Divinus Lux Observatory Bulletin: Report #1

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Abstract: This report contains theta/rho measurements from 94 different double star systems. The time period spans from 2004.508 to 2004.579. All measurements were obtained using a 20-cm Schmidt-Cassegrain telescope and an illuminated reticle micrometer. This report represents a portion of the work that is currently being conducted in double star astronomy at Divinus Lux Observatory in Flagstaff, Arizona.

The selected double star systems, which appear in this report, have been taken from the 2001.0 version of the Washington Double Star Catalog, with published measurements that are no more recent than ten years ago. Various items of significance are discussed in the following paragraphs, such as large theta/rho shifts, possible newly discovered components, and possible discrepancies in the WDS catalog.

First of all, several theta/rho shifts have been noted, because of proper motion, by either one or both of the components of certain double stars. Bu 1286 AB and AG 379 are cases in point. For Bu 1286 AB, proper motion by the "A" component has caused the position angle to decrease by almost 3 degrees, and the separation to increase by 11.5%, since 1991. Regarding AG 379, a large proper motion by the companion star has caused a decrease of 4 degrees, in position angle, since 1991.

Large proper motions by the reference point stars in STF 2708 AB and ENG 76 have also caused theta/rho shifts in these double stars. As a consequence, a separation increase of 2.6% seems to have occurred, since 1994, for STF 2708AB. More drastic shifts are noted for ENG 76, since the separation has decreased by 16.5% and the position angle has decreased by almost 9 degrees, since 1956.

In a like manner, proper motions by reference point stars have caused shifts in AG 415, HLM 39, AG 416, and HJ 280. For AG 415, a position angle increase of 3 degrees has been recorded as having occurred since 1991. HLM 39 has shown a separation increase of approximately 3.4% since 1991. In AG 416, a position angle decrease of 3.5 degrees appears to have occurred since 1991. In the case of HJ 280, the position angle has increased by almost 2 degrees, and the separation by about 2.4%, since 1991.

Significant increases in one position angle and two separations are also noted for ARG 39 AB and AGC 13 AB-D. In the ARG 39 AB system, these increases amount to over 2 degrees in p.a. and 17% in separation, since 1994, because of a large proper motion by the "B" component. For AGC 13 AB-D, a large proper motion by "AB," relative to "D," has caused the separation to increase by 35 seconds, since 1924, which equates to a 21 % shift. The position angle has decreased by 2 degrees during this time period.

Two double stars that appear in the table, which contain components with proper motions in opposite directions, are HJ 1523 and ARG 38 AB. As a consequence of this, HJ 1523 has shown a position angle decrease of almost two degrees, while ARG 38 AB has had a three degrees position angle increase, since 1991. The divergent proper motions reveal that both of these pairs are, obviously, optical doubles.

Also listed in the table are some measurements of common proper motion double stars that do not appear to have been previously cataloged. One such pair, labeled as ARN 76 (19291+4615), is located near AW Cygni. Secondly, measurements that contain a new "D" component, in the HJ 1539 star system, appear in the table as ARN 77 BD (20333+4119). While the "B" and "D" components might form a common proper motion pair, additional time will be needed in order to make a more definitive determination. A third common proper motion pair, which does not appear to have been previously cataloged, is listed as ARN 78

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(21314+4829). This double star is located in the M 39 open cluster.

Another double star listing in this report, which does not appear in the WDS catalog, pertains to HDS 2761 AC (19265-1308). Although the catalog has a listing for HDS 2761, this item actually has mixed measurements for both AB and AC. Appearing in the first set of columns in the catalog are measurements for AB, while the second set of columns contain measurements that refer to AC. This article has only reported on measurements for AC because I was unable to see the "B" component well enough to extract measurements with my instrumentation. However, the Guide 8 CD-ROM star chart, which is based upon the Hipparcos/Tycho catalogs, clearly shows all three components in the manner described above.

A position angle measurement that is listed in the WDS catalog, which may not be accurate, appears in reference to STF 2667. The 1994 position angle measurement is recorded with a value of 229 degrees for this relatively fixed, common proper motion pair. However, the 1821 catalog value, the Hipparcos Catalog value, and my measurements give listings of 225 degrees, 224.1 degrees, and 223.9 degrees respectively. Since these three position angle measurements are clustered rather close together, and because the position angle appears to be slightly decreasing, the 1994 catalog value seems to be anomalous.

