

# Double Star Measurements with a 12-inch Newtonian Telescope, Annual Report of 2019

Joerg S. Schlimmer

64342 Seeheim-Jugenheim, Germany  
[js@epsilon-lyrae.de](mailto:js@epsilon-lyrae.de)

**Abstract:** This report shows the results on 180 double star measurements from 2019.

## Methodology

In 2019 180 double stars were measured. As in previous years, pairs with especially large magnitude differences were of interest, so the observations of 2017 and 2018 were continued (Schlimmer, 2018, 2019). Most of the listed double stars in this report were originally discovered by T.H.E.C Espin (discovery code ES), a British Astronomer and double star observer in the late 19th and early 20th centuries.

Observations in this report were done with a 12-inch Newtonian telescope in combination with a CMOS QHY5L II Color camera. Reproduction scale is about 0.52 as per pixel. In cases of separation < 3" focal length was magnified with a Barlow lens.

For each measurement a video with 100 or 200 frames were recorded. Every frame is like a single measurement, individually influenced by the current seeing conditions. Data analyses were done with RE-DUC software Version 5, which is a free analyzing

tool for double star measurements (Losse, 2016). For each frame separation and position angel will be automatically analyzed. The ELI interface (Easy Lucking Image) sorts the frames by its sharpness and looks for best correlation between them. Frames which don't fit gets automatically eliminated. Typically 30-60% of the frames remains and contributes to the result. The standard deviation of my measurements for separation is usually smaller than  $\pm 0.15''$ . The standard deviation for measurements of position angel depends on the separation of both components. For double stars with separation of about 5" the standard deviation for position angle

The following table shows the measurements of separation and position angle of 180 components from 2019. Brightness and coordinates are taken from The Washington Double Star catalog (Mason, 2017). Date is given in Besselian years. N gives the numbers of observation nights. Usually every double star will be observed only for one night (N=1).

RA+DEC	Name	MAGS	PA	SEP	DATE	N	Notes
00004+6026	STI 1248	10.37,10.78	47.7	12.36	2019.703	1	
00013+6021	STT A254AB	7.40,8.33	88.8	57.82	2019.703	1	
02011+5331	ES 6	7.99,11.3	208.2	6.00	2019.925	1	
02289+4941	ES 457	8.14,11.9	7.5	6.55	2019.925	1	
03061+7925	STF320	5.72,9.15	227.6	4.76	2019.925	1	
03543+3641	ES 2335	8.94,12.4	260.9	3.88	2019.120	1	
03546+4453	ES 563	9.96,13.6	21.7	5.82	2019.120	1	
04029+5133	ES 880	10.12,12.6	290.5	3.26	2019.120	1	
04038+3758	ES 2085	8.42,12.14	271.7	4.64	2019.120	1	
04050+3644	ES 2561	9.43,12.9	58.6	5.60	2019.120	1	
04080+1720	STT 72AB	6.10,9.71	327.3	4.83	2019.925	1	
04224+3515	ES 279	10.61,12.6	239.5	3.68	2019.120	1	
04229+4940	ES 1069	10.21,14.2	106.4	4.27	2019.120	1	
04274+4404	ES 1370AB	10.24,12.8	253.7	3.26	2019.120	1	
04388+5447	ES 885AB	9.99,13.8	155.9	4.61	2019.120	1	
04388+5447	ES 885AC	9.99,11.17	186.1	28.34	2019.120	1	
04440+4225	STF 582AB	7.64,10.19	23.6	5.56	2019.120	1	
04569+4049	ES 1716AB	10.24,12.9	140.1	5.36	2019.120	1	
04569+4049	ES 1716AC	10.24,11.75	342.6	25.29	2019.120	1	

