not reach a plate solution were discarded. MOP Canopus [Warner, 2006] was the primary measurement and plate solution software. The new UCAC3 catalog [Zacharias et al 2011] was used for Canopus' plate solution routine. The star-sparse Spring CCD images produced a number of known asteroids and dozens of faint galaxies, none of which (alas) contained a supernova.

## Results

The measures reported are the arithmetic means of measures from the total number of CCD images for each star. Each image had an independent plate solution. Table 1 shows the WDS designation, discoverer, measures in separation and position angles, standard deviations of the measures, number of previous measures and a reference note number if applicable.

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A number of doubles on the list were not located at the listed position. Notes on those doubles are included.

### New Doubles

Table 2 lists twelve new doubles discovered during the observing run. All are in the same CCD field as a neglected WDS double. The author is aware that the WDS catalog is not in need of new doubles with so many current binaries needing measurements. However, it seemed wasteful not to do the measurement when high quality data was available

CCD images taken during this run easily reach 17th magnitude and I could have "discovered" dozens of faint and wide doubles. All the new doubles reported here are about 12 to 14 magnitude and have separations of 12 arc seconds or less. Probability theory indicates that they are likely to be physical systems [Romero, 2007]. However, inclusion of these doubles into the WDS catalog is solely at the discretion of the USNO authorities.

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**Table 1:** Summary data of doubles measured at Kitt Peak AOP are reported. **WDS ID** and **Discover** are Washington Double Star Catalog identifiers and discoverer codes. Doubles marked with "?" indicate the identity of the double is uncertain. **PAsd** and **SEPs** refer to the standard deviations of the angle (**PA**) and separation (**SEP**) based on the number (**No.**) of CCD images measured, followed by the date of the last measure (**Last**), the number of previous measures (**PREV**) and the number of associated note, if any. Doubles labeled "**NF**" indicate the double was not found at the catalog position.

WDS ID	DISCOVERER	PA	SEP	Epoch	No.	PAsd	SEPs	Last	Prev	Notes
08593-1233	LDS3839	16.4	3.79	2010.206	4	1.59	0.627	1998	2	
08595+5603	STI2216	55.3	7.89	2010.206	3	0.15	0.041	2006	3	#1
09001-1228	WOR 36AB-C	NF	NF	2010.206				1976	2	#2
09005-1239	HJ 4160	282.7	13.04	2010.206	5	0.24	0.072	1920	2	#3
09012+0245	STF1302AC	255.2	23.92	2010.209	5	0.34	0.276	1904	2	
09165+2403	POU3038	22.9	3.26	2010.206	5	0.67	0.063	1999	2	
09193+5230	VBS 15	178	16.68	2010.206	5	0.05	0.039	2007	3	
09325+0906	XMI 93	196.3	21.82	2010.206	5	0.10	0.049	2000	5	
09340+2412	POU3051	237.5	10.01	2010.206	5	0.15	0.083	1899	1	
09390+3017	ARY 51	273.2	118.36	2010.206	4	0.00	0.065	2003	9	
09575+1359	HEI 59	4.6	6.32	2010.206	5	0.52	0.146	1978	1	
10059+5156	HJ 5543	313.3	41.29	2010.206	10	0.04	0.026	1908	1	#4
10059+5154	HJ 2518	98.9	32.17	2010.206	10	0.04	0.044	1999	5	
10069+5427	STI2241	247.7	7.60	2010.209	8	0.11	0.029	2006	4	#5
10113+1001	BU 1425DE	196.1	151.03	2010.206	5	0.02	0.036	2000	6	
10113+1001	BU 1425CD	232.9	133.74	2010.206	10	0.02	0.075	2000	7	
10113+1001	BU 1425AC	202.9	340.03	2010.209	10	0.01	0.053	2002	8	
10282+3819	LDS 915AB	150.8	270.37	2010.209	5	0.01	0.033	1936	1	#6
10282+3819	LDS 915AC	152.1	274.24	2010.209	5	0.01	0.020	new		#6
10282+3819	LDS 915BC	210.7	7.56	2010.209	5	0.08	0.015	new		#6
10301-0252	J 1566	269.1	12.08	2010.206	5	0.25	0.043	1957	2	
10304-0257	LDS3996	73.5	1.58	2010.206	5	1.66	0.103	1960	1	
10362-1757	ARA 223	177.9	6.53	2010.206	4	0.16	0.065	1916	1	
10474+2355	POU3089	193.5	11.95	2010.209	9	0.08	0.118	1898	1	
10586+0908	STF1497	70.7	16.81	2010.206	5	0.11	0.020	2006	13	
11051+1026	LDS4055AB	97.6	245.51	2010.209	5	0.02	0.045	1960	1	
11051+1026	LDS4055AC	156.6	1.33	2010.209	5	2.00	0.130	new		
11117+3441	KZA 10CD	86.7	59.42	2010.206	5	0.04	0.079	1998	2	
11168+2344	POU3099	NF	NF	2010.206				1899	1	#7

