Double Star Measurements Using A Small Refractor

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Abstract: On the following pages, I present measurements of stars made from 2010 to 2012 with a 6 inch folded refractor.

The Instrument used for these measurements is a folded refractor of the type known as “Schaer – Refractor” or “réfracto – réflecteur”. It is equipped with an air – spaced achromatic doublet made by Lichtenknecker Optics, which has a free aperture of 150mm and and a focal length of 3000mm. The secondary spectrum was eliminated by a yellow – green filter (No 11), which also removes atmospheric dispersion.

The image scale at the prime focus is 0,384”/pixel. Double Stars with separations < 1,5” can be resolved, but are difficult to measure with acceptable accuracy. For observation of these doubles – as for many observations of wider pairs - different optical setups were tried: With a Barlow lens and an image scale of 0,232”/pixel, with Telekonverters and image scales of 0,19876”/pixel and 0,189”/pixel. Calibration of the image scale was done with calibration stars. The plate scale of the instrument is nearly constant, due to the thermal stability of long – focus refractors.

The camera used for most of the observations is a DMK 21 bw - camera with 480 x 640 pixels and a pixel size of 5,6 micron, manufactured by “The Imaging Source”. It is more comfortable to use and has less electronic noise than webcams. It was used at the highest “gain” setting and typical exposure times ranged from 1/60s or even shorter for bright pairs down to 1/5 or 1/4s for stars of 8th magnitude.

In most cases the position angle of the camera was calibrated with drifts of the double star actually measured. Exceptions were made if two double stars were close neighbours in the sky. In a few cases a nearby star was used for the drift calibration, especially when a binary was too faint for good drift exposures. Normally 10 drifts were taken for every star.

In most cases 25 to 100, and sometimes even 200, AVI files were taken for each star at one observing session. The AVI files were processed with *Registax*. The resulting pictures were measured with *Reduc* and pictures of lower quality were rejected. In Table 1 under “No” the number of pictures actually used for the final value is listed.

The table begins on the next page.