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04038+3758	ES 2085	8.42,12.14	271.7	4.64	2019.120	1	
04050+3644	ES 2561	9.43,12.9	58.6	5.60	2019.120	1	
04080+1720	STT 72AB	6.10,9.71	327.3	4.83	2019.925	1	
04224+3515	ES 279	10.61,12.6	239.5	3.68	2019.120	1	
04229+4940	ES 1069	10.21,14.2	106.4	4.27	2019.120	1	
04274+4404	ES 1370AB	10.24,12.8	253.7	3.26	2019.120	1	
04388+5447	ES 885AB	9.99,13.8	155.9	4.61	2019.120	1	
04388+5447	ES 885AC	9.99,11.17	186.1	28.34	2019.120	1	
04440+4225	STF 582AB	7.64,10.19	23.6	5.56	2019.120	1	
04569+4049	ES 1716AB	10.24,12.9	140.1	5.36	2019.120	1	
04569+4049	ES 1716AC	10.24,11.75	342.6	25.29	2019.120	1	
04599+4319	ES 14AB,C	8.94,10.07	156.9	33.36	2019.145	1	
04599+4319	ES 14CD	10.07,12.9	283.9	4.76	2019.145	1	
05020+4349	BU 554AC	2.99,11.26	276.5	43.60	2019.145	1	
05078+4748	ES 1230	9.28,12.5	8.7	6.99	2019.145	1	
05100+4009	ES 169AB	8.24,10.5	187.5	5.23	2019.120	1	
05100+4009	SIN 118AC	8.24,13.1	314.6	20.62	2019.120	1	
05101+5339	ES 708	10.93,13.7	71.9	5.69	2019.120	1	
05166+4240	ES 573	8.14,11.42	127.1	5.66	2019.145	1	
05185+1800	J 1818	9.2,11.6	355.9	6.21	2019.145	1	
05189+1757	J 2729	10.4,11.6	359.8	6.62	2019.145	1	
05302+1144	J 243	10.02,12.3	35.9	5.22	2019.145	1	
05377+5833	A 1307	8.63,11.72	129.2	3.64	2019.150	1	
05476+5748	A 1311	9.19,13.28	174.6	2.88	2019.150	1	
05510+5622	A 1312	9.76,13.7	37.2	3.81	2019.150	1	
05511+2939	MLB 749	10.94,12.9	104.6	4.85	2019.150	1	
05549+0552	STF 816	6.90,9.27	286.6	4.00	2019.150	1	
05560+3949	ES 2153	9.93,11.96	75.3	3.66	2019.150	1	
05569+2121	HU 449AB	9.5,12.7	342.3	3.13	2019.150	1	
05584+5350	ES 895	10.16,13.4	88.1	5.60	2019.150	1	
06025+4639	ES 1322	8.04,11.5	266.8	5.73	2019.150	1	
06049+1054	J 311	9.28,11.7	91.6	4.44	2019.150	1	
06321+0458	STF 927AB	9.16,10.3	84.5	5.10	2019.150	1	
06452+3050	STF 957AB	7.45,9.40	90.5	3.60	2019.235	1	
07127+2154	COU 275AB	9.55,11.6	205.9	5.17	2019.235	1	
07218+1352	J 2472	9.4,11.8	43.9	6.17	2019.235	1	
07249+4451	ES 585	8.03,11.06	246.8	3.26	2019.235	1	
08045+1346	BRT 1245	7.83,10.97	119.1	5.47	2019.249	1	

