Double Star Observations with a 150mm Refractor in 2015

Marc Oliver Maiwald
Witten, Germany
oliver-maiwald@web.de

Abstract: I present 136 measurements of 69 pairs made in 2015. For 26 stars, residuals were calculated.

In 2015 the same telescope and observing techniques as in previous years were used (Maiwald, 2013; Maiwald, 2014; Maiwald, 2015), with the only exception of a Alccd QHY 5-II camera with 3.75mm pixels aquired in autumn 2015 and used for 9 observations in autumn and winter. For one observation a Philips SPC 900 NC was used. All other observations were made with an Imaging Source DMK 21 camera.

The imaging scales for the different optical setups are:

- DMK 21 at direct focus (f): 0.384 a.s. per pixel.
- DMK 21 with teleconverter 1.4x (TK 1.4): 0.297322 a.s. per pixel
- DMK 21 with teleconverter 2x (TK 2): 0.19876 a.s. per pixel
- QHY 5 – II at direct focus (f; A) : 0.25739 a.s. per pixel
- QHY 5 – II with teleconverter 1.4 (TK1.4; A): 0.1851 a.s. per pixel
- SPC 900 NC with teleconverter 2x (TK2; NC): 0.2091 a.s. per pixel

Acknowledgements

This paper made use of the Washington Double Star Catalog and the Sixth Catalog of Orbits of Visual Binary Stars, both maintained at the U.S. Naval Observatory. Noncommercial software used was: *Binary Star Calculator* by Brian Worman; *Reduc 3.88* by Florent Losse; *Registax 4 and 5* by Coer Berrevoets and *SharpCap* by Robin Glover.

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Table 1. Double Star Measurements in 2015

Designation	WDS ident	θ	ρ	Date	No	Name	Notes
STF 060 AB	00491+5749	324.6 324.3	13.44 12.92	2015.781 2015.904	76 37	η Cas	f; A TK2
STF 180	01535+1918	1.1 1.1	7.16 7.14	2015.953 2015.978	32 29	γ Ari	TK2 TK2
STF 299	02433+0314	299.1	2.03	2015.978	26	γ Ceti	TK2
SHJ 49	04590+1433	305.6	39.32	2015.102	30		f
STF 627	05006+0337	260	21.2	2015.102	35		f
STF 652	05118+0102	179.8	1.6	2015.126	31		TK2
STF 696	05228+0333	29.1	32	2015.129	36	23 Ori	f
STF 729 AB	05312+0318	26.9 26.6	1.85 1.85	2015.115 2015.126	45 30	33 Ori	TK2 TK2
STFA 14AC	05320-0018	0.4	51.75	2015.129	17	δ Ori	f
STF 738 AB	05351+0956	44.2	4.18	2015.115	45	λ Ori	TK2
STF 762 AD	05387-0236	84	13.13	2015.129	33	σ Ori	f
STF 762 AE	05387-0236	61.6	41.65	2015.129	41	σ Ori	f
STF 795	05480+0627	221 221.9	1.02 0.96	2015.126 2015.159	28 40	52 Ori	TK2 TK2
STF 855 AB	06090+0230	114.1	29.27	2015.129	43		f
SHJ 70 AB	06278+2047	202.2 202.1	24.78 24.8	2015.187 2015.189	36 44	15 Gem	f
STTA 77	06290+2013	329.9	112.76	2015.167	10	ν Gem	f
STF 924	06323+1747	211	19.86	2015.187	51	20 Gem	f
STF 1066	07201+2159	229.7 228.5 228.1 228.3	5.6 5.6 5.7 5.7	2015.189 2015.198 2015.206 2015.209	35 36 41 26	δ Gem	f f f f
STF 1090 AB	07265+1831	98.2	60.7	2015.189	42		f
STF 1108	07328+2253	178.7	11.6	2015.198	33		f
STF 1110 AB	07346+3153	54.8 54.4	4.91 4.9	2015.137 2015.159	92 73	α Gem	TK2 TK2
STF 1196 AB	08122+1739	22.3 27.3 18.7 20.9 20.7 24.7	1.04 0.99 0.99 1.03 1.09 1.05	2015.222 2015.258 2015.261 2015.263 2015.269 2015.282	87 82 64 137 121 43	ζ Cnc	TK2 TK2 TK2 TK2 TK2 TK2
STF 1196 AC	08122+1739	61.9 62.5 62.5 62 62 61.8	6.24 6.25 6.15 6.14 6.15 6.17	2015.222 2015.258 2015.261 2015.263 2015.269 2015.282	81 55 65 130 119 40	ζ Cnc	TK2 TK2 TK2 TK2 TK2 TK2
STF 1224	08267+2432	51.5	5.54	2015.222	34	24 Cnc	TK2
ENG 37	08401+2000	151.8	149.6	2015.181	34	39 Cnc	f
S 574	08405+1933	249.9	133.97	2015.181	30	ε Cnc	f
STF 1338 AB	09219+3811	311.8 309.4	0.97 0.96	2015.263 2015.269	59 65		TK2 TK2