Table 1 continued on next page.

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Table 1 (continued): Summary data of doubles measured at Kitt Peak AOP ...

WDS ID	DISCOVERER	PA	SEP	Epoch	No.	PAsd	SEPsd	Last	Prev	Notes
11243+5553	STI2269	94.5	7.46	2010.206	6	0.22	0.067	1912	1	
11246+5651	STI2270	203.5	12.78	2010.209	10	0.16	0.043	1912	1	
11315+2349	POU3103	56.7	9.33	2010.209	5	0.10	0.022	1898	1	
11328+0653	LDS5206	70.7	30.03	2010.209	5	0.06	0.028	1960	1	
11360+5804	STI2274	23.8	7.41	2010.209	10	0.07	0.020	1913	1	
11393+0610	HJ 2580	169.5	26.82	2010.209	5	0.07	0.011	2000	8	
11404-0322	HJ 186	297.8	11.02	2010.209	5	0.13	0.038	2008	3	
11407+0616	LDS 925?	215.8	175.71	2010.209	5	0.01	0.049	1936	1	#8
11401-0326	GAU 13?	7.6	20.99	2010.209	5	0.04	0.057	1893	1	#9
11498+0557	LDS5743	154.5	7.96	2010.206	5	0.20	0.034	1960	2	
11544+1546	BNW 1?	282.9	144.72	2010.209	5	0.01	0.053	1899	1	#10
11596-0130	HJ 196	289.3	8.83	2010.209	5	0.18	0.008	1922	1	
12051-0907	HJ 1208	279.6	10.47	2010.209	5	0.01	0.011	1922	1	
12056+5659	A 1359AB-C?	NF	NF					1933	1	#11
12102+1858	A 2057	NF	NF	2010.209				1931	2	#12
12144+5506	HJ 2604	336.6	19.74	2010.206	5	0.22	0.024	1999	5	
12150+5501	HJ 2605	311.5	21.78	2010.206	5	0.19	0.056	1908	1	
12185+5725	STI2280	175.5	20.84	2010.207	5	0.04	0.056	1912	1	#13
12225-0524	LDS 406	175.7	10.43	2010.209	5	0.18	0.009	1920	1	
12312+0120	A 2583BC	337.6	3.8	2010.209	5	0.95	0.197	1952	5	
12312+0120	SHJ 146AB	290.1	49.6	2010.206	6	0.06	0.095	2002	36	
12359+3018	SDK 101	211.8	3.29	2010.206	5	1.34	0.170	1977	1	#14
12366+3012	LDS4235	35.7	21.25	2010.206	10	0.02	0.026	1960	1	
12391+2344	POU3129	137.5	13.35	2010.209	10	0.16	0.024	1907	1	
12391+2344	POU3129BC	60.3	4.41	2010.209	5	0.46	0.196	new		#15
12416+4105	LDS5757	150.3	150.26	2010.207	10	0.01	0.054	2003		
12416+4814	LDS4251	166.5	18.03	2010.207	5	0.29	0.027			#16
12418+0953	HO 54A-BC	101.4	113.67	2010.207	4	0.16	0.095	2000	5	
12418+0953	HO 54A-E	20.8	15.35	2010.207	5	0.24	0.160	new		#17
12418+0953	HO 54BD	82.5	21.44	2010.207	5	0.26	0.098	1906	3	
12469+2959	LDS4265	230.9	8.33	2010.207	10	0.38	0.027	1998	2	
12473+2958	LDS4267	287.7	21.84	2010.207	6	0.21	0.038	1998	2	
12473+2959	LDS4268	56.1	6.29	2010.207	8	0.22	0.038	1960	3	
12523+2908	LDS1338AB?	15.0	4.25	2010.207	8	0.89	0.780	1960	1	#18
12523+2908	LDS1338AC	220.6	103.2	2010.207	9	0.02	0.081	2000	3	
13027-0159	HJ 1225	110.9	14.88	2010.207	5	0.21	0.043	2007	3	#19
13104+3744	KZA 44AB	208.7	76.76	2010.209	5	0.01	0.012	2007	5	
13104+3744	KZA 44AC	4.4	93.29	2010.209	5	0.01	0.031	2007	6	