Double Star Measurements Using A Small Refractor

Name	RA & De	PA	Sep	Date	No	Notes
STF 3053AB	00026+6606	70.4	15.13	2012.827	36	
STF 59	00480+5127	147.9	2.24	2012.826	38	
STF 60AB	00491+5749	322	14.06	2010.716	19	η Cas
STF 60AB	00491+5749	322.8	13	2010.724	31	η Cas
STF 60AB	00491+5749	323.2	13.06	2011.877	31	η Cas
STF 60AB	00491+5749	323	13.21	2012.766	34	η Cas
STF 73AB	00550+2338	326.5	1.13	2012.851	82	36 And
H 3 23AC	01201+5814	230.9	134	2012.829	37	φ Cas
S 397	01211+6439	341.9	57.19	2012.895	19	35 Cas
STF 262AB	02291+6724	227.9	2.71	2010.784	18	ι Cas
STF 262AB	02291+6724	229.3	2.9	2011.877	34	ι Cas
STF 262AB	02291+6724	230.2	2.75	2012.810	42	ι Cas
STF 262AC	02291+6724	113.3	7.39	2010.784	24	ι Cas
STF 262AC	02291+6724	115.6	7.16	2012.810	39	ι Cas
STF 299	02433+0314	298.4	2.08	2012.969	33	γ Ceti
STF 948AB	06462+5927	69	1.87	2011.220	75	12 Lyn
STF 948AB	06462+5927	69	1.85	2011.239	69	12 Lyn
STF 948AB	06462+5927	68.9	1.88	2012.202	73	12 Lyn
STF 948AC	06462+5927	308.8	8.82	2011.220	77	12 Lyn
STF 948AC	06462+5927	308.9	8.81	2011.239	85	12 Lyn
STF 948AC	06462+5927	308.8	8.79	2012.202	51	12 Lyn
STF 1110AB	07346+3153	57.8	4.43	2010.187	10	α Gem
STF 1110AB	07346+3153	57.3	4.68	2010.261	10	α Gem
STF 1110AB	07346+3153	57.3	4.67	2010.272	12	α Gem
STF 1110AB	07346+3153	56.4	4.76	2010.278	17	α Gem
STF 1110AB	07346+3153	56.8	4.74	2011.145	17	α Gem
STF 1110AB	07346+3153	57.3	4.75	2011.167	85	α Gem
STF 1110AB	07346+3153	56.7	4.77	2011.192	74	α Gem
STF 1110AB	07346+3153	56.2	4.85	2012.170	63	α Gem
STF 1196AB	08122+1739	38.8	0.92	2010.187	7	ζ Cnc
STF 1196AB	08122+1739	37.6	1.08	2010.264	10	ζ Cnc
STF 1196AB	08122+1739	38.3	1.03	2010.272	19	ζ Cnc
STF 1196AB	08122+1739	38.7	0.91	2010.275	6	ζ Cnc
STF 1196AB	08122+1739	36.9	0.94	2011.214	106	ζ Cnc
STF 1196AB	08122+1739	37.7	1.05	2011.222	90	ζ Cnc
STF 1196AB	08122+1739	32.4	1.04	2012.180	71	ζ Cnc
STF 1196AC	08122+1739	66.8	6.35	2010.187	10	ζ Cnc
STF 1196AC	08122+1739	67.7	6.4	2010.209	8	ζ Cnc
STF 1196AC	08122+1739	65.8	6.67	2010.264	10	ζ Cnc
STF 1196AC	08122+1739	66.5	6.63	2010.272	13	ζ Cnc
STF 1196AC	08122+1739	66.5	6.54	2010.275	8	ζ Cnc
STF 1196AC	08122+1739	65.7	6.65	2011.214	107	ζ Cnc
STF 1196AC	08122+1739	65.3	6.65	2011.222	76	ζ Cnc
STF 1196AC	08122+1739	65.8	6.91	2012.180	72	ζ Cnc
STF 1306AB	09104+6708	349.5	4.19	2011.310	15	σ^2 Uma
STF 1306AB	09104+6708	349.9	4.33	2011.313	50	σ^2 Uma

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Double Star Measurements Using A Small Refractor

