Divinus Lux Observatory Bulletin: Report #14

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Abstract: This report contains theta/rho measurements from 98 different double star systems. The time period spans from 2007.937 to 2008.221. 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.

Since 2001, when this series of articles began to be published, the table that appeared with each article was formatted according to the recommendations of the publisher at that time. However, in the interest of eliminating unnecessary details, the "N" column will no longer appear in the table, beginning with this article. This column has been previously part of the table to indicate the total number of different nights that a double star was measured, but since almost all of the submitted double star measurements are done during the period of one night, this column has become redundant. In future articles, if measurements exceed the period of one night, this will be mentioned in the text. Otherwise, the reader can correctly assume that the default value is one night.

As has been done in previous articles, 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. Several systems are included from the 2006.5 version of the WDS catalog as well. There are also some noteworthy items that are discussed pertaining to the following table.

To begin with, several double stars have displayed significant theta/rho shifts over the past ten years, especially as a result of proper motion. In the case of POC 1 AB, proper motions by both components have caused an increase of 8.5% in the rho value since 1998. Proper motions by both components have also caused noteworthy parameter changes for STT 154. Since 1998, the theta value has decreased by 5.5 degrees, while the rho value has increased by 5%. Shifts in both the theta and rho values have also been measured for SHJ 75. In this case, the theta value has increased by almost 2 degrees, while the rho value has decreased by 3%. Proper motion by the reference point star is responsible for these changes during the past ten years.

Proper motion by the reference point star has resulted in a measurable increase in the rho value for GAL 274. Since 1998, this value has shown an increase of over 6%. A rho value increase is also being reported for KU 47 AB. During the past 10 years, an increase of 11% has occurred because of proper motion by the "B" component. Significant theta value shifts are being noted for ENG 33 AB and AC because of a large proper motion by the "A" component. Since 1998, the theta value has increased by 2.5 degrees for "AB," and decreased 2 degrees for "AC." These opposing value shifts are occurring because the "A" component is located in between "B" and "C," and its proper motion vector is pointed straight in the direction of a decreasing declination value.

Proper motion appears to be the cause of a theta value increase of almost 2 degrees, during the past ten years, for AG 342. In fact, the theta value has increased by almost 40 degrees in the past 109 years.

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This type of a shift is not obvious by examining the proper motion vectors, since one might conclude that common proper motion is operational and the shift is the result of orbital motion. However, since the reference point star has a parallax value of approximately 63 milliarcseconds and the companion has a value of around 33 milliarcseconds, this would seem to imply that this is an optical pair. Perhaps this is a case in which the proper motion vectors appear to be in common because of the angle from which this pair is viewed from earth when, in fact, these stars are actually traveling in different directions through space.

Some notable items are worthy of mention regarding the STF 1424 multiple star listing. First of all, the "AB" components form a visual binary that has had orbital elements preliminarily determined. While the orbit is listed as a grade 5 in Sky Catalogue 2000.0, Vol. 2, the theta/rho values that are calculated from the orbital elements nearly match the values that appear in the table. Secondly, the rho value for "AC" has increased by 10" since 1995, because of proper motion by both components in opposite directions. Thirdly, the rho value for "AD" has increased by almost 7" since 1988, mostly as a result of proper motion by "A." Finally, the theta values that were obtained for "AC" and "AD" differ from catalog values. The value in the table for "AC" is almost 2 degrees greater, while the value for "AD" is almost 4 degrees larger than the listings in the WDS catalog. Again, proper motions by all three components are probably the cause for most of these increases.

A discrepancy is also being noted regarding the listing for SCA 83 Ba (10380-1257) in the WDS catalog. In order for the published theta parameter to be correct, the components would have to be listed as aB, instead of as Ba. Perhaps a quadrant flip has occurred in this case. The table lists the components as aB so that the reported theta value is consistent with the previously published value.

Another possible update to the WDS catalog is being submitted for the 2004 published theta measurement for ARN 71 AD (09207+5116). The 2004 value of 49 degrees deviates from the value listed in the table below, and from the value that is generated from the Hipparcos/Tycho 2 catalogs. A measurement of the theta value, for the date of 2008.052, yields a reading of 51.8 degrees. The Hipparcos/Tycho 2 data indicates a value of 51.4 degrees. If the current proper motion values for these two stars are accurate, it would appear that the theta value should gradually increase over time.

