Double Star Measurements at the *Internationale Amateur Sternwarte* (IAS) in Namibia in 2009

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Abstract: This paper is a continuation of earlier work published in JDSO in 2010. Using a 40-cm-Cassegrain telescope in Namibia and a fast CCD camera, 87 double and multiple systems were recorded and analyzed with the technique of "lucky imaging". Measurements are compared with literature data. Some noteworthy systems are discussed in more detail.

Introduction

During two weeks in September 2009, I used the 40-cm-Cassegrain at the *Internationale Amateur Sternwarte* (IAS) in Namibia for observing double stars in the southern sky [1]. Some measurements have already been published earlier in this Journal [2]. Results for 87 more systems obtained during this period are presented here.

The technique of "lucky imaging" for recording and measuring double stars is well known, and details have been described in earlier papers [2,3]. With "lucky imaging", seeing effects can be drastically reduced, and the resolution can be pushed to the theoretical limit of the telescope. The accuracy of position measurements can even be one order of magnitude better than this. With a 40-cm telescope, standard deviations of separation measurements of close pairs of the order of ±0.05" were obtained.

Most of the 87 investigated systems are well known, with brightness down to the range of ninth magnitude, with only a few dimmer ones. Thirty are binaries with more or less well documented orbits. However, in many cases literature data are scarce, such that estimates of residuals are somewhat ambiguous. For some systems, deviations from predicted movements could be manifested. Systems, for which sufficient and trustworthy literature data exist, are used for calibration of the image scale.

Instrumental

The nominal focal length of the 40-cm Cassegrain is 6.3 m. With my b/w-CCD camera (DMK21AF04, pixel size 5.6 µm square, *The Imaging Source*), an image scale of 0.187"/pixel was determined from measurements of reference systems, as described earlier. When using a 2x-Barlow lens, the scale was 0.0970"/pix. Almost always, a red filter was used to reduce seeing effects, as well as the chromatic aberration of the Barlow lens. Exposure times were from 0.5 µsec up to 0.1 sec, depending on the star brightness and the seeing. From recordings of some thousands of frames, I usually select the best ones by visual inspection with the program *VirtualDub*. The typical yield is about 50 to 150 frames, which are re-sampled and aligned with the program *Registax*, often with the option "manual", and finally automatically stacked.

Calibration and Measurements

As described in earlier papers, the image scale is determined by measuring a number of doubles with well known separations. All systems are suitable, for which literature data can unambiguously be extrapolated to the actual date. Main sources are the *WDS* [4], and the *4th Catalog of Interferometric Measurements of Binary Stars* [5]. Results for binaries are also compared with data from the *Sixth Catalog of Orbits of Visual Binary Stars* [6]. 22 systems were

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found suitable as reference. In the table below, these are marked with shaded lines. The scale factors cited above were essentially the same as obtained in earlier work with the 40-cm telescope, with standard deviation of about ±0.05". While the accuracy of separation measurements is constant, the contribution of the scale factor lets the total error margin increase for greater separations to up to ±1.0%. The position angle was deduced from recordings of star trails with the telescope drive switched off, so as to reveal the actual east-west-direction in the field of view. The error margin depends on the separation, and ranges from ±0.1° for wide pairs up to almost ±4° for close ones near the resolution limit. All measurements are listed in Table 1, and the scatter of the residuals is illustrated in Figures 1 and 2 (see below).

Comments

Most of the 87 systems presented here are fairly bright and easily accessible with not too small telescopes, which also means suitable for "lucky imaging". Nevertheless, many of them can be deemed as "neglected", as there are only few data in the literature. More attention is generally paid to binaries with not too long periods, for obvious reasons. Twenty-two systems were found, for which extrapolations of literature data of separations appear sufficiently accurate, such that they can be taken for reference. The standard deviation of the resulting residuals of about ±0.05", calculated versus the thus determined calibration constant, contains both contributions from errors of own measurements, as well as of literature data, as is the case for the residuals of all other pairs. As was already mentioned above, the total, absolute error margin increases with separation, due to the contribution of the calibration factor with constant relative error of ±1.0 %. Some pairs were found noteworthy, be it because of large residuals, which are marked in Figure 2, or for other reasons.