A similar situation seems to exist with the separation measurements for STF 2718 AB. The 1831 WDS catalog value, the Hipparcos Catalog value, and my measurements are clustered around a separation figure of 8.3 to 8.4 arc seconds. The 1994 catalog value is approximately 10% removed from this cluster of values, being listed at 9.4 arc seconds. Based upon the proper motions of this pair of stars, STF 2718 AB should probably appear to be relatively fixed, and hence, would not display a 10% separation shift in such a short period of time.

Finally, the 1991 WDS catalog position angle value for HJ 1681 appears to have had a 180 degrees reversal because of a quadrant flip. Based upon p.a. values in the Hipparcos Catalog, in the WDS catalog for 1902, and my measurements, the position angle measurement for 1991 should be listed as 108 degrees instead of 288 degrees. This conclusion is reached with the assumption that the brighter component would be considered as the reference point star.

NAME	RA DEC	MAGS	PA	SEP	DATE	N	NOTES
BU 1286 AB	19260+3555	9.3 10.5	46.2	20.74	2004.508	1n	1
HDS2761 AC#	19265-1308	9.7 10.3	121.5	11.85	2004.508	1n	2
AG 379	19274+1359	9.5 10.4	87.1	12.84	2004.511	1n	3
ARN 76 #	19291+4615	9.8 10.3	248.8	45.43	2004.511	1n	4
STF2631	20072+2106	8.0 9.1	337.5	4.44	2004.546	1n	5
S 737	20099+2100	7.8 9.2	129.5	100.73	2004.544	1n	6
STF2637 AB	20099+2055	6.5 8.8	329.9	11.85	2004.544	1n	7
STF2637 AC	20099+2055	6.5 7.4	222.2	88.88	2004.544	1n	7
STF2658 AC	20136+5307	7.1 10.3	205.7	61.23	2004.541	1n	8
CHE 221	20139+1441	9.9 10.3	6.9	17.78	2004.527	1n	9
SEI1028	20140+3633	9.3 10.5	177.5	13.33	2004.525	1n	10
ES 2047 AB	20146+3855	9.5 10.3	175.6	34.56	2004.525	1n	11
STF2659 AB-D	20157+4339	8.6 9.3	253.1	19.26	2004.525	1n	12
SMA 115	20160+3403	9.9 10.3	188.9	18.76	2004.525	1n	13
ES 2693 AB	20190+4938	8.8 9.6	109.7	30.61	2004.525	1n	19
AG 253 AB	20193+3635	9.3 9.7	116.9	9.38	2004.525	1n	20
STF2669 AB	20194+5607	9.2 9.9	259.0	23.70	2004.525	1n	21

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NAME	RA DEC	MAGS	PA	SEP	DATE	N	NOTES
ES 800 AB	20200+5116	8.9 10.5	320.5	29.63	2004.525	1n	22
ES 800 AE	20200+5116	8.9 9.5	96.1	115.54	2004.525	1n	22
BLL 50	20214+3656	9.2 9.7	109.7	125.41	2004.525	1n	23
STF2670 AB	20222+1623	8.8 9.2	153.7	29.63	2004.527	1n	24
ARG 38 AB	20224-2014	9.5 10.2	292.9	17.78	2004.527	1n	25
A 289 AC	20229+4243	8.7 10.4	351.2	70.11	2004.525	1n	26
ARG 91	20234+3053	8.6 9.5	176.0	20.74	2004.527	1n	27
SEI1116	20242+3819	9.1 10.0	341.4	30.61	2004.527	1n	28
STF2680	20248+1452	9.2 9.4	288.1	16.29	2004.527	1n	29
HJ 1509	20250+1016	9.8 9.9	180.0	18.76	2004.527	1n	30
AG 405	20276+2803	9.1 9.9	69.1	23.70	2004.527	1n	31
HJ 1523	20295+4100	9.2 9.8	342.3	12.34	2004.527	1n	32
HJ 1525 AB	20299+4022	9.1 9.5	234.1	8.89	2004.527	1n	33
AG 407	20302+4343	9.9 10.1	230.8	6.91	2004.527	1n	34
HJ 1526 A-BC	20307+3521	9.0 9.2	148.9	8.89	2004.527	1n	35
HJ 1530	20317+4143	9.8 10.5	242.0	16.29	2004.527	1n	36
ES 507 AC	20331+2852	8.7 9.8	344.5	35.55	2004.527	1n	37
ES 507 AD	20331+2852	8.7 10.4	224.2	36.54	2004.527	1n	37
HJ 609	20332+4028	8.8 9.2	320.5	26.65	2004.546	1n	38
SEI1162	20332+3324	8.8 10.3	90.9	20.74	2004.527	1n	39
HJ 1539 AB	20333+4119	9.1 10.7	203.1	9.38	2004.541	1n	40
ARN 77 AD#	20333+4119	9.1 10.0	120.6	38.02	2004.541	1n	40
ARN 77 BD#	20333+4119	10.7 10.0##	106.3	37.53	2004.541	1n	40
AG 409	20339+4034	9.4 9.9	267.2	9.88	2004.541	1n	41
HJ 1534	20350+3323	9.3 9.7	26.0	16.79	2004.541	1n	42
STF2708 AB	20387+3838	6.8 8.6	323.0	53.33	2004.541	1n	43
STT 410 AB-C	20396+4035	6.7 8.7	68.7	68.14	2004.541	1n	44
STT 410 AB-D	20396+4035	6.7 10.0	326.1	106.65	2004.541	1n	44
SEI1224	20423+3637	9.7 10.3	160.9	24.69	2004.541	1n	45
ARG 39 AB	20425+4916	8.3 8.8	178.8	14.32	2004.546	1n	46
STF2718 AB	20426+1244	8.2 8.3	87.5	8.40	2004.541	1n	47
STF2718 AC	20426+1244	8.2 8.8	347.3	167.88	2004.541	1n	47

