

Double Star Measurements Using a Webcam and DSLR, Annual Report of 2013

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Abstract: I report on 173 double star measurements made in 2013; minimum separation is 1.07 as, maximum separation is 706.9 as. The mean value of all measurements is 73.2 as.

I report on 173 double star measurements from 2013 made with a standard webcam and a DSLR camera. Minimum separation is 1.07 as, maximum separation is 706.9 as. The mean value of all measurements is 73.2 as.

Measurements were made with a 12 inch Newtonian telescope. A detailed description of the optical setup is given in annual report of 2012 (Schlimmer 2013a). Reproduction scale is about 0.77 as/pixel for webcam measurements and 0.70 as/pixel for DSLR images. In the case of DSLR imaging an additional coma corrector was used. In both cases data analyses were done with REDUC software.

During observations some stars could be found which are not yet listed in the WDS catalog. These stars are discussed below.

1. STFA 7, WDS 03311+2744

STFA 7 is a common proper motion pair in constellation Taurus. Proper motion is 27.17 mas in R.A. and -28.68 mas in declination (Simbad). Separation is about 44.1 as. Brightness of STFA 7 is 7.41 and 7.81 magnitudes, so it is easy to observe with small telescopes. It is surprising that STFA 7 isn't listed in the LSPM Catalog (Lepine, 2005) or LDS catalog (Luyten, 1940-87). Since its first observation in 1836, it has been measured 49 times. There is no relative motion between both components, therefore STFA 7 can be used as a calibration star. A further component can be found at a distance of only 12.0 as from STFA 7B. Its brightness is only about 12 magnitudes and it is probably only a background star and not physically related to STFA 7.

This star is shown in Figure 1 and is not yet listed in the WDS catalog.



Figure 1: STFA 7, 30 seconds exposure from epoch 2013.168

2. SEI 350, WDS 05362+3407

SEI 350 is a double star inside the open star cluster M36 in constellation Auriga. The separation is about 15.8 as. Proper motions of both components are a little bit different: 1.1 mas for R.A. and -4.1 mas in declination for A component and 0.6 mas in R.A. and -3.9 mas

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Figure 2. SEI 350, 30 second exposure from epoch 2013.168

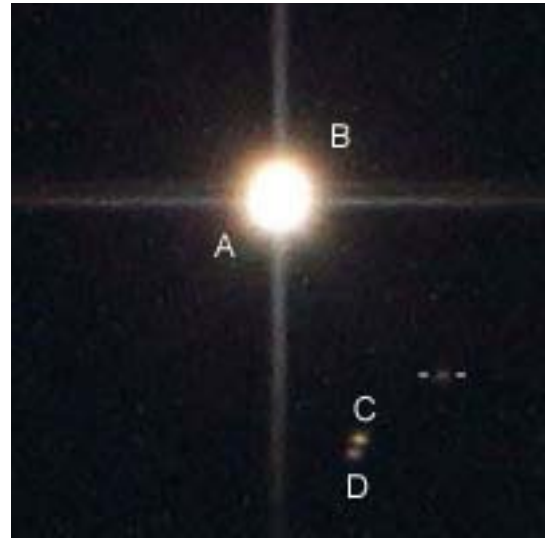


Figure 3. STF1954, 30 second exposure from epoch 2013.518

in declination for B component. At a distance of only 8.4 as from SEI 350 A, a further star could be found. Because its proper motion is unknown, it can't be verified if it's physically related to SEI 350 or if it's just another member of the M36 cluster.

3. STF1954, WDS 15348+1032, δ Serpens

STF1954 was found in 1782 by William Herschel. Components C and D were discovered in 1911. The proper motion of A is about -72 mas in R.A. and 13 mas in declination. The proper motion for B is about -73 mas in R.A. and 3 mas in declination. The proper motions for the C and D components are not known. Therefore it can be expected that C and D aren't physically related to STF 1954AB.