- The pair ε Sculptoris (HJ3461 AB, #12) seems to be physical. A "premature" orbit has been published in 1974, but positions strongly deviate, in accordance with the trend of literature data.

- The multiple θ^1 Orionis, the trapezium (STF 748, #30), although prominent, has not often been measured. Literature data of separations, both visual and speckle, exhibit large scatter and residuals are somewhat ambiguous. In contrast, residuals for P.A. are all within the error limits.

(Continued on page 23)

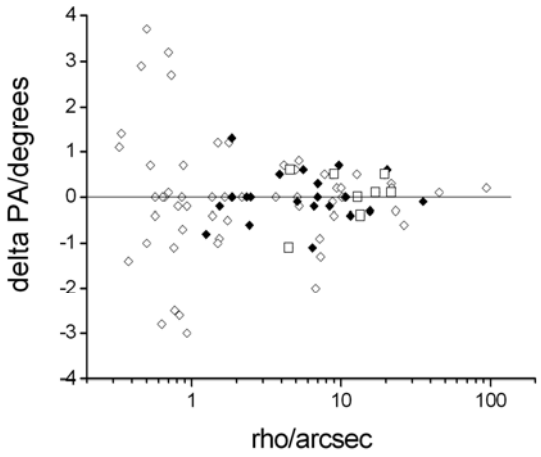

Figure 1: Plot of the residuals of the position angle versus separation rho. Note semi-logarithmic scaling. Full rhombs indicate 22 pairs used for calibration, open rhombs all others. Open squares refer to the system θ^1 Orionis, the "trapezium". The increase of scatter towards small separations is due to the fixed image resolution. The standard deviation for only the calibration systems is ±0.53°.

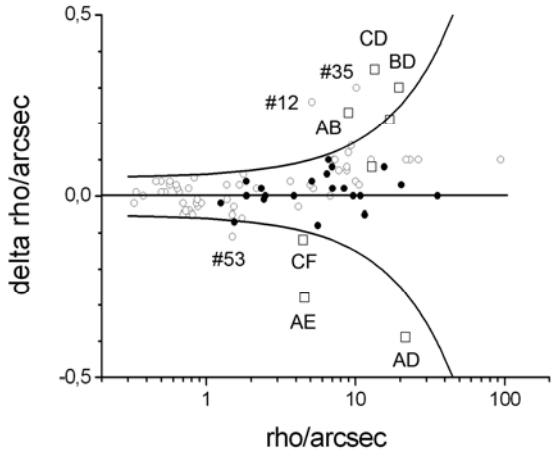

Figure 2: Plot of the residuals delta rho versus rho. Note semi-logarithmic scaling. Full circles indicate pairs used for calibration, open circles all others. Three of them with residuals exceeding the error limits are marked with their note numbers. Open squares refer to the system θ^1 Orionis, the trapezium. The standard deviation for only the calibration systems is ±0.047" with range between –0.08" and +0.10". The curves indicate the total, absolute error margins.

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Table 1: List of measurements. Systems used for calibration are marked with shaded lines. System names, positions and magnitudes are taken from the WDS. The two columns before the last one show the differences delta of measured position angles (P.A.) and separations (rho) minus reference data. For several pairs, no residuals are given because of insufficient reference data. N is the number of measurements at different nights, or with different camera settings or filters. Individual notes are following the table. Asterisks denote systems of which images are shown in the figures.