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NAME	RA DEC	MAGS	PA	SEP	DATE	N	NOTES
ES 2699	20433+4456	8.6 9.5	296.8	40.49	2004.541	1n	48
AG 410	20448+3022	10.0 10.4	185.4	18.76	2004.544	1n	49
ENG 76	20454+5735	4.5 9.9	146.3	48.39	2004.544	1n	50
STT 428	21090+0643	8.4 9.9	256.0	24.69	2004.563	1n	51
AG 415	21140+1106	10.0 10.5	20.9	15.80	2004.563	1n	52
STF2779 AB	21144+2905	9.6 9.8	166.9	15.31	2004.563	1n	53
STF2775 AB-C	21147-0050	7.5 10.3	177.9	21.73	2004.563	1n	54
AGC 13 AB-D	21148+3803	3.7 9.9	208.2	205.40	2004.546	1n	55
HJ 1629	21155+4637	9.7 10.2	70.8	12.34	2004.563	1n	56
HJ 1634	21183+4244	9.1 9.4	142.3	28.64	2004.549	1n	57
STF2790 Aa-D	21193+5837	5.7 10.0	352.1	75.05	2004.549	1n	58
HLM 39	21199+5841	9.8 10.5	62.7	17.78	2004.563	1n	59
AG 416	21206+1537	9.5 10.4	354.4	23.70	2004.566	1n	60
HJ 280	21214-1219	8.6 9.4	209.7	47.40	2004.566	1n	61
BLL 54	21260+4144	8.7 10.1	295.5	80.98	2004.549	1n	62
STF2800	21287+4952	9.5 10.4	254.0	8.89	2004.563	1n	63
ARN 78 #	21314+4829	7.6 8.8	99.4	49.78	2004.563	1n	64
SCJ 29	21317-1330	9.1 10.0	291.8	58.26	2004.566	1n	65
HJ 1659	21328+5839	8.5 9.6	287.0	8.40	2004.566	1n	66
HDS3070	21339+5045	9.4 9.5	348.2	5.43	2004.563	1n	67
AG 418	21346+4322	9.1 10.2	113.0	13.83	2004.563	1n	68
HJ 3042	21357+5133	9.2 10.2	52.1	19.75	2004.563	1n	69
HJ 1661	21359+2622	9.2 9.2	84.9	11.85	2004.563	1n	70
HJ 3039	21359+0041	8.8 10.0	153.9	11.36	2004.566	1n	71
STF2813	21360+5728	9.2 9.7	272.0	10.37	2004.566	1n	72
HJ 1671	21373+5050	9.5 10.1	326.1	9.88	2004.563	1n	73
HJ 5284	21375-1618	9.0 10.5	267.9	55.30	2004.566	1n	74
STT 443	21376+0643	9.3 9.5	347.9	7.90	2004.549	1n	75
STF2814	21389+3623	8.7 9.8	159.2	7.41	2004.563	1n	76
HJ 3043	21395-1913	8.5 9.9	148.5	34.56	2004.566	1n	77
HJ 1681	21401+4824	9.4 10.2	108.0	7.41	2004.546	1n	78
S 799 AC	21434+3817	5.7 10.1	318.4	135.29	2004.546	1n	79