Name	RA Dec	MAGS	PA	Sep	Date	Notes
RST4290 AB	06007-0204	9.7 10.7	105.7	53.82	2007.975	1
STF 860	06111+2453	8.6 9.8	356.7	5.93	2007.975	2
STT 75	06206+1803	7.6 8.8	129.4	46.91	2007.940	3
STT 154	06443+4037	6.9 9.5	85.7	24.19	2007.975	4
STF 948 AC	06462+5927	5.4 7.0	310.2	8.89	2007.995	5
SHJ 75	06467+4335	5.3 8.5	39.8	30.12	2007.940	6
STF 958 AB	06482+5542	6.3 6.2*	256.0	4.44	2007.940	7
GAL 274	06554-1217	9.8 10.3	350.5	5.43	2007.975	8
ES 340	07066+3142	10.0 10.6	141.5	5.43	2007.975	9
STF1045	07127-0311	8.0 9.0	236.3	5.43	2007.995	10
STF1099	07294+1132	8.5 8.9	343.0	3.95	2007.940	11

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Name	RA Dec	MAGS	PA	Sep	Date	Notes
STF1103	07306+0515	7.1 8.6	245.4	4.44	2007.940	12
POC 1 AB	07457-1720	10.0 10.1	60.2	5.43	2007.937	13
STF1135 AC	07475+3325	5.1 10.6	343.5	92.83	2007.937	14
H 67	07488+2855	9.0 10.7	10.6	50.86	2007.937	15
SRT 4	07509-1410	10.2 10.3	278.9	11.85	2007.937	16
SEI 483	07530+3138	10.4 10.6	150.9	22.71	2007.937	17
ENG 33 AB	07549+1914	7.8 10.7	284.5	96.78	2007.995	18
ENG 33 AC	07549+1914	7.8 10.5	65.2	125.41	2007.995	18
HJ 71	07557-0328	9.5 10.5	212.1	19.26	2007.995	19
STF1156	07560+2440	7.7 10.1	160.0	19.26	2007.937	20
STF1174 AB-C	08047+4717	8.9 9.3	215.9	5.93	2007.995	21
STF1177	08056+2732	6.7 7.4	351.0	3.95	2007.995	22
AG 148	08059-0146	10.2 10.3	176.6	6.91	2007.959	23
HJ 2424	08060+5915	6.7 10.7	149.9	42.46	2007/959	24
SEI 488	08112+3255	10.3 10.6	314.4	22.71	2007.959	25
AG 151	08138+3346	10.2 10.5	149.0	6.42	2007.959	26
HJ 2438	08154-1959	9.8 10.6	53.5	23.21	2007.959	27
ENG 34 AB	08161+5706	7.5 9.3	144.2	127.39	2007.959	28
ES 593 AB	08167+4053	9.2 9.9	342.1	20.74	2008.052	29
STF1217	08243+4457	7.7 9.3	243.1	29.13	2007.995	30
SCJ 10 A-BC	08258-0025	7.3 9.8	78.1	37.53	2008.003	31
STF1223	08268+2656	6.1 6.2	218.1	4.94	2007.995	32
STF1259	08466+3829	9.4 9.9	342.0	4.94	2008.052	33
ARG 71	08547+4954	10.2 10.3	338.0	5.43	2008.052	34
HJ 116	09042-0252	9.8 10.7	43.6	32.59	2008.003	35