Table 1 continued on next page.

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Table 1 (concluded): Summary data of doubles measured at Kitt Peak AOP ...

WDS ID	DISCOVERER	PA	SEP	Epoch	No.	PASd	SEPSd	Last	Prev	Notes
13235+1401	HJ 226AB	16.2	4.28	2010.209	6	0.21	0.190	1909	2	#20
13258+2402	POU3139	307.2	14	2010.209	9	0.10	0.027	1999	2	
13261+2354	POU3140	211.2	9.39	2010.209	10	0.14	0.018	1898	1	
13276+5721	VBS 22	NF	NF	2010.209				1909	1	#21
13333-0426	LDS 451?	4.2	18.89	2010.209	5	0.10	0.083	1920	1	#22
13436+2243	POU3149	187	13.53	2010.209	10	0.08	0.011	1898	1	
13594+2515	BUP 155AB	64	212.03	2010.209	4	0.01	0.019	2002	5	
13594+2515	BUP 155AC	129.6	156.25	2010.209	5	0.01	0.024	2002	7	
13594+2515	LDS6288AD	178	20.29	2010.209	5	0.22	0.086	2000	3	
14357+5437	STI2311	109.4	7.49	2010.209	5	0.12	0.021	1911	1	
14415+5641	STI2314	170	15.11	2010.209	5	0.07	0.007	1917	1	
14453+2235	POU3173	239.8	2.78	2010.209	5	0.57	0.244	1900	1	
15017+0707	GIC 123	112.5	41.37	2010.209	6	0.13	0.068	1963	1	
15024-0708	BRT 552	NF	NF	2010.209				1933	1	#23
15233+3619	A 1367AB-C	NF	NF	2010.209				1933	1	#24
15507+2400	POU3208	99.9	5.06	2010.209	5	0.20	0.097	1899	1	
155513+2408	POU3210	150.6	6.12	2010.209	5	0.12	0.017	2000	2	

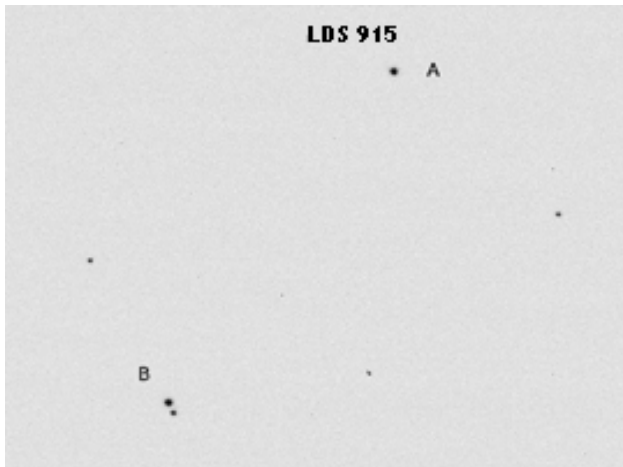
**Table 2:** Summary data for new doubles discovered. RA (P) and DEC (P) are the catalog positions of the primary star from UCAC3. USNO-UCAC3 is the catalog number of the primary. Cat. Mag is the catalog magnitudes of the primary and secondary. Magnitudes marked with an asterisk are arithmetic mean of the Canopus' photometry routine and should NOT be considered precision photometry. PASd and SEPSd are the standard deviations of the measures based on the number (No.) of CCD images.