During measurements of STF1954, I found a further component which is not yet listed in the WDS catalog. The separation is about 63 as and the position angle is 42°. Probably, this component is also a background star like components C and D.

4. STF2094, WDS16442+2331

STF2094AB was discovered in 1831. Component C was discovered one year later. Because proper motions of these 3 components are still the same, A, B, and C are a multiple system. At a distance of about 44 as, I found a further component which is not yet listed in the WDS catalog.

The measurements of 2013 are listed in Table 1. In the column notes, the type of measurement is given; W stands for webcam and D stands for DSLR Camera. In some cases both methods were used.

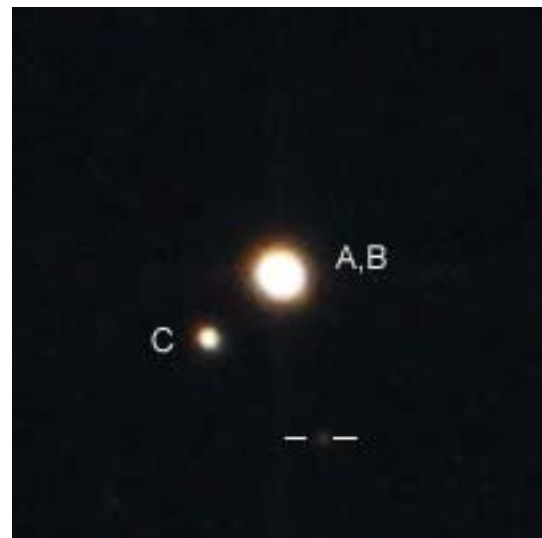


Figure 4: STF2094, 30 seconds exposure from epoch 2013.518

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Table 1: Measurements of 2013

NAME	RA+DEC	MAGS	PA	SEP	DATE	N	NOTES
STF 196AC	01596+2100	9.36 10.18	154.6	21.07	2013.943	1	W
STF 196AD	01596+2100	9.36 6.01	8.8	199.01	2013.943	1	W
H 5 12AB	01579+2336	4.80 6.65	47.5	37.19	2013.943	1	W
STF 212	02062+2507	8.35 8.71	162.9	1.93	2013.943	1	W
STF 401AB	03313+2734	6.58 6.93	268.7	11.33	2013.168	1	D
STFA 7	03311+2744	7.41 7.81	-	-	2013.168	1	D
BC	03311+2744	7.81 13	359.9	12.00	2013.168	1	D see text
BAR 25AB	05167+4600	0.08 17.1	6.2	91.47	2013.168	1	D
BU 1392AC	05167+4600	0.08 13	331.9	132.26	2013.168	1	D
BU 1392AD	05167+4600	0.08 13.6	194.0	71.45	2013.168	1	D
BU 1392AE	05167+4600	0.08 12.1	325.9	192.94	2013.168	1	D
HJ 2256AF	05167+4600	0.08 10.21	135.4	107.50	2013.168	1	D
A2	05167+4600	0.08 13	272.6	132.87	2013.168	1	D