Name	RA & De	PA	Sep	Date	No	Notes
STF 1306AB	09104+6708	349.6	4.41	2012.217	22	σ^2 Uma
STF 1333	09184+3522	49.6	1.92	2010.272	10	
STF 1333	09184+3522	49.2	1.8	2010.278	16	
STF 1333	09184+3522	48.9	1.89	2010.291	12	
STF 1333	09184+3522	49.3	1.81	2011.170	24	
STF 1333	09184+3522	49.6	1.92	2011.176	65	
STF 1333	09184+3522	49.8	1.93	2011.236	54	
STF 1333	09184+3522	50.2	1.8	2012.208	31	
STF 1334AB	09188+3648	224.1	2.6	2010.272	8	38 Lyn
STF 1334AB	09188+3648	224.8	2.59	2010.275	9	38 Lyn
STF 1334AB	09188+3648	224.1	2.66	2010.278	18	38 Lyn
STF 1334AB	09188+3648	224.6	2.74	2010.291	11	38 Lyn
STF 1334AB	09188+3648	223	2.57	2011.170	46	38 Lyn
STF 1334AB	09188+3648	223.9	2.64	2012.202	73	38 Lyn
STF 1338AB	09219+3811	297.5	1.06	2010.291	17	
STF 1338AB	09219+3811	301.4	0.9	2010.297	15	
STF 1338AB	09219+3811	301.4	1.07	2011.225	153	
STF 1338AB	09219+3811	306	0.93	2012.216	70	
STF 1424AB	10200+1950	125	4.46	2010.190	12	γ Leo
STF 1424AB	10200+1950	125.9	4.86	2010.264	8	γ Leo
STF 1424AB	10200+1950	125.8	4.66	2011.217	136	γ Leo
STF 1424AB	10200+1950	125.9	4.66	2011.241	141	γ Leo
STF 1424AB	10200+1950	126.2	4.69	2012.208	80	γ Leo
STF 1523AB	11182+3132	210.1	1.62	2010.321	26	ξ Uma
STF 1523AB	11182+3132	211.1	1.5	2010.352	21	ξ Uma
STF 1523AB	11182+3132	202.2	1.61	2011.263	111	ξ Uma
STF 1523AB	11182+3132	202.5	1.7	2011.269	63	ξ Uma
STF 1523AB	11182+3132	194.4	1.6	2012.284	98	ξ Uma
STF 1670	12417-0127	22.4	1.5	2010.373	20	γ Vir
STF 1670	12417-0127	24.6	1.57	2010.384	22	γ Vir
STF 1670	12417-0127	18.9	1.74	2011.297	114	γ Vir
STF 1670	12417-0127	18.9	1.66	2011.300	100	γ Vir
STF 1670	12417-0127	19.4	1.74	2011.302	76	γ Vir
STF 1670	12417-0127	13.9	1.8	2012.364	99	γ Vir
STF 1670	12417-0127	14.3	1.8	2012.367	79	γ Vir
STT 261	13120+3205	338.7	2.62	2011.329	23	
STT 261	13120+3205	338.6	2.58	2011.332	18	
STF 1768	13375+3618	98.3	1.76	2010.393	21	25 CVn
STF 1768	13375+3618	98.3	1.76	2010.406	29	25 CVn
STF 1768	13375+3618	96.6	1.78	2011.315	58	25 CVn
STF 1768	13375+3618	96.5	1.78	2011.340	14	25 CVn
STF 1768	13375+3618	96.5	1.65	2012.301	55	25 CVn
STF 1864AB	14407+1625	111	5.53	2010.387	20	π Boo
STF 1864AB	14407+1625	110.8	5.54	2010.390	21	π Boo
STF 1864AB	14407+1625	110.8	5.61	2011.348	11	π Boo
STF 1864AB	14407+1625	110.9	5.57	2011.354	38	π Boo
STF 1864AB	14407+1625	110.7	5.55	2012.375	56	π Boo