PAIR	RA + DEC	MAGS	P.A. meas.	rho meas.	DATE	N	delta P.A.	delta rho	NOTES
BU 391AB	00 09.4 -27 59	6.13 6.24	258.5	1.38	2009.712	3	-0.4	-0.01	1
BU 395	00 37.3 -24 46	6.60 6.20	95.6	0.50	2009.708	3	+3.7	+0.04	2
HDO 182	00 42.7 -38 28	6.60 7.01	20.6	0.70	2009.706	2	+0.1	-0.02	3
DUN 2	00 52.4 -69 30	6.70 7.35	81.6	20.41	2009.714	1	+0.6	+0.03	4
HJ 3416AB	01 03.3 -60 06	7.58 7.67	129.2	5.11	2009.720	2	-0.1	+0.04	5
RST1205AB	01 08.4 -55 15	4.02 6.80	110.0	0.57	2009.722	1	-0.4	+0.03	6
RMK 2AB-C		4.00 8.23	239.4	6.78	2009.722	1	-2.0	~0	
BU 1229	01 19.3 -34 29	8.51 8.74	275.6	0.76	2009.710	1	-1.1	+0.02	7
STF 113A-BC	01 19.8 -00 31	6.45 6.99	19.5	1.67	2009.726	1	~0	+0.03	8
HJ 2036	01 20.0 -15 49	7.40 7.61	339.5	2.34	2009.726	1	~0	+0.02	9
HJ 3447	01 36.1 -29 54	5.97 7.35	183.0	0.77	2009.709	2	-2.5	-0.04	10
DUN 5	01 39.8 -56 12	5.78 5.90	188.0	11.60	2009.714	2	-0.4	-0.05	11
HJ 3461AB	01 45.6 -25 03	5.38 8.50	20.4	5.10	2009.707	2	~0	+0.26	12
HJ 3475	01 55.3 -60 19	7.18 7.23	77.4	2.49	2009.726	1	~0	~0	13
STF 186	01 55.9 +01 51	6.79 6.84	66.5	0.81	2009.706	2	-0.2	-0.05	14*
H 2 58	01 59.0 -22 55	7.28 7.56	302.5	8.77	2009.726	1	+0.5	+0.07	15
BU 738	02 23.2 -29 52	7.60 7.97	213.4	1.86	2009.708	1	+1.3	+0.04	16
HJ 3506	02 33.8 -28 14	4.95 7.71	245.0	10.80	2009.718	1	~0	~0	17
BU 741AB	02 57.2 -24 58	8.06 8.20	342.9	0.88	2009.707	1	+0.7	-0.03	18*
S 723AC		8.06 7.68	225.6	29.34	2009.707	1	-	-	
HJ 3555	03 12.1 -28 59	3.98 7.19	299.7	5.24	2009.708	1	-0.2	+0.02	19
DUN 15	03 39.8 -40 22	6.93 7.72	328.6	7.78	2009.723	1	+0.5	+0.07	20
DUN 16	03 48.6 -37 37	4.72 5.25	216.2	8.39	2009.723	1	-0.2	+0.02	21
STF 470AB	03 54.3 -02 57	4.80 5.89	349.0	6.98	2009.721	4	+0.3	+0.08	22*
BU 184	04 27.9 -21 30	7.40 7.70	248.3	1.87	2009.726	1	~0	~0	23
HJ 3683	04 40.3 -58 57	7.33 7.45	89.7	3.66	2009.726	1	~0	+0.04	24
STF 590	04 43.6 -08 48	6.74 6.78	318.2	9.38	2009.721	1	+0.2	+0.14	25
DUN 18AB	04 50.9 -53 28	5.61 6.24	58.5	12.80	2009.726	1	+0.5	+0.1	26
STT 98	05 07.9 +08 30	5.76 6.67	300.4	0.86	2009.710	1	~0	-0.02	27
STT 517AB	05 13.5 +01 58	6.79 6.99	241.0	0.66	2009.710	1	~0	+0.01	28*
STF 728	05 30.8 +05 57	4.44 5.75	44.1	1.25	2009.710	1	-0.8	-0.02	29

Table continued on next page.