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08148+4302	STT 189	6.87,10.73	297.6	4.66	2019.249	1	
08155+4358	BRT 98	9.61,11.73	297.6	5.41	2019.249	1	
08211+4725	HU 224AB	8.56,11.95	312.6	4.16	2019.249	1	
08356+1438	HU 857AB	9.6,12.1	223.0	4.34	2019.249	1	
08525+1957	TDS 6160	9.75,10.12	322.5	9.34	2019.249	1	
08545+1957	BRT 2394	11.1,11.4	132.1	3.47	2019.249	1	
08593+2006	BRT 2396	9.7,11.7	132.1	5.46	2019.249	1	
09013+1516	STF 1300AB	9.47,9.73	179.1	5.04	2019.249	1	
09272-0913	BU 590ABC	7.79,11.30	171.0	10.85	2019.249	1	
09438+5557	ES 1825	8.02,12.35	43.7	6.42	2019.235	1	W UMa
10050+4634	ES 1149	9.33,12.7	249.4	8.01	2019.331	1	
10052+3539	ES 2108	10.6,11.6	227.9	4.41	2019.331	1	
10086+3534	ES 180	10.26,12.3	356.6	7.55	2019.331	1	
10245+3259	ES 2222	10.15,11.4	290.7	7.68	2019.331	1	
10568+5211	STF 1488	8.17,11.2	214.4	19.97	2019.388	1	
11004+5237	ES 722	9.95,11.4	103.9	8.47	2019.388	1	
11439+4717	ES 1084	10.5,11.7	260.9	4.75	2019.419	1	
11527+5647	ES 1826	8.95,12.8	213.7	5.61	2019.388	1	
12269+2816	SMR 58	4.4,12.0	204.9	15.93	2019.408	1	
12403+4537	ES 727	8.98,12.54	7.1	6.15	2019.419	1	
12417-0127	STF 1670AB	3.48,3.53	359.0	2.84	2019.408	1	
12429+2555	ES 438	8.89,12.33	281.1	5.42	2019.419	1	
12586+3253	ES 2413	10.82,12.3	340.3	5.62	2019.419	1	
13185+3954	ES 1544	8.20,11.57	270.6	7.24	2019.388	1	
13208+3158	ES 308	11.16,11.21	113.6	7.34	2019.427	1	
13213+5321	ES 733	10.15,10.8	211.4	6.22	2019.388	1	
13221+5122	ES 734	11.1,11.4	165.7	7.03	2019.408	1	
13298+5905	ES 1790	11.75,11.62	250.7	4.94	2019.388	1	
13330+3402	ES 2414	10.5,10.5	269.2	3.10	2019.408	1	
13340+4318	ES 1549	10.3,12.2	300.7	6.98	2019.388	1	
13382+5010	ES 735	10.6,12.1	287.0	3.26	2019.419	1	
13388+1926	HJ 533	10.29,12.29	287.0	13.52	2019.501	1	
13407+1957	STF 1772AB	5.76,9.60	132.5	4.42	2019.501	1	
13547+1824	SHJ 169	2.72,9.99	84.8	115.42	2019.501	1	

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13553+3328	ES 2474	9.7,10.7	328.6	2.82	2019.427	1	
13563+3438	BU 936	9.77,12.8	96.1	4.96	2019.427	1	
13581+1928	BU 30	8.82,11.78	199.4	8.08	2019.501	1	
13598+1953	STF 1794	9.48,9.65	125.3	1.78	2019.501	1	
14018+5852	ES 1792	10.01,12.27	167.8	2.66	2019.427	1	
14135+5147	STF 1821AB	4.53,6.62	236.2	13.71	2019.427	1	
14162+5122	STFA 26AB	4.76,7.39	33.7	39.39	2019.427	1	
14252+5151	STT 580	4.10,11.46	182.5	70.16	2019.427	1	
14291+2932	HO 544	9.9,13.4	255.3	14.20	2019.501	1	
14318+3022	HJ 2728	3.58,11.5	344.3	33.42	2019.501	1	
14462+5017	ES 773	9.82,12.8	84.3	6.23	2019.427	1	
14516+3453	ALI 131	9.6,11.9	112.6	8.87	2019.501	1	
14527+0746	HLD 120AB	8.05,11.6	226.3	15.61	2019.501	1	
14533+3426	ES 311	10.22,11.2	293.7	3.70	2019.427	1	
14560+3218	STT 289	6.2,11.1	111.7	5.06	2019.501	1	
14571+3529	HJ 243	7.4,12.4	23.3	18.09	2019.501	1	
15092+3304	HJ 566	8.43,11.24	285.2	23.53	2019.501	1	
15149+5048	ES 775	10.9,11.1	220.2	6.71	2019.482	1	
15151+3318	SMR 32AB	12.76,11.21	336.0	27.17	2019.501	1	
15151+3318	SMR 32AC	12.76,12.90	71.4	37.13	2019.501	1	
15151+3318	SMR 32BC	11.21,12.90	105.6	48.05	2019.501	1	
15187+5334	ES 740	10.2,10.7	37.6	3.16	2019.482	1	
15384+5234	ES 964	10.57,10.8	218.7	5.39	2019.482	1	
15469+4736	ES 1087	10.5,12.5	173.7	6.87	2019.482	1	
15470+5337	ES 742	9.98,10.35	82.6	3.35	2019.482	1	
16185+4510	ES 1253	10.08,11.1	234.4	7.39	2019.561	1	
16392+5237	ES 968	10.21,11.4	227.3	5.58	2019.482	1	
16579+4523	ES 1254	10.85,13.9	232.6	7.04	2019.482	1	
17222+6345	ES 182	10.20,12.7	17.9	4.36	2019.561	1	
17322+5236	ES 777	8.15,12.2	348.5	5.79	2019.561	1	
17424+6501	ES 1910	9.93,10.04	54.1	5.16	2019.561	1	