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Name	RA & De	PA	Sep	Date	No	Notes
STF 1877AB	14450+2704	343.3	2.94	2010.385	24	ε Boo
STF 1877AB	14450+2704	342.3	2.94	2010.387	14	ε Boo
STF 1877AB	14450+2704	342.7	2.94	2011.346	36	ε Boo
STF 1877AB	14450+2704	342.2	2.97	2011.376	30	ε Boo
STF 1877AB	14450+2704	343.8	2.78	2012.400	81	ε Boo
STF 1877AB	14450+2704	342.9	2.88	2012.402	81	ε Boo
STF 1888AB	14514+1906	308.1	6.1	2010.420	46	ξ Boo
STF 1888AB	14514+1906	307	6	2011.354	20	ξ Boo
STF 1888AB	14514+1906	307.3	6	2011.362	21	ξ Boo
STF 1888AB	14514+1906	305.5	5.8	2012.375	79	ξ Boo
STF 1888AB	14514+1906	305.6	5.73	2012.454	36	ξ Boo
STT 288	14534+1542	159.8	1.16	2010.426	20	
STT 288	14534+1542	159.7	0.97	2011.409	36	
STT 288	14534+1542	160.9	1.09	2011.417	19	
STT 288	14534+1542	159.4	0.95	2011.419	31	
STT 288	14534+1542	160.9	1.09	2012.455	32	
STT 288	14534+1542	159.3	0.97	2012.463	48	
STF 1909	15038+4739	60.2	1.62	2010.423	49	44 Boo
STF 1909	15038+4739	61.3	1.51	2011.391	42	44 Boo
STF 1909	15038+4739	60.6	1.39	2011.395	43	44 Boo
STF 1909	15038+4739	60	1.46	2011.403	67	44 Boo
STF 1909	15038+4739	60.7	1.38	2012.383	117	44 Boo
STF 1909	15038+4739	62.4	1.4	2012.391	118	44 Boo
STF 1909	15038+4739	62.8	1.34	2012.397	123	44 Boo
STF 1909	15038+4739	62.5	1.31	2012.438	79	44 Boo
STF 1932AB	15183+2650	263.7	1.53	2012.517	10	
STF 1932AB	15183+2650	264	1.57	2012.558	31	
STF 1931AB	15187+1026	166.4	13.38	2012.436	15	
STFA 28AB	15245+3723	170.7	108.8	2010.390	25	μ Boo
STFA 28AB	15245+3723	170.8	108.79	2010.407	24	μ Boo
STFA 28AB	15245+3723	170.9	108.8	2011.387	44	μ Boo
STF 1938BC	15245+3723	5.4	2.27	2010.404	11	μ Boo
STF 1938BC	15245+3723	5.9	2.32	2011.389	38	μ Boo
STF 1938BC	15245+3723	4.8	2.23	2011.392	17	μ Boo
STF 1938BC	15245+3723	6.1	2.3	2011.395	20	μ Boo
STF 1938BC	15245+3723	4.9	2.2	2012.408	32	μ Boo
STF 1954AB	15348+1032	172.6	3.92	2012.487	81	δ Ser
STF 2021AB	16133+1332	356.8	4.13	2012.564	39	49 Ser
STF 2032AB	16147+3352	238	6.95	2012.517	35	σ CrB
STF 2032AB	16147+3352	238	6.94	2012.558	39	σ CrB
STFA 30AC	16361+5255	193.3	90.11	2012.588	22	16&17Dra
STF 2078AB	16361+5255	104.3	3.07	2012.588	31	17 Dra
STF 2118AB	16564+6502	65.9	0.95	2012.610	41	20 Dra
STF 2118AB	16564+6502	67.4	0.93	2012.613	60	20 Dra
STF 2130AC	17053+5428	7.5	2.46	2010.716	39	μ Dra
STF 2130AC	17053+5428	6.9	2.47	2011.740	58	μ Dra

Table continues on next page.

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Name	RA & De	PA	Sep	Date	No	Notes
STF 2130AC	17053+5428	5.7	2.39	2012.504	77	μ Dra
STF 2140AB	17146+1423	103.7	4.82	2010.461	49	α Her
STF 2140AB	17146+1423	103.6	4.86	2011.644	40	α Her
STF 2161AB	17237+3709	320.3	4.11	2010.478	40	ρ Her
STF 2161AB	17237+3709	320	4.11	2011.644	75	ρ Her
STF 2161AB	17237+3709	320.1	3.94	2012.556	34	ρ Her
STF 2161AB	17237+3709	319.6	3.97	2012.558	31	ρ Her
STFA 35	17322+5511	310.9	62.03	2012.591	29	ν Dra
STF 2199	17386+5546	55.7	2.06	2012.591	46	
STF 2199	17386+5546	56.2	2.06	2012.610	24	
STF 2220AB	17465+2743	249.9	34.72	2010.486	4	μ Her
H 6 2 AC	18006+0256	142	54.38	2012.501	21	67 Oph
STF 2264	18015+2136	256.7	6.15	2012.561	42	95 Her
STF 2272AB	18055+0230	130.8	6	2010.508	37	70 Oph
STF 2272AB	18055+0230	130.5	5.9	2010.532	22	70 Oph
STF 2272AB	18055+0230	130.9	5.86	2010.538	39	70 Oph
STF 2272AB	18055+0230	129.7	5.98	2011.633	57	70 Oph
STF 2272AB	18055+0230	128.5	5.9	2012.495	46	70 Oph
STF 2272AB	18055+0230	128	5.84	2012.501	36	70 Oph
STF 2272AB	18055+0230	128	5.85	2012.564	40	70 Oph
STF 2323AB	18239+5848	349	3.82	2012.506	64	39 Dra
STF 2323AC	18239+5848	19.3	88.84	2012.506	54	39 Dra
STF 2316	18272+0012	320.4	3.61	2012.567	28	59 Ser
STT 358AB	18359+1659	149.9	1.63	2012.561	27	
STT 358AB	18359+1659	150.5	1.64	2012.569	20	
STT 358AC	18359+1659	235.3	198.73	2012.569	8	
STF 37AC	18443+3940	172.1	208.8	2011.488	43	ε&5 Lyr
STF 37AC	18443+3940	171.7	208.59	2012.498	21	ε&5 Lyr
STF 2382	18443+3940	347.9	2.37	2010.546	52	ε Lyr
STF 2382	18443+3940	348	2.36	2011.518	36	ε Lyr
STF 2382	18443+3940	347.8	2.35	2011.537	45	ε Lyr
STF 2383	18443+3940	77.6	2.42	2010.546	46	5 Lyr
STF 2383	18443+3940	78	2.38	2011.518	37	5 Lyr
STF 2383	18443+3940	77.5	2.44	2011.537	36	5 Lyr
STTA 182AB	19268+5009	297.3	73.21	2012.750	38	
STFA 46AB	19418+5032	133.2	39.68	2012.728	40	16 Cyg
STFA 46AB	19418+5032	133.2	39.69	2012.747	27	16 Cyg
STF 2579AB	19450+4508	224.9	2.78	2010.598	22	δ Cyg
STF 2579AB	19450+4508	224.3	2.3	2011.636	15	δ Cyg
STF 2579AB	19450+4508	225	2.61	2012.649	41	δ Cyg
STF 2576AB	19456+3337	158.8	2.98	2012.750	38	
STF 2578AB	19457+3605	124.7	14.86	2012.750	38	
STF 2580AB	19464+3344	68.2	26.05	2012.728	28	17 Cyg
STF 2580AB	19464+3344	68.3	26.05	2012.747	19	17 Cyg
STF 2580AC	19464+3344	124.4	108.53	2012.728	24	17 Cyg
STF 2580AC	19464+3344	124.3	108.53	2012.747	18	17 Cyg