D 7AB	05273+3426	10.01 11.12	330.1	20.98	2013.168	1	D
D 7AC	05273+3426	10.01 9.77	284.3	170.03	2013.168	1	D
HSW 6AE	05273+3426	10.01 14.2	42.2	23.18	2013.168	1	D
D 7CD	05273+3426	9.77 11.6	52.8	28.81	2013.168	1	D
BU 9027CF	05273+3426	9.77 13.6	122.1	15.11	2013.168	1	D
BUP 79AB	05276+3429	5.22 14.6	353.4	23.57	2013.168	1	D
BUP 79AC	05276+3429	5.22 10.87	71.5	61.76	2013.168	1	D
BLL 15AD	05276+3429	5.22 8.07	15.4	210.09	2013.168	1	D
MLB1039	05278+3446	11.02 11.2	114.4	6.62	2013.168	1	D
BU 889AD	05281+3425	9.40 14.7	108.0	12.39	2013.168	1	D
STF 707AE	05281+3425	9.40 10.80	133.1	18.23	2013.168	1	D
BU 889AF	05281+3425	9.40 11.45	199.6	27.75	2013.168	1	D
SEI 272	05284+3447	10.51 11.7	194.0	5.35	2013.168	1	D
SEI 278AB	05285+3549	10.4 12.2	142.9	19.31	2013.168	1	D
BKO 252AC	05285+3549	10.4 11.4	0.1	35.28	2013.168	1	D
BKO 252CD	05285+3549	11.4 12.5	302.5	7.36	2013.168	1	D
SEI 350	05362+3407	10.48 10.55	75.0	15.84	2013.168	1	D
AC	05362+3407	10.48	335.3	8.37	2013.168	1	D see text
SEI 351	05363+3412	11.11 12.22	98.1	10.83	2013.168	1	D
STF 737AB	05364+3408	9.13 9.38	305.6	10.85	2013.168	1	D
BKO 269BC	05364+3408	9.38 13.0	273.3	11.62	2013.168	1	D
STF 761AB	05386-0233	7.86 8.39	203.7	67.45	2013.168	1	D
STF 761AC	05386-0233	7.86 8.55	210.0	71.60	2013.168	1	D
STF 761BC	05386-0233	8.39 8.55	268.5	8.64	2013.168	1	D
STF 762AB C	05387-0236	3.76 8.79	239.2	11.24	2013.168	1	D
STF 762AB D	05387-0236	3.76 6.56	85.2	13.07	2013.168	1	D
STF 762AB E	05387-0236	3.76 6.34	62.2	41.32	2013.168	1	D
STF 774AC	05407-0157	1.88 9.55	10.2	58.07	2013.168	1	D
BAL2660	06236+0444	10.74 11.81	223.0	10.60	2013.171	1	D
STF 900AC	06238+0436	4.44 12.7	253.5	92.42	2013.171	1	D