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PAIR	RA + DEC	MAGS	P.A. meas.	rho meas.	DATE	N	delta P.A.	delta rho	NOTES
STF 748AB	05 35.3 -05 23	6.55 7.49	31.5	9.01	2009.710	1	+0.5	+0.23	30
STF 748AC		6.55 5.06	132.0	12.28	2009.710	1	~0	+0.08	
STF 748AD		6.55 6.38	96.1	21.79	2009.710	1	+0.1	-0.39	
STF 748AE		6.55 11.1	350.6	4.58	2009.710	1	+0.6	-0.28	
STF 748BC		7.49 5.06	163.1	17.11	2009.710	1	+0.1	+0.21	
STF 748BD		7.49 6.38	120.5	19.70	2009.710	1	+0.5	+0.30	
STF 748CD		5.06 6.38	61.6	13.55	2009.710	1	-0.4	+0.35	
STF 748CF		5.06 11.5	119.9	4.48	2009.710	1	-1.1	-0.12	
AGC 1AB	06 45.1 -16 43	-1.46 8.5	90.0	8.78	2009.721	2	-0.1	-0.19	31
I 10AB	08 44.7 -54 43	1.99 5.57	302.3	0.57	2009.716	2	~0	+0.04	32
RHD 1AB	14 39.6 -60 50	0.14 1.24	244.2	7.02	2009.714	1	+0.3	+0.02	33
SHJ 243AB	17 15.3 -26 36	5.12 5.12	143.4	4.98	2009.718	1	+0.6	+0.03	34
BSO 13AB	17 19.1 -46 38	5.61 8.88	255.7	10.19	2009.701	2	~0	+0.30	35
STF2262AB	18 03.1 -08 11	5.27 5.86	284.8	1.54	2009.718	1	-0.2	-0.07	36
STF2272AB	18 05.5 +02 30	4.22 6.17	132.3	5.60	2009.718	1	+0.6	-0.08	37
H 5014	18 06.8 -43 25	5.65 5.68	3.5	1.78	2009.709	3	+1.2	+0.06	38
DUN 222	18 33.4 -38 44	5.58 6.16	358.7	21.73	2009.710	2	+0.3	-	39
BSO 14AB	19 01.1 -37 04	6.33 6.58	280.2	13.05	2009.710	1	-	-	40
HJ 5075	19 04.1 -63 47	7.68 7.69	112.5	1.74	2009.721	1	-0.5	-0.06	41
HJ 5084	19 06.4 -37 04	4.53 6.42	13.3	1.37	2009.708	3	~0	+0.03	42
GLE 3	19 17.2 -66 40	6.12 6.42	343.4	0.53	2009.716	2	+0.7	+0.01	43
DUN 226	19 22.6 -44 28	3.98 7.21	76.0	28.7	2009.714	1	-	-	44
SCJ 22	19 28.2 -12 09	8.12 8.69	275.0	0.93	2009.705	1	-3.0	-0.02	45
S 722	19 39.2 -16 54	7.17 7.45	235.9	10.02	2009.714	1	+0.2	+0.04	46
HJ 599AB	19 40.7 -16 18	5.31 12.6	279.2	45.2	2009.714	1	-	-	47*
HJ 599AC		5.42 7.65	41.6	45.6	2009.714	1	-	-	
DUN 227	19 52.6 -54 58	5.80 6.39	147.9	23.28	2009.721	1	-0.3	+0.10	48
STF2594	19 54.6 -08 14	5.65 6.35	170.2	35.55	2009.718	1	-0.1	~0	49
HDO 295	20 11.1 -57 31	6.76 7.68	283.5	0.46	2009.721	1	+2.9	+0.04	50
RMK 25	20 14.9 -56 59	7.97 8.02	28.1	7.23	2009.721	1	-0.9	+0.1	51
DUN 230	20 17.8 -40 11	7.42 7.72	117.7	9.69	2009.714	1	+0.7	~0	52
SHJ 323 AB	20 28.9 -17 49	4.97 6.88	191.3	1.50	2009.705	4	+1.2	-0.11	53
SHJ 324	20 29.9 -18 35	5.91 6.68	238.2	21.89	2009.718	1	+0.2	+0.10	54