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NAME	RA DEC	MAGS	PA	SEP	DATE	N	NOTES
STT 224	21458+1545	7.7 9.1	1.2	58.76	2004.566	1n	80
STF2832 AB	21492+5031	7.9 8.3	213.1	13.33	2004.549	1n	81
STT 227	21576+1157	7.5 9.0	32.3	78.01	2004.566	1n	82
ES 534 AC	22184+4940	9.3 10.3	67.9	48.39	2004.579	1n	83
ES 147 AC	22245+5452	8.6 10.0	205.1	30.61	2004.579	1n	84
HO 184 AC	22265+4332	9.5 10.1	315.0	43.94	2004.579	1n	85
HO 185 AC	22265+3837	10.1 8.5##	80.7	88.88	2004.579	1n	86
HJ 1768	22274+4749	9.2 9.5	8.1	24.69	2004.579	1n	87
ES 837 AD	22318+5004	9.6 9.7	172.5	45.43	2004.579	1n	88
ES 1116	22323+5156	9.3 10.4	133.5	6.91	2004.579	1n	89
ARG 44	22343+5023	9.2 9.2	168.9	7.41	2004.579	1n	90
HJ 1785	22346+2944	8.9 10.0	172.0	13.83	2004.579	1n	91
STF2926	22375+3855	9.1 9.4	335.2	21.73	2004.579	1n	92
BAR 61 AB	22384+5223	9.2 10.0	166.1	29.13	2004.579	1n	93
STF2932 AB	22415+3003	9.1 9.4	281.8	21.73	2004.579	1n	94

Not listed in the WDS CATALOG.

Companion star is the brighter component.

NOTES

1. In Lyra. Sep increasing; p.a. decreasing. Spect. K0, A5.
2. In Sagittarius. Position angle increasing. Spect. G8II, G5.
3. In Aquila. Sep. & p.a. decreasing. Spect F8.
4. In Cygnus. Common proper motion. Near AW Cygni.
5. In Sagitta. Common proper motion; p.a. decreasing. Spect. G0, G0.
6. In Sagitta. Little change in sep. Possible cpm. Spect. K0, K0.
7. In Sagittarius. AB = cpm; p.a. inc. AC = sep. inc; p.a. dec. Spect. F2, F2, K2.
8. In Cygnus. Sep. increasing; p.a. decreasing. Spect. F5V, A0.
9. In Aquila. Sep. & p.a. decreasing. Spect. K0, G0.
10. In Cygnus. Relatively fixed. Common proper motion. Spect. B0.5.
11. In Cygnus. Separation increasing. Spect. B0.5III.
12. In Cygnus. Separation decreasing. Spect. F5.
13. In Cygnus. Separation and position angle decreasing.
14. In Cygnus. AB = sep. slightly inc. BC = relfix. Spect. BC = B0III, B0V.
15. In Cygnus. Relatively fixed. Spect. F8.
16. In Cygnus. Relatively fixed. Common proper motion. Spect. A5, A2.
17. In Cygnus. Common proper motion. Sep. slightly decreasing. Spect. A2V, A0.