Table continues on next page.

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Table 1(continued): Measurements of 2013

NAME	RA+DEC	MAGS	PA	SEP	DATE	N	NOTES
SLE 287	06296+0542	9.54 9.8	209.5	8.64	2013.171	1	D
STF 926AB	06317+0546	7.23 8.62	287.8	10.73	2013.171	1	W
SLE 299	06332+0528	9.4 11.0	305.0	11.22	2013.171	1	D
SLE 298	06332+0508	10.53 11.44	138.9	15.97	2013.171	1	D
SLE 554	06376+0828	10.00 11.40	358.1	13.56	2013.171	1	D
STF 951AB	06406+0947	8.49 10.91	309.3	21.09	2013.171	1	D
STF 951AC	06406+0947	8.49 12.46	285.3	25.08	2013.171	1	D
STF 950AC	06410+0954	4.66 9.9	15.9	16.44	2013.171	1	D
STF 950AD	06410+0954	4.66 9.7	309.5	40.52	2013.171	1	D
STF 950AE	06410+0954	4.66 8.86	139.3	73.49	2013.171	1	D
STF 950AF	06410+0954	4.66 9.0	222.3	155.08	2013.171	1	D
STF 950AG	06410+0954	4.66 10.01	230.1	186.75	2013.171	1	D
STF 950AH	06410+0954	4.66 9.81	166.6	88.78	2013.171	1	D
STF 950AM	06410+0954	4.66 9.75	103.8	178.28	2013.171	1	D
STF 950AO	06410+0954	4.66 9.7	260.8	135.47	2013.171	1	D
STF 952MN	06410+0954	9.75 10.05	115.5	13.91	2013.171	1	D
SMR 9AQ	06410+0954	9.75 11.5	6.3	95.70	2013.171	1	D
SMR 9AR	06410+0954	9.75 11.5	143.2	142.85	2013.171	1	D
SMR 9AS	06410+0954	9.75 11.5	154.8	124.30	2013.171	1	D
BRT1245	08045+1346	7.83 10.97	122.4	5.23	2013.202	1	W
STF1196AB	08122+1739	5.30 6.25	28.1	1.07	2013.202	1	W
STF1196AB-C	08122+1739	5.30 6.20	63.9	6.56	2013.202	1	W
FOX 163	09510+0805	8.86 12.4	279.1	5.42	2013.343	1	W
HJ 476	10120+2007	8.0 10.3	49.1	23.95	2013.343	1	W
STF1424AB	10200+1950	2.37 3.64	125.6	4.79	2013.330	2	W
STF1523AB	11182+3132	4.33 4.80	187.7	1.61	2013.361	3	W ξ Uma
STF1643AB	12272+2701	9.03 9.45	5.1	2.77	2013.425	1	W
STF1651	12317+2701	8.65 10.07	215.1	6.93	2013.379	1	W
STF1670AB	12417-0127	3.48 3.53	6.8	2.04	2013.371	2	W γ Vir
STF1670AD	12417-0127	3.48 12.05	91.0	175.83	2013.343	1	W
STF1670AE	12417-0127	3.48 8.94	168.2	260.52	2013.343	1	W
STF1670AF	12417-0127	3.48 9.53	268.1	422.49	2013.343	1	W
STT 578	13119+2753	4.3 12.1	181.0	126.46	2013.431	2	W D β Com
STF1744AB	13239+5456	2.23 3.88	151.8	14.51	2013.431	1	D Mizar
STF1744AC	13239+5456	2.23 4.01	70.1	706.92	2013.431	1	D
SMR 4AD	13239+5456	2.23 7.6	100.4	493.16	2013.431	1	D
STF1909	15038+4739	5.20 6.10	61.4	1.30	2013.374	2	W 44 Boo
STFA 27	15155+3319	3.56 7.89	79.0	104.66	2013.433	1	D δ Boo
SMR 31AC	15155+3319	3.56	5.3	92.35	2013.433	1	D
SMR 32AB	15151+3318	12.7	333.7	25.33	2013.433	1	D
SMR 32AC	15151+3318	12.7	75.2	35.51	2013.433	1	D
SMR 32BC	15151+3318		106.7	47.54	2013.433	1	D
STF1931AB	15187+1026	7.20 8.07	166.6	13.34	2013.516	1	W
STF1930AB	15193+0146	5.06 10.11	35.4	11.10	2013.516	1	W 5 Ser

Table continues on next page.

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Table 1(continued): Measurements of 2013