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PAIR	RA + DEC	MAGS	P.A. meas.	rho meas.	DATE	N	delta P.A.	delta rho	NOTES
HU 200AB	20 39.3 -14 57	5.38 7.31	121.6	0.34	2009.710	1	+1.4	+0.01	55
S 763AB	20 48.4 -18 12	7.24 7.79	293.5	15.64	2009.718	1	-0.3	+0.08	56
STF2729AB	20 51.4 -05 38	6.40 7.43	23.8	0.83	2009.697	1	-2.6	+0.05	57
RMK 26	20 51.6 -62 26	6.23 6.58	80.6	2.44	2009.720	2	-0.6	-0.01	58
HJ 3003	20 53.0 -23 47	6.57 8.57	194.4	1.53	2009.710	1	-0.9	-0.03	59
H 1 47	21 12.4 -15 00	8.25 8.31	309.8	4.15	2009.718	1	+0.7	-0.03	60
HJ 5258	21 19.9 -53 27	4.50 6.93	269.5	7.32	2009.721	4	-1.3	+0.1	61*
BU 252	21 20.0 -27 18	8.75 8.84	88.1	2.17	2009.708	1	~0	+0.02	62
BU 766AB	21 24.4 -41 00	6.24 6.88	197 ?	0.18?	2009.723	1	-3.0	-0.02	63
BU 1212AB	21 39.5 -00 03	6.94 8.44	286.1	0.50	2009.697	1	-1.0	+0.01	64
HDO 296AB	21 55.2 -61 53	6.6 6.8	106.4	0.33	2009.724	2	+1.1	-0.02	65
BU 276	22 00.8 -28 27	5.70 6.77	112.6	1.86	2009.710	1	~0	~0	66
H N 56AB	22 14.3 -21 04	5.63 6.72	112.2	5.23	2009.720	8	+0.8	-	67
I 20	22 18.0 -62 49	7.36 8.42	187.8	0.64	2009.721	1	~0	+0.02	68
BU 172AB	22 24.1 -04 50	6.45 6.63	38.7	0.38	2009.705	1	-1.4	~0	69*
PZ 7AC	22 31.5 -32 21	4.28 7.12	172.1	30.6	2009.713	3	-	-	70
DUN 241	22 36.6 -31 40	5.93 7.55	31.6	93.9	2009.714	1	+0.2	+0.10	71
BU 773	23 06.9 -38 54	5.70 8.24	205.0	0.93	2009.710	1	-0.2	-0.02	72
JC 20AB	23 06.9 -43 31	4.45 6.60	113.9	1.50	2009.707	2	-1.0	-0.05	73
DUN 246	23 07.2 -50 41	6.29 7.05	253.9	8.99	2009.703	1	-0.4	+0.12	74
HU 295	23 22.7 -15 02	5.59 6.72	281.5	0.35	2009.704	3	-0.4	+0.02	75
STF3008	23 23.8 -08 28	7.21 7.67	149.3	6.60	2009.726	1	-0.2	+0.10	76
DUN 249	23 23.9 -53 49	6.14 7.07	211.4	26.5	2009.714	1	-0.6	+0.10	77
I 23	23 28.2 -56 26	7.58 8.91	353.6	0.68	2009.694	1	-0.4	-0.12	78
B 1900	23 33.3 -20 55	4.76 7.68	127.8	0.96	2009.726	1	-	-	79
I 25	23 35.3 -57 30	8.45 8.43	25.0	0.70	2009.694	1	+3.2	-0.05	80*
SEE 492	23 35.7 -27 29	6.84 9.18	17.2	0.63	2009.694	1	-2.8	+0.03	81*
DUN 251	23 39.5 -46 38	6.53 7.27	277.6	3.88	2009.694	1	+0.5	~0	82
HU 1550	23 41.5 -41 35	8.45 8.71	194.6	0.73	2009.694	1	+2.7	-0.04	83
H 2 24	23 46.0 -18 41	5.65 6.46	135.7	6.98	2009.714	1	~0	+0.08	84
SLR 14	23 50.6 -51 42	8.28 8.59	72.8	0.87	2009.708	4	-0.7	-0.01	85*
LAL 192	23 54.4 -27 03	6.79 7.41	268.9	6.44	2009.718	1	-1.1	+0.06	86
LAL 193	23 59.5 -26 31	8.05 8.30	169.5	10.63	2009.718	1	~0	+0.03	87

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Notes:

Terms "cpm" (common proper motion) and "relfix" (relatively fixed) refer to Burnham [7].