Table 1 continues on next page.

Double Star Observations with a 150mm Refractor in 2015

Table 1 (continued). Double Star Measurements in 2015

Designation	WDS ident	θ	ρ	Date	No	Name	Notes
STF 1369 AB	09354+3958	149.4 149.4	24.94 24.98	2015.299 2015.302	30 35		f f
STF 1369 AC	09354+3958	322.4 322.5	116.57 116.64	2015.299 2015.302	35 38		f f
STT 215	10163+1744	175.7 176.1	1.42 1.45	2015.293 2015.303	37 80		TK2 TK2
STF1424 AB	10200+1950	126.2 126.2	4.58 4.6	2015.222 2015.258	45 67	γ Leo	TK2 TK2
STF 1450	10350+0839	158.4 155.9 157.8	2 2.03 2.05	2015.285 2015.288 2015.293	28 34 38	49 Leo	TK2 TK2 TK2
S 612	10459+3041	173.5 173.6	196.15 196.18	2015.288 2015.291	36 36	42 LMi	f f
STF1540 AB	11268+0301	149.6	28.26	2015.272	47	83 Leo	f
STF1523 AB	1118+3132	174.9 176	1.67 1.71	2015.282 2015.285	71 68	ξ Uma	TK2 TK2
STF1565	11396+1900	304.4	21.71	2015.310	29		f
STF1670	12417-0127	4.8 6.8 4.8	2.35 2.25 2.32	2015.307 2015.310 2015.332	44 49 49	γ Vir	TK2; NC TK2 TK2
STF 1768 AB	13375+3618	95.9 94.4 94.5	1.69 1.68 1.68	2015.343 2015.346 2015.362	59 63 65	25 CVn	TK2 TK2 TK2
STF 1821	14135+5147	235.5	13.71	2015.433	42	κ Boo	f
STFA 26	14162+5122	32.6 32.6	38.93 38.88	2015.436 2014.439	45 45	ι Boo	f f
STF 1825	14165+2007	153.6 153.8	4.39 4.39	2015.441 2015.444	44 34		f f
STF 1850	14286+2817	261.2 261.1	25.43 25.42	2015.441 2015.444	36 36		f f
STF 1864AB	14407+1625	112.2 111.5	5.34 5.34	2015.384 2015.395	45 29	π Boo	TK2 TK2
STF 1884	14484+2422	55.7 55.1	2.13 2.1	2015.433 2015.436	18 36		TK2 TK2
STF 1888 AB	14514+1906	302.6 303.4 302.6	5.50 5.53 5.49	2015.374 2015.384 2015.395	40 18 29	ξ Boo	TK2 TK2 TK2
STT 288	14534+1542	159.5 159.9 160.6 160.2	0.96 0.89 0.93 1.08	2015.374 2015.384 2015.395 2015.425	35 17 40 23		TK2 TK2 TK2 TK2
STF 1909	15038+4739	69 68.9	0.84 0.88	2015.365 2015.37	100 61	44 Boo	TK2 TK2
STF 1931 AB	15187+1026	166.3	13.35	2015.430	37		f
STF 1938	15245+3723	3.8 5.1 3.9	2.18 2.2 2.19	2015.4 2015.411 2015.425	61 28 63	μ Boo	TK2 TK2 TK2

Table 1 continues on next page.