NAME	RA+DEC	MAGS	PA	SEP	DATE	N	NOTES
STF1950	15300+2530	8.07 9.23	91.3	3.37	2013.518	1	W
STF1952AB C	15319+0940	8.70 10.12	221.1	16.44	2013.516	1	W
STTA140AB	15325+0835	8.30 8.74	179.7	114.81	2013.516	1	W
STU 9AC	15325+0835	8.30 11.08	355.9	86.34	2013.516	1	W
STU 9AD	15325+0835	8.30 11.46	241.7	104.21	2013.516	1	W
STT 297	15348+2500	8.3 12.3	331.2	12.30	2013.518	1	W
STF1954AB	15348+1032	4.17 5.16	173.3	3.93	2013.516	1	W δ Ser
STF1954AC	15348+1032	4.17 13.9	17.9	66.80	2013.518	1	D
STF1954CD	15348+1032	13.9 14.6	339.7	3.99	2013.518	1	D
A1	15348+1032	4.17 15	42.1	63.36	2013.518	1	D see text
STT 300	15402+1203	6.32 10.07	260.8	15.16	2013.516	1	W
A 2230AC	15440+0231	5.95 9.23	208.0	193.86	2013.518	1	D
A 2230AD	15440+0231	5.95 10.95	284.9	172.78	2013.517	2	D W ψ Per
HJ 1277AB	15443+0626	2.65 11.8	333.7	57.40	2013.517	2	D W 24 Ser
ROE 75	15444+1518	8.23 10.68	326.9	6.07	2013.516	1	W
STF1970AB	15462+1525	3.66 9.96	263.7	30.33	2013.517	2	D W β Ser
STF1970AC	15462+1525	3.66 10.7	210.7	201.18	2013.518	1	D
STT 583	15532+1312	6.10 11.8	81.3	81.28	2013.513	1	W 39 Ser
STF1985	15559-0210	7.03 8.65	353.1	5.92	2013.513	1	W
SHJ 227AB	16219+1909	3.76 10.05	226.2	43.25	2013.581	1	D γ Her
SHJ 227BC	16219+1909	10.05 12.5	297 6	82.27	2013.581	1	D
ES 631	16352+4326	8.7 11.5	160.7	10.28	2013.620	1	W
STFA 31AB	16406+0413	5.76 6.92	229.4	69.50	2013.602	2	W 36 Her
STF2074BC	16406+0413	6.92 11.4	315.7	25.66	2013.584	1	W
STF2093AB	16429+3855	3.58 12.50	265.2	116.72	2013.620	1	W ϵ Her
STF2094AC	16442+2331	7.48 11.7	310.0	24.73	2013.581	1	D
	16442+2331	7.48	13.1	43.59	2013.581	1	D see text
STT 317AB	16530+4424	8.21 12.0	200.3	24.80	2013.620	1	W
STT 317AC	16530+4424	8.21 9.22	315.7	130.37	2013.620	1	W
STF2140AB	17146+1423	3.48 5.40	102.3	4.77	2013.549	2	W α Her
STF3127AB	17150+2450	3.12 8.3	288.1	12.68	2013.583	2	W D δ Her
STF3127AC	17150+2450	3.12 10.45	352.7	174.22	2013.583	2	W D
STF2161AB	17237+3709	4.50 5.40	320.9	3.98	2013.620	1	W ρ Her
STF2170AB	17287+1029	9.38 10.01	59.8	3.29	2013.570	1	W
GUI 18AC	17287+1029	9.38 7.08	18.5	189.92	2013.570	1	W
STF2176AB	17311+1027	9.53 10.32	16.7	16.74	2013.570	1	W
GUI 19AC	17311+1027	9.53 9.46	71.2	89.56	2013.570	1	W
STFA 34AB	17346+0935	5.80 7.50	190.2	41.20	2013.570	1	W
STFA 34AC	17346+0935	5.80 11.90	343.3	96.85	2013.570	1	W
STFA 34AD	17346+0935	5.80 10.5	213.1	127.05	2013.570	1	W
STF2185AB	17348+0601	7.46 10.32	4.0	27.22	2013.570	1	W
STF2185AC	17348+0601	7.46 8.43	252.3	92.02	2013.570	1	W
STF2188	17362+0637	9.22 9.98	202.6	5.54	2013.570	1	W
STF2220A BC	17465+2743	3.49 9.78	248.5	35.61	2013.584	1	W μ Her

Table continues on next page.

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Table 1(conclusion): Measurements of 2013