1. κ Sculptoris, PA decreasing.
2. in Cetus, binary, P=25y.
3. λ Sculptoris, PA increasing.
4. in Tucana, although only few data, extrapolation seems fairly trustworthy, PA slowly increasing, rho slowly decreasing.
5. in Tucana, although deemed relfix, rho is slowly increasing.
6. ζ Phoenicis, AB binary, P=210y, PA fast inc. Few data for AC.
7. in Sculptor, probably binary, PA and rho dec.
8. 42 Ceti, PA inc.
9. in Cetus, probably binary, PA dec, rho inc.
10. τ Sculptoris, binary, P=1876y.
11. p Eridani, binary, P=484y.
12. ε Sculptoris, binary, a "premature" orbit has been calculated in 1969, few data. While PA close to ephemeris, and decreasing, rho deviates markedly.
13. in Hydrus, few data, but small scatter, PA inc.
14. in Cetus, binary, P=162y, many speckle data, see Figure 3.
15. in Cetus, few data, but relatively small scatter, PA dec, rho inc.
16. in Fornax, binary, P=305y, orbit highly inclined.
17. ω Fornacis, relfix, cpm.
18. in Fornax, AB binary, P=137y, orbit highly inclined, newly computed in 2010. Few data for AC, no residuals given. PA and rho inc. See also Figure 4.
19. α Fornacis, binary, P=314y, orbit highly inclined, few data.
20. in Eridanus, few data.
21. f Eridani, few data, but small scatter, PA and rho inc.
22. 32 Eridani, rho fairly constant, nice color contrast, see Figure 6.
23. in Eridanus, PA slow dec, rho inc.
24. in Dorado, binary, P=240y, residuals given versus recently revised ephemeris, orbit highly inclined.

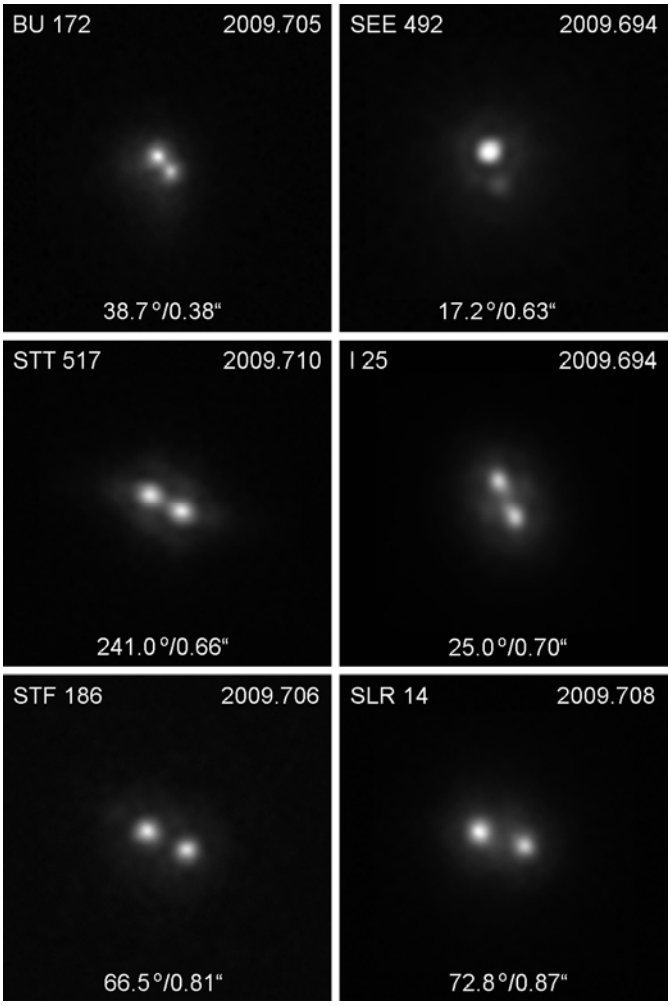

Figure 3: Some sub-arcsecond doubles. Except for I 25, the physical nature of the others is well documented with orbit calculations. See also notes # 69, 81, 28, 80, 14, and 85 (in rows from top to bottom).