Name	RA (P)	DEC (P)	USNO-3UCAC	Cat. Mag	PA	SEP	Epoch	No.	PASd	SEPSd	Notes
1AB	09:00:18.9	+56:07:14.7	293-107362	13.5	254.1	1.64	2010.206	3	0.24	0.018	
1AC				13.53	228.2	12.67	2010.206	3	0.11	0.075	
1BC				14.23	224.0	10.98	2010.206	3	0.25	0.120	
2	09:30:17.89	-01:22:08.6	178-112098	12.6, 14.0	17.7	5.93	2010.206	5	0.19	0.037	
3	10:11:18.96	+09:55:37.2	200-118413	14.0, 14.4	3.8	7.55	2010.206	10	0.12	0.023	
4	11:59:24.06	-01:24:08.2	178-121405	13.9, 15.04	311.7	10.57	2010.207	5	0.11	0.011	
5	12:19:18.80	+57:30:17.5	296-112444	13.79, 14.67	331.0	9.55	2010.207	5	0.36	0.026	
6	12:40:00.69	+41:01:31.0	263-120302	13.04, 13.59	211.7	12.15	2010.209	6	0.09	0.036	
7	12:52:27.22	+29:09:31.0	239-110145	14.2, 16.24	186.5	13.62	2010.209	10	0.08	0.011	
8	13:23:44.6	+14:04:31.9	209-113781	12.77, 12.80	346.5	5.09	2010.209	10	0.52	0.062	
9	13:59:28.22	+25:24:21.1	231-111619	12.42, 13.88*	140.0	1.74	2010.209	4	0.54	0.112	
10	14:35:11.22	+54:44:40.8	290-1148818	13.31, 15.40	263.0	9.65	2010.209	6	0.23	0.021	
11	14:41:55.83	+56:39:32.3	294-119643	14.29, 14.62	234.1	12.87	2010.209	5	0.07	0.016	
12	15:01:25.53	-07:08:42.2	166-135712	12.97, 14.36	198.4	7.32	2010.209	5	0.37	0.041	#23

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### Table Notes

1. WDS 08595+5603, STI 2216. Quality control star. J. Daley measured PA 55.3 and SEP 8.01 on 2006.277: *JDSO* 3:71.
2. WDS 09001-1228, WOR 36AB-C. No sign of "C" component in my CCD image reaching +17.5 magnitude.
3. WDS 09005-1239, HJ 4160. measuring "A" as UCAC3 155-113856 and "B" as 155-113852.
4. WDS 10059+5156, HJ 5543. Measuring "A" as UCAC3 284-110245 and "B" as 284-110242.
5. WDS 10069+5427, STI 2241. Quality control star. J. Daley measured PA 247.5 SEP 7.62 on 2006.323: *JDSO* 3:71.
6. WDS 10282+3819, LDS 915. "B" component is itself a double star. Measuring "B" as UCAC3 257-103420 and new "C" component as 257-103421. See Figure 1.