NAME	RA+DEC	MAGS	PA	SEP	DATE	N	NOTES
STF2216	17470+0542	8.01 10.09	26.3	27.20	2013.570	1	W
STF2232	17503+2517	6.71 8.85	137.4	6.31	2013.584	1	W
STF2264	18015+2136	4.85 5.20	256.8	6.47	2013.584	1	W
HO 426	18039+2639	7.0 12.0	228.8	11.88	2013.584	1	W
ES 471AC	18047+2707	7.21 10.2	45.0	24.34	2013.584	1	W
SLE 106AD	18047+2707	7.21 11.03	244.2	88.67	2013.584	1	W
SLE 106AE	18047+2707	7.21 10.84	42.6	183.40	2013.584	1	W
STF2272AB	18055+0230	4.22 6.17	129.2	6.28	2013.570	1	W 70 Oph
STF2272AC	18055+0230	4.22 12.05	326.3	93.07	2013.570	1	W
STF2272AT	18055+0230	4.22 12.25	45.0	128.44	2013.570	1	W
STF2272AV	18055+0230	4.22 10.83	275.7	144.51	2013.570	1	W
STF2280AB	18078+2606	5.81 5.84	182.6	14.36	2013.584	1	W 100 Her
H 5 39AB	18369+3846	0.09 9.5	183.3	81.95	2013.706	2	W Vega
STFB 9AE	18369+3846	0.09 9.5	38.4	86.55	2013.706	2	W
STFA 37AD	18443+3940	5.15 5.38	172.1	208.64	2013.706	2	W ϵ Lyr
STFA 37AI	18443+3940	5.15 10.43	137.5	150.17	2013.680	1	W
SHJ 277EF	18443+3940	11.71 11.2	37.2	45.37	2013.680	1	W
SHJ 277GH	18443+3940	13.83 13.22	358.1	35.14	2013.680	1	W
J 121AB	19401+1801	4.37 13.2	179.6	29.83	2013.680	1	W α Sge
WAL 118AD	19401+1801	4.37 11.21	147.7	82.64	2013.680	1	W
STF2585AB C	19490+1909	5.04 9.01	310.9	8.44	2013.680	1	W
STFB 10AB	19508+0852	0.95 9.82	285.6	195.23	2013.732	1	W Altair
STFB 10AC	19508+0852	0.95 10.3	108.8	186.92	2013.732	1	W Altair
DAL 27AD	19508+0852	0.95 11.9	104.6	29.13	2013.732	1	W Altair
SMR 5AE	19508+0852	0.95 11.0	354.2	152.14	2013.732	1	W Altair
SMR 5AF	19508+0852	0.95 10.3	47.4	293.64	2013.732	1	W Altair
SMR 7	20000+1736	10.1 11.4	265.3	4.15	2013.706	2	W
S 730AB	20001+1737	7.16 8.45	14.3	112.75	2013.732	1	W
S 730AC	20001+1737	7.16 10.21	337.6	78.77	2013.732	1	W
S 730AD	20001+1737	7.16 9.9	198.6	40.94	2013.732	1	W
ROE 10	20002+2251	10.84 10.91	67.1	9.06	2013.658	1	D
S 737	20099+2100	7.93 9.26	128.1	100.56	2013.732	1	W
STF2637AB	20099+2055	6.56 8.85	330.8	11.50	2013.732	1	W
STF2637AC	20099+2055	6.56 7.52	221.5	90.84	2013.732	1	W
STF2758AB	21069+3845	5.35 6.10	151.8	31.36	2013.694	3	W D 61 Cyg
STF2758AE	21069+3845	5.35 9.63	267.9	329.19	2013.677	1	D
STF2758AF	21069+3845	5.35 11.3	240.4	357.03	2013.677	1	D
STF2758AG	21069+3845	5.35 10.84	235.7	244.94	2013.674	1	W
STF2758AG	21069+3845	5.35 10.89	274.8	99.89	2013.674	1	W
SMR 1AI	21069+3845	5.35 11.	257.2	7.25	2013.703	2	W
ES 2059	21070+3839	10.11 12.6	266.6	7.0	2013.677	1	D
MLB1018	21072+3841	11.22 12.2	250.9	4.61	2013.677	1	D
MLB1019	21074+3841	12.2 13.7	242.1	6.01	2013.677	1	D

Notes:

"D" - A DSLR was used for imaging

"W" - A webcam was used for imaging

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This research made use of the Washington Double Star Catalog maintained at the U.S. Naval Observatory and the SIMBAD database, operated at CDS, Strasbourg, France

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