Double Star Observations with a 150mm Refractor in 2015

Table 1 (conclusion). Double Star Measurements in 2015

Designation	WDS ident	θ	ρ	Date	No	Name	Notes
STF 1954 AB	15348+1032	172.1	3.9	2015.430	75	δ Ser	TK2
STF 2010 AB	16081+1703	13.2	27	2015.524	39	κ Her	f
STF 2032 AB	16147+3352	238.5 238.4	6.98 6.99	2015.450 2015.455	40 48	σ CrB	TK2 TK2
STF 2118 AB	16564+6502	64.7 66.4	0.94 0.95	2015.450 2015.455	60 28	20 Dra	TK2 TK2
STF 2130 AB	17053+5428	2.7 2.5	2.42 2.42	2015.496 2015.499	50 61	μ Dra	TK2 TK2
STF 2140	17146+1423	103.8 103.4	4.63 4.65	2015.543 2015.545	45 45	α Her	TK2 TK2
STF 2161AB	17237+3709	320.2 320.3	3.94 3.99	2015.554 2015.556	51 36	ρ Her	TK2 TK2
STF 2272 AB	18055+0230	125.3 125.5	6.15 6.18	2015.515 2015.521	90 33	70 Oph	TK2 TK2
STF 2289	18101+1629	222.2 224 221.7	1.19 1.19 1.15	2015.521 2015.543 2015.554	41 50 39		TK2 TK2 TK2
STT 358AB	18359+1659	148.8 148.4 149.1	1.63 1.60 1.5	2015.573 2015.575 2015.595	20 19 39		TK2 TK2 TK2
STF 37 AB	18443+3940	172.1	208.73	2015.513	11	ε & 5 Lyr	f
STF 2382 AB	18443+3940	345.8 346.4	2.13 2.21	2015.502 2015.513	33 38	ε Lyr	TK2 TK2
STF 2383 CD	18443+3940	76.6 76.2	2.27 2.3	2015.502 2015.513	29 38	5 Lyr	TK2 TK2
STF 2579 AB	19450+4508	215.5 217.8 217.1 217.7	2.21 2.62 2.65 2.6	2015.636 2015.641 2015.568 2015.74	59 23 71 57	δ Cyg	TK2 TK2 TK2 TK1.4; A
STF 2583 AB	1948+1149	102.3 103.1 102.4	1.33 1.32 1.37	2015.581 2015.586 2015.597	66 66 125	π Aql	TK2 TK2 TK2
STF 2737AB - C	20591+0418	67.3	10.29	2015.822	32	ε Equ	TK2
STF 2758 AB	21069+3845	152.4 152.4	31.6 31.59	2015.742 2015.748	71 13	61 Cyg	f; A f; A
S 799 AB	21434+3817	60.2	149.47	2015.742	14	79 Cyg	f; A
STF 2822 AB	21441+2845	319.1 318 318 318.8	1.6 1.52 1.62 1.56	2015.568 2015.707 2015.74 2015.748	74 40 77 38	μ Cyg	TK2 f; A TK1.4; A TK1.4; A
STF 2909	22288-0001	163.8 163.5	2.3 2.23	2015.819 2015.822	80 39	ζ Aqr	TK1,4; A TK2

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Table 2. Residuals for Double Stars in 2015