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17521+4657	ES 1259	9.23,10.0	219.5	6.57	2019.561	1	
17563+5731	ES 1744	10.65,10.8	266.0	7.41	2019.563	1	
18027+5552	ES 79AB	10.72,12.9	55.8	6.26	2019.563	1	
18029+4109	ES 1648	10.6,11.9	9.4	3.70	2019.563	1	
18077+3904	ES 2018	10.13,11.15	236.1	5.74	2019.563	1	
18193+4724	ES 1158	8.74,12.2	196.7	4.91	2019.563	1	
18267+3610	ES 2173	8.48,11.9	302.9	6.20	2019.563	1	
18443+3940	STF 2382AB	5.15,6.10	346.0	2.05	2019.642	1	
18443+3940	STF 2383CD	5.25,5.38	74.7	2.33	2019.642	1	
18493+3301	ES 2287	10.9,12.3	292.0	3.82	2019.638	1	
18517+5116	ES 788	9.41,11.99	320.6	3.32	2019.638	1	
18541+5417	ES 976	10.50,11.12	278.4	5.01	2019.638	1	
18548+3611	ES 2029	10.02,11.36	205.8	4.88	2019.638	1	
18584+3554	ES 2031	10.0,11.3	38.0	5.30	2019.638	1	
19005+4313	ES 1429AB	9.70,11.1	12.1	6.14	2019.638	1	
19015+2724	AG 370	9.71,10.49	341.0	3.98	2019.638	1	
19019+2718	ES 479	9.3,10.5	141.6	8.21	2019.638	1	
19088+2825	ES 348	8.78,11.3	255.2	5.33	2019.638	1	
19169+6200	ES 1845	8.21,9.9	147.0	5.33	2019.640	1	
19197+3404	ES 2293	10.09,12.3	102.2	7.09	2019.640	1	
19252+3708	HJ 1395AB	9.48,9.54	61.6	2.54	2019.640	1	
19257+3658	ES 2179	8.98,11.5	129.5	6.87	2019.640	1	
19310+3359	ES 2295	9.40,12.4	197.6	4.05	2019.640	1	
19339+2723	ES 487	10.07,12.5	335.2	4.63	2019.640	1	
19389+4808	ES 1165	11.0,11.1	297.0	4.43	2019.640	1	
19458+3936	ES 2575	10.6,10.6	9.4	3.95	2019.662	1	
19495+4123	ES 1671	10.75,10.9	62.2	4.24	2019.662	1	
19508+0852	SMR 5AE	0.95,11.0	351.4	151.71	2019.673	1	
19510+3443	SEI 697	10.3,10.7	309.5	4.02	2019.662	1	
19520+3449	ES 2299	10.52,15.0	124.4	5.81	2019.665	1	
19522+3449	ES 2300	9.6,12.7	250.1	5.91	2019.665	1	
19546+4940	TDS 1023	11.19,11.30	356.2	2.05	2019.665	1	
19535+4939	ARG 87	10.57,10.60	271.3	14.81	2019.662	1	
19555+4049	ES 1673	9.00,12.1	199.7	4.89	2019.664	1	
19559+4912	HU 688	8.07,11.77	290.7	3.90	2019.664	1	
20007+3232	ES 2430AB	9.74,12.2	265.2	6.54	2019.665	1	
20007+3232	ES 2430AC	9.74,12.0	39.0	17.09	2019.665	1	