25. 55 Eridani, cpm, while deemed relfix, large scatter of rho data, residuals given versus average of last entries in speckle catalog of 1991 and 2004, PA inc.
26. ι Pictoris, few data with large scatter, rho inc?
27. 14 Orionis, binary, P=199y, many speckle data.
28. in Orion, binary, P=312y, many speckle data, see Fig. 3.
29. 32 Orionis, binary, P=586y, many speckle data.
30. θ^1 Orionis, "trapezium", relatively large differences of mainly rho measurements compared

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with last entries in the speckle catalog from 2002 to 2008, reason unknown.

31. α Canis Majoris, "Sirius", binary, P=50.1y, residuals vs. ephemeris.
32. δ Velorum, binary, P=142y, difficult, because dim companion on diffraction ring, residuals vs. ephemeris.
33. α Centauri, binary, P=79.9y, residuals vs. ephemeris.
34. 36 Ophiuchi, binary, "premature" orbit, P=550y.
35. in Ara, also known as L7194, binary, P=693y, few data, recent measurements tend to deviate from calculated orbit.
36. τ Ophiuchi, binary, P=280y, many speckle data, residuals given vs. trend.
37. 70 Ophiuchi, binary, P=88.3y, many speckle data with small scatter.
38. in Corona Australis, binary, P=191y, residuals vs. ephemeris.
39. κ Coronae Australis, relfix, few data with large scatter, residual of rho ambiguous.
40. in Corona Australis, large scatter of literature data, no residuals given.
41. in Pavo, few data.
42. γ Coronae Australis, binary, P=122y, PA dec.
43. in Pavo, binary, P=157y.
44. β Sagittarii, large scatter of literature data.
45. in Sagittarius, also know as BU 142, binary, P=162y, many speckle data with relatively small scatter. Residuals given vs. speckle data of about the same epoch.
46. in Sagittarius, few data with large scatter.
47. 54 Sagittarii, no recent literature data of AB, large scatter of data for AC, no residuals given. Dim companion of about 13th magnitude at 252.3 °/56.8" not listed in the WDS. See Figure 5.
48. in Telescopium, cpm, few data, PA dec, rho slow inc.
49. 57 Aquilae, relfix.
50. in Pavo.
51. in Pavo.
52. in Sagittarius, PA inc, rho almost fixed.
53. rho Capricorni, binary, P=278y, orbit highly inclined, own measurements, as well as literature data seem to deviate from ephemeris,

Figure 4: The triple system BU 741 AB/S 723 AC in Fornax. The pair AB is a physical binary with period 137 y. See also note 18.

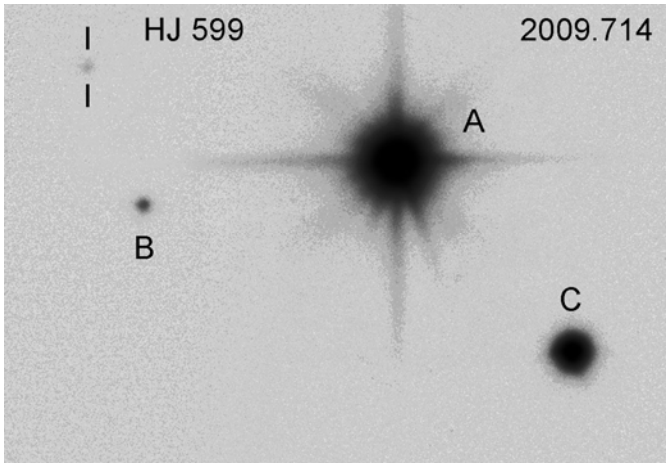

Figure 5: The multiple HJ 599 or 54 Sagittarii. The seeing allowed for 2 sec exposure, superposition of 40 frames. The dim companion at upper left, which is marked with black lines, is not listed in the WDS. See also note 47.

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residuals given vs. ephemeris.