Designation	WDS ident	Date	No	θ	ρ	Δθ	Δρ	Ref.	Notes
STF 060 AB	00491+5749	2015.8	2	324.5	13.27	0.5	-0.10	Str1969a	
STF1066	07201+2159	2015.2	4	228.6	5.64	0.4	0.14	Hop1960a	
STF1110 AB	07346+3153	2015.1	2	54.6	4.91	0.2 0.5	-0.15 -0.1	Hei1988a Doc1985c	
STF1196 AB	08122+1739	2015.3	6	22.1	1.04	4.1 3	-0.09 -0.08	Sod1999 WSI2006B	1
STF1338 AB	09219+3811	2015.3	2	310.5	0.96	-3	-0.04	Sca2002b	2
STT 215	10163+1744	2015.3	2	176	1.44	-2.4	-0.12	Zae 1984	3
STF1424 AB	10200+1950	2015.2	2	126.2	4.59	0.1	0.12	Rab1958	
STF1523 AB	1118+3132	2015.3	2	175.4	1.69	0.2	-0.11	Msn1995	
STF1670	12417-0127	2015.3	3	5.5	2.31	0.2 2.2	0 -0.05	Sca2007c Sod1999	
STF1768 AB	13375+3618	2015.4	3	94.9	1.68	-0.1	-0.01	Sod1999	
STF1888 AB	14514+1906	2015.4	3	302.8	5.5	0.4	-0.11	Sod1999	
STT 288	14534+1542	2015.4	4	160.1	0.96	1.6	-0.05	Hei1998	
STF1909	15038+4739	2015.4	2	69	0.86	0.8 1.6	0.03 -0.15	Sod1999 Zir2011	4
STF1938	15245+3723	2015.4	2	4.1	2.19	0.4 0.7	-0.03 -0.05	Sca2013a Sod1999	
STF2032 AB	16147+3352	2015.5	2	238.4	6.99	0.1 0.1	-0.2 -0.3	Rag2009 Sca1979	
STF2118 AB	16564+6502	2015.5	2	65.2	0.94	-1.6	-0.21	Sca2002d	
STF2130 AB	17053+5428	2015.5	2	2.6	2.42	0.1	-0.09	Pru2012	
STF2272 AB	18055+0230	2015.5	2	125.4	6.16	-0.5	-0.19	Pbx2000b	
STF2289	18101+1629	2015.5	3	222.7	1.18	6.9	-0.06	Hop1964b	5
STT358AB	18359+1659	2015.6	3	148.9	1.56	2.7	0.06	Hei1995	6
STF2382	18443+3940	2015.5	2	346.1	2.17	0.2 0.2 0	-0.1 -0.17 -0.31	Nov2006e WSI2004b Gzl1956a	
STF2383	18443+3940	2015.5	2	76.4	2.29	0.4	-0.1	Doc1984b	
STF2579 AB	19450+4508	2015.6	4	216.9	2.51	-0.3	-0.22	Sca2012c	
STF2758 AB	21069+3845	2015.7	2	152.4	31.6	0.4 -0.2	0 -0.06	Pko2006b Kis1997	
STF2822 AB	21441+2845	2015.7	4	318.5	1.59	-3.3	0.05	Hei1995	7
STF2909	22288-0001	2015.8	2	163.7	2.28	-0.2 -1.2	0.02 -0,11	Sca2010c Hei1984c	

Notes to Table 2

1. Measurements for previous years in (Maiwald, 2014, p. 107). (Argyle, 2015, p.4) gives Δθ +1,6 and Δρ +0,03 for 2014.222 against the 2006 orbit.
2. My own measurements for previous years in (Maiwald, 2014, p. 191) and (Maiwald, 2015, p.106). (Courtot, 2015, p. 11): Δθ –5,2 and Δρ +0,09 for 2014,290. Δθ always negative.
3. (Maiwald, 2014, p.190): Δθ –2,4 and Δρ –0,13 for 2013,3. (Argyle, 2012, p.4): Δθ –2,1 and Δρ –0,08 for 2011.360.
4. I was very surprised that this star could be measured with my telescope. Obviously the seeing was very good at these two evenings. My measurements for 2009 to 2014 in (Maiwald, 2014, p.191) and (Maiwald, 2015, p.106).
5. Star is known for deviation from ephemeris. See (Maiwald, 2014, p.190) and (Maiwald, 2015, p. 106) for my measurements from 2013 and 2014.
6. My own measurements show positive residuals in θ from 2012.6 to 2014.5. (Courtot, 2015, p.11): Δθ +1,4 for 2014.694; (Argyle, 2013, p.4): Δθ +4,4 for 2012,683.
7. Star is known for deviation from ephemeris. Residuals in θ always negative.