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20026+2859	ES 496	9.9,11.0	277.4	2.67	2019.673	1	
20051+3021	ES 497	10.15,11.8	194.0	5.60	2019.673	1	
20075+3053	ES 360	11.56,12.12	82.0	2.58	2019.714	1	
20080+3040	ES 361	9.8,11.8	118.2	4.62	2019.694	1	
20081+3926	ES 1972	10.8,11.9	146.3	4.41	2019.673	1	
20111+4131	HJ 1491	9.56,9.62	297.1	4.75	2019.665	1	
20397+5227	ES 992	9.9,11.3	166.4	7.33	2019.665	1	
20397+4734	ES 90ABC	8.48,12.0	141.3	7.09	2019.665	1	
20431+3411	ES 2310	10.53,11.0	33.3	4.10	2019.785	1	
20466+4020	ES 1982	10.64,11.30	301.4	3.90	2019.785	1	
21009+4730	BU 1290AB	10.09,10.65	34.9	9.26	2019.832	1	
21031+5519	ES 1001	10.1,10.6	31.8	3.60	2019.785	1	
21069+3845	STF 2758AB	5.20,6.05	152.9	32.04	2019.689	3	
21070+3839	ES 2059	10.11,12.7	266.7	6.99	2019.720	1	
21072+3841	MLB 1018	12.3,13.7	250.2	4.60	2019.720	1	
21074+3841	MLB 1019	12.1,13.5	246.2	5.20	2019.720	1	
21081+5046	TDT 2775	11.46,12.19	182.9	3.38	2019.832	1	
21087+5148	ES 1003	9.48,11.7	153.9	7.06	2019.785	1	
21125+5318	ES 209	10.04,12.5	239.2	4.13	2019.785	1	
21142+4930	ES 819	10.8,11.4	202.7	5.01	2019.832	1	
21161+4224	ES 1582	9.9,11.2	134.4	3.49	2019.832	1	
21260+4905	ES 821	10.84,12.0	202.6	5.05	2019.832	1	
21304+4717	ES 516	9.4,11.0	146.7	3.36	2019.832	1	
21376+3712	ES 2065	11.4,11.5	183.7	3.92	2019.832	1	
21435+5847	BU 690AB	4.27,12.3	262.5	19.52	2019.785	1	
21435+5847	BU 690AC	4.27,12.7	296.5	42.44	2019.785	1	
21435+5847	SMR 41AD	4.27,13.0	191.7	62.46	2019.785	1	
21435+5847	SMR 41AE	4.27,13.0	348.9	45.13	2019.785	1	
21435+5847	SMR 41AF	4.27,13.0	16.9	75.85	2019.785	1	
21435+5847	SMR 41AG	4.27,11.0	32.8	107.30	2019.785	1	
21492+5031	STF 2832AB	7.77,8.32	212.9	13.21	2019.832	1	
21511+5040	ES 827	11.60,11.9	241.9	3.12	2019.832	1	

*Table 1: Table of measurements*

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### Acknowledgements

This research has made use of the Washington Double Star Catalog maintained at the U.S. Naval Observatory.