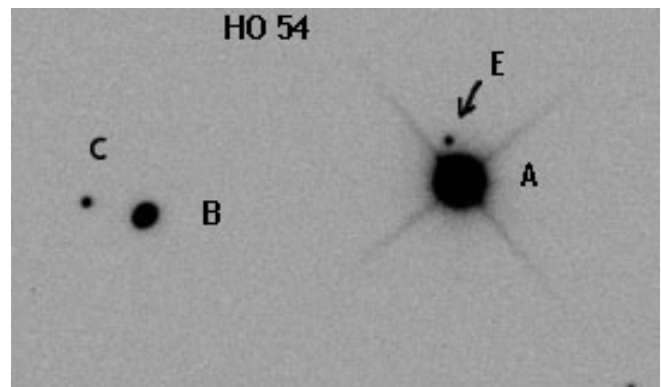


**Figure 1:** LDS 915 shows new "C" component

7. WDS 11168+2344, POU 3099. Not found on my CCD image at listed position. No likely candidate on 13.13" X 12.44" DSS1.F. POSSII plate.
8. WDS 11407+0616, LDS 925. Listed as a "dubious double" in WDS. I'm measuring UCAC3 193-111094 and 193-111086, which have a very good match in PA. Perhaps "typo"(i.e. 188 instead of 388) in the original 1936 SEP measure?
9. WDS 11401-0326, GAU 13. Listed as a "dubious double" in WDS. I'm measuring UCAC3 174-125163 and 174-125165.
10. WDS11544+1546. BNW1. I'm measuring UCAC3 212-114701 as the secondary at 11:54:24.67+15:44:53.
11. WDS12056+5659, A 1358AB-C. This double has no "C" component. I believe the listed "C" component is associated with HDS 1700 and is UCAC3

294-115311. Using Aladin's measurement tool of a POSS II plate, I get a SEP of 35.4 and PA of 174.3 (not a publishable measure), which is close to the catalog measure of A1358AB-C. HDS 1700 was just off my CCD image, so no precise measure was possible.

12. WDS 12102+1858, A 2057. Star image perfectly round in the 20".
13. WDS 12185+5725, STI 2280. One previous measure w/no listed PA. I'm measuring UCAC3 295-116745 and 295-116746.
14. WDS 12359+3018, SDK 101. "A" component is UCAC3 241-108742.
15. WDS 12391+2344, POU 3129. New "C" component is UCAC3 228-108977.
16. WDS 12416+4814, LDS 4251. Large difference from previous measurement. I'm measuring UCAC3 277-115757 and 277-115758.
17. WDS 12418+0953, HO 54. New "E" component is UCAC3 200-125569. Note "B" component is elongated in CCD image. See Figure 2.



**Figure 2:** HO 54 showing new "E" component.

18. WDS 12523, LDS 1338AB. Large difference from 1960 measure. I'm measuring "B" component as UCAC3 239-110139. Both components have high proper motion.
19. WDS 13027-0159, HJ 1225. It seems that this double is also listed as BAL 548 in WDS.
20. WDS 13235+1401, HJ 226AB. I'm measuring "A" component as UCAC3 209-117381 and "B" as 209-117380. Position of "A" is 13:23:23.16+13:56:16.2. This double seems to be tangled up with BU 1436AC as they have the same listed coordinates in WDS. The note for HJ 226AB in WDS "Notes" file belongs to BU 1436. HJ 226AB is listed as having a note, but none exists. Also, the "B" component of BU 1436 AB is the nucleus of NGC 5129. There seems to be an error in UCAC3 as the nucleus of NGC 5129 is listed as star

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### Acknowledgments

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This research has made use of Aladin and the Washington Double Star Catalog maintained by the US Naval Observatory.

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*(Table Notes Continued from page 231)*

- 208-118256 in the UCAC catalog.
21. WDS 13276+5721, VBS 22. Not found on my CCD image of listed position. Perhaps UCAC3 295-118393 and 295-118391 at 13:23:25.00+57:17:02? This pair was just off my CCD image, but Aladin's measurement tool of a POSS II plate gives SEP 20.0 and PA 286.0 (not a publishable measure), which is fairly close to the catalog measure.

22. WDS 13333-0426, LDS 451. Listed position is UCAC3 172-127958, which is a single star. I'm measuring UCAC3 172-127964 and 172-127965.
23. WDS 15024-0708, BRT 522. Not found at listed coordinates. Could BRT 522 be my new double #12 at 15:01:25.53-07:08:42.2? Measuring UCAC3 166-135712 and 166-135710.
24. WDS 15233+3619, A 1367AB-C. No "C" component found on my CCD image reaching to +17.5.