Table concludes on next page.

Double Star Measurements Using A Small Refractor

Name	RA & De	PA	Sep	Date	No	Notes
S 726AD	19466+3253	191.1	29.22	2012.747	21	
STF 2583AB	19487+1149	104.6	1.5	2010.563	60	π Aql
STF 2583AB	19487+1149	103.1	1.47	2011.584	51	π Aql
STF 2583AB	19487+1149	103.9	1.38	2012.556	41	π Aql
STF 2583AB	19487+1149	104.2	1.38	2012.567	38	π Aql
STF 2725	20462+1554	11.2	6.15	2012.676	43	
STF 2727	20467+1607	265.4	8.98	2012.673	37	γ Del
STF 2727	20467+1607	265.8	9	2012.676	38	γ Del
STF 2758AB	21069+3845	151.6	31.35	2010.579	45	61 Cyg
STF 2758AB	21069+3845	151.9	31.45	2011.718	48	61 Cyg
STF 2758AB	21069+3845	152	31.4	2012.657	72	61 Cyg
STT 432	21143+4109	114.9	1.26	2012.684	39	
STT 437	21208+3227	19.5	2.48	2012.660	38	
STF 2822AB	21441+2845	312	1.8	2010.598	34	μ Cyg
STF 2822AB	21441+2845	315.2	1.69	2011.666	42	μ Cyg
STF 2822AB	21441+2845	316.1	1.69	2012.660	49	μ Cyg
STF 2863AB	22038+6438	274.9	8	2012.802	42	ξ Cep
STF 2909	22288-0001	168.1	2.21	2010.779	46	ζ Aqr
STF 2909	22288-0001	168.3	2.1	2011.805	73	ζ Aqr
STF 2909	22288-0001	166.7	2.17	2012.775	34	ζ Aqr
STF 58AC	22292+5825	191.3	40.63	2012.802	40	δ Cep
HJ 1823AC	22518+4119	337.2	81.9	2012.824	25	
HJ 1823AE	22518+4119	262.7	118.98	2012.824	22	
STF 2978	23075+3250	144.7	8.32	2012.775	39