54. ο Capricorni.
55. τ Capricorni, binary, P=200y, peculiar scatter of literature (speckle) data, residuals given vs. ephemeris.
56. in Capricornus, relfix.
57. 4 Aquarii, binary, P=187y, recent rho data seem to deviate from ephemeris, residuals given vs. ephemeris.
58. in Pavo, also known as L8550, cpm, PA dec.
59. in Capricornus, PA fast, rho slowly dec.
60. in Capricornus, probably binary, ephemeris questionable, residuals vs. speckle data from 2009.
61. θ Indi, cpm, PA slow dec?, rho fast inc, nice color contrast, see Fig.6.
62. in Capricornus, PA and rho dec..
63. in Microscopium, not resolved here, but elongated, PA and rho estimated, both are decreasing, residuals vs. trend of literature data, last entry in speckle catalog from 1999.
64. 24 Aquarii, binary, P=49y, many speckle data with small scatter.
65. in Indus, binary, P=27.5y, orbit highly inclined, few data.
66. η Piscis Austrini, relfix, PA dec.
67. 41 Aquarii, few data with large scatter, especially for rho, PA dec, color contrast.
68. in Tucana, binary, P=983y, PA decreasing, rho slowly inc, residuals estimated vs. trend.
69. 51 Aquarii, binary, P=146y, residuals vs. speckle data from 2009.
70. β Piscis Austrinus, cpm, relfix, few data with large scatter, no residuals given.
71. in Piscis Austrinus, optical, few data, rho seems to linearly increase.
72. υ Gruis, few data, PA and rho decreasing, some earlier speckle data show peculiar scatter, residuals vs. trend.
73. θ Gruis, cpm, both PA and rho seem to linearly increase.
74. in Grus, PA slowly decreasing, rho inc.
75. 97 Aquarii, binary, P=63y, residuals vs. ephemeris.
76. in Aquarius, optical, residuals vs. rectilinear extrapolation.
77. in Grus, few data.
78. in Phoenix, PA inc, few data.
79. in Aquarius, few data with large scatter, no residuals given.
80. in Phoenix, PA dec.
81. in Sculptor, binary, P=78y, difficult, because dim companion is close to diffraction ring of main star, not resolved with speckle interferometry in 2008, PA fast inc.
82. θ Phoenicis, PA increasing, rho slowly decreasing?
83. in Phoenix, few data with large scatter, PA and rho increasing?
84. 107 Aquarii, rho slow inc?
85. in Phoenix, binary, P=117y, PA fast dec, rho fast inc.

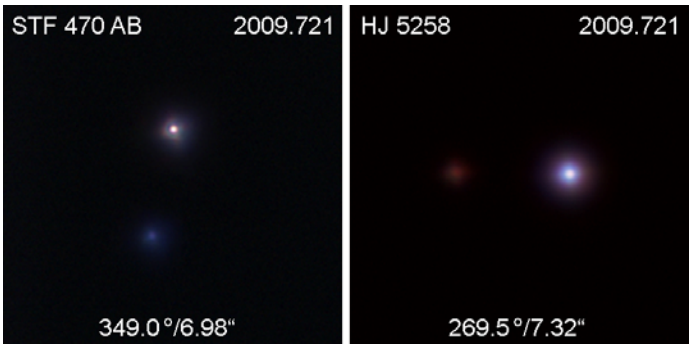

Figure 6: Two colorful doubles: Left: 32 Eridanis, spectra are G8III and A2V. Description of colors in the literature range from grapefruit-orange and silvery-blue to topaz-yellow and sea green. Right: theta Indi. A not so frequent case of a red companion to a main sequence star. Spectral class of the latter is A5V, that of the companion is not listed. Colors are described in the literature as light-yellow and reddish-brown. See also notes 22 and 61.

86. ϕ Sculptoris, also known as DUN 253, relfix.
87. also known as Arg 46, few data, PA and rho slowly dec.

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(Continued from page 16)

- For the binary BSO 13/L 7194 in Ara (#35), with period of about 700 years, only few data are available in the literature. Recent measurements of the separation tend to deviate from the ephemeris from 1957.

- The binary rho Capricorni (SHJ 323 AB, #53) exhibits a highly inclined orbit. Both own measurements and literature data tend to deviate from the currently assumed ephemeris.

- The close pair 4 Aquarii (STF 2729 AB, #57) is a binary with period 187 years. Separation measures tend to be greater than expected from the ephemeris by about 0.05", in accordance with literature data.

- Residuals for the pair H I 47 in Capricornus (#60) are within the error limits, when referred to recent speckle data, but strongly deviate from the ephemeris published in 1974. With an estimated period of more than 4000 years, this seems to be in error.

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