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18. In Cygnus. Position angle decreasing. Spect. F8, K2.
19. In Cygnus. Separation decreasing. Spect. A2, A2.
20. In Cygnus. Common proper motion; p.a. decreasing. Spect. G5, G8III.
21. In Cygnus. Relatively fixed. Common proper motion. Spect. F5, G0.
22. In Cygnus. AB = p.a. increasing. AE = sep. increasing. Spect. K3III, G0, A0.
23. In Cygnus. Relatively fixed. Spect. M4, B2.
24. In Delphinus. Position angle increasing. Spect. M0, A8V.
25. In Capricornus. Sep. & p.a. increasing. Spect. K0.
26. In Cygnus. Sep. decreasing; p.a. increasing. Spect. A.
27. In Cygnus. Relatively fixed. Common proper motion. Spect. A3.
28. In Cygnus. Sep. & p.a. increasing. Spect. A0V.
29. In Delphinus. Relatively fixed. Common proper motion. Spect. A0, F0.
30. In Delphinus. Relatively fixed. Common proper motion. Spect. F8, F8.
31. In Vulpecula. Relatively fixed. Spect. G8III, A0.
32. In Cygnus. Sep. & p.a. decreasing. Spect. F0.
33. In Cygnus. Position angle increasing. Spect. A2, A5.
34. In Cygnus. Position angle decreasing. Spect. A2.
35. In Cygnus. Relatively fixed. Common proper motion. Spect. A2.
36. In Cygnus. Common proper motion. Separation increasing.
37. In Vulpecula. AC = p.a. & sep. inc. AD = relfix; cpm. Spect. F, G, F2.
38. In Cygnus. Position angle decreasing. Spect. A2, G5.
39. In Cygnus. Separation decreasing. Spect. F8.
40. In Cygnus. AB = sep. & p.a. inc. BD = cpm. Spect. AB = B0, 06.
41. In Cygnus. Relatively fixed. Common proper motion. Spect. F5, F8.
42. In Cygnus. Relatively fixed. Spect. F, G0.
43. In Cygnus. Sep. increasing; p.a. decreasing. Spect. G2V, G0.
44. In Cygnus. AC= sep. & p.a. dec. AD= sep. & p.a. inc. Spect. B8III, A0, F8.
45. In Cygnus. Relatively fixed.
46. In Cygnus. Sep. & p.a. increasing. Spect. K5, K0.
47. In Delphinus. AB = relfix. AC = sep. & p.a. inc. Spect. F5, F5, M0.
48. In Cygnus. Relatively fixed. Spect. B9.5V, B8.
49. In Cygnus. Sep. decreasing; p.a. increasing. Spect. F5.
50. In Cepheus. Sep. & p.a. decreasing. Spect. F8IV.
51. In Equuleus. Separation increasing. Spect. A5, F8.
52. In Equuleus. Position angle increasing. Spect. F5.
53. In Cygnus. Sep. & p.a. decreasing. Spect. F0, F0.
54. In Aquarius. Relatively fixed. Spect. A1V.
55. Tau or 65 Cygni. Sep. increasing; p.a. decreasing. Spect. F3IV.
56. In Cygnus. Sep. & p.a. decreasing. Spect. B8.
57. In Cygnus. Sep. & p.a. increasing. Spect. K0, K2.
58. In Cepheus. Sep. & p.a. slightly increasing. Spect. A0.
59. In Cepheus. Sep. increasing; p.a. decreasing. Spect. F8, B5.
60. In Pegasus. Position angle decreasing. Spect. G5, F8.
61. In Aquarius. Sep. & p.a. increasing. Spect. G0, G0.
62. In Cygnus. Relatively fixed. Common proper motion. Spect. G0.
63. In Cygnus. Position angle slightly decreasing. Spect. A5, A5.
64. In Cygnus. Common proper motion. In M 39. Spect. A0, A2.
65. In Capricornus. Position angle slightly decreasing. Spect. K4 III, K0.
66. In Cepheus. Sep. increasing; p.a. decreasing. Spect. A0, A0.
67. In Cygnus. Position angle increasing. Spect. B8, B8.
68. In Cygnus. Common proper motion. Spect. G0, F8.

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69. In Cygnus. Sep. decreasing; p.a. increasing.
70. In Pegasus. Position angle decreasing. Spect. F8, F8.
71. In Aquarius. Relatively fixed. Common proper motion. Spect. G5.
72. In Cepheus. Relatively fixed. Common proper motion. Spect. F5, F0.
73. In Cygnus. Relatively fixed. Spect. K0.
74. In Capricornus. Separation increasing. Spect. K0III.
75. In Pegasus. Common proper motion; p.a. decreasing. Spect. K2, K2.
76. In Cygnus. Position angle decreasing. Spect. F0, F0.
77. In Capricornus. Sep. decreasing; p.a. increasing. Spect. F0III.
78. In Cygnus. Common proper motion. Position angle decreasing.
79. In Cygnus. Slight sep. increase; slight p.a. decrease. Spect. A0V.
80. In Pegasus. Sep. increasing; p.a. decreasing. Spect. G5.
81. In Cygnus. Relatively fixed; common proper motion. Spect. B9IV, A2.
82. In Pegasus. Relatively fixed. Common proper motion. Spect. A0, A0.
83. In Lacerta. Separation decreasing. Spect. K0.
84. In Lacerta. Separation increasing. Spect. B9.
85. In Lacerta. Separation slightly decreasing. Spect. A0, A0.
86. In Lacerta. Separation decreasing. Spect. F5, K2.
87. In Lacerta. Relatively fixed. Common proper motion. Spect. A0, A.
88. In Lacerta. Sep. & p.a. decreasing. Spect. F.
89. In Lacerta. Relatively fixed. Common proper motion. Spect. A2, A2.
90. In Lacerta. Relatively fixed. Common proper motion.
91. In Pegasus. Relatively fixed. Common proper motion. Spect. F2.
92. In Lacerta. Relatively fixed. Spect. A0IV, M.
93. In Lacerta. Relatively fixed. Spect. A2.
94. In Pegasus. Separation increasing. Spect. K3III, A5.

Dave Arnold has been involved in the current double star measuring program since April 2001. He has previously published 23 double star research reports in the DOUBLE STAR OBSERVER. During this time, several new double star systems, or additional components for existing double star systems, have been discovered.