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Name	RA Dec	MAGS	PA	Sep	Date	Notes
SCJ 12	09078-0013	10.2 10.2	260.7	6.42	2008.003	36
STT 97	09084+2732	8.2 8.2	237.6	51.84	2008.003	37
STF1312	09103+5223	8.3 8.8	147.7	4.94	2008.003	38
STF1320	09134+4220	9.4 10.4	216.2	11.85	2008.003	39
ES 1148	09190+4438	10.1 10.6	31.8	5.93	2008.003	40
STT 199 AC	09207+5116	6.1 10.5	7.2	128.38	2008.052	41
ARN 71 AD	09207+5116	6.1 7.8	51.8	231.08	2008.053	41
STT 571 AB	09213+3426	3.1 8.8	42.1	222.19	2008.003	42
SKI 6	09271-1716	9.2 10.0	358.1	6.42	2008.003	43
HJ 470	09448+1940	10.1 10.3	211.5	22.22	2008.003	44
STF1376 AB	09450+4314	9.0 9.0	309.5	5.43	2008.052	45
STF1394	09572+4554	8.8 9.7	250.0	4.44	2008.052	46
WEI 22	10065+4333	9.8 10.5	296.6	10.37	2008.036	47
OSV 4 AB	10151+3931	10.2 10.5	40.7	97.27	2008.036	48
STF1419	10170+1007	8.9 9.8	223.7	4.44	2008.036	49
STF1421	10181+2731	8.1 9.1	332.0	4.44	2008.036	50
STF1424 AB	10200+1950	2.2 3.6	125.5	4.44	2008.107	51
STF1424 AC	10200+1950	2.2 9.5	289.8	332.79	2008.107	51
STF1424 AD	10200+1950	2.2 10.5	304.8	368.34	2008.107	51
HJ 2532 AB	10296+3757	10.3 10.6	70.1	13.33	2008.036	52
FOX 166 AC	10296+3757	10.3 10.1*	250.9	202.93	2008.036	52
STF1440	10298-0355	7.8 9.1	345.2	15.31	2008.036	53
STT 105	10299+2835	6.9 8.1	226.4	134.30	2008.107	54
SCA 71	10346-1258	9.4 10.6	326.6	145.16	2008.036	55
SCA 76	10354-1252	6.8 8.9	135.6	130.35	2008.036	56

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Name	RA Dec	MAGS	PA	Sep	Date	Notes
SCA 77	10356-1300	7.6 10.0	47.9	123.44	2008.036	57
SCA 83 aB #	10380-1257	8.1 10.7	94.5	133.31	2008.036	58
STF1460	10406+4209	8.7 8.9	161.5	3.95	2008.036	59
BLL 28	10422+3142	6.1 10.7	176.1	109.61	2008.036	60
KU 100	10503+2234	10.0 10.1	103.3	47.89	2008.036	61
STF1487	10556+2445	4.5 6.3	113.2	6.91	2008.107	62
AG 342	10596+2527	8.5 9.1	111.9	5.43	2008.036	63
STF1510	11080+5249	7.6 8.9	329.5	5.43	2008.107	64
STF1520	11161+5246	6.5 7.7	344.1	12.84	2008.107	65
HJ 4433	11256+1627	5.6 10.7	3.5	54.81	2008.107	66
KU 38	11272+1908	10.5 10.6	55.1	5.93	2008.093	67
STF1564	11396+2657	8.7 9.3	88.0	4.94	2008.107	68
STF1575	11520+0850	7.3 7.8	210.3	30.61	2008.107	69
STF1603	12081+5528	7.8 8.2	84.2	21.73	2008.183	70
STF1622	12161+4040	5.7 8.6	260.1	11.36	2008.183	71
WAL 62 AC	12167+3936	7.3 9.2	143.2	161.95	2008.093	72
STF1634	12207+2255	8.7 9.8	147.6	5.43	2008.093	73
STF1645	12281+4448	7.4 8.0	156.8	9.88	2008.183	74
STF1653	12334+3202	9.6 9.6	342.7	7.90	2008.093	75
STF1669 AB	12413-1301	5.8 5.8	312.4	5.43	2008.183	76
ES 2643	12491+4213	8.5 8.8	46.2	45.43	2008.183	77
STF1695 AB	12563+5406	6.0 7.7	280.5	3.46	2008.183	78
HJ 2639 AC	13062+4055	7.3 10.7	136.6	52.83	2008.183	79
STF1737	13218+1746	7.8 10.2	219.6	14.81	2008.129	80
STF1735	13218+0550	9.8 10.0	110.1	3.95	2008.186	81

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Name	RA Dec	MAGS	PA	Sep	Date	Notes
H 119	13228-1311	7.8 10.7	312.1	19.26	2008.129	82
STF1738	13233-1456	8.6 8.7	278.5	3.46	2008.183	83
HJ 1234	13344+3847	6.4 10.4	8.7	28.64	2008.129	84
BU 613 AB-C	13514+3441	10.3 10.6	74.6	45.92	2008.129	85
KU 47 AB	13540+3209	10.2 10.7	149.2	21.73	2008.221	86
BGH 50	14048+2549	7.0 8.8	32.1	96.78	2008.145	87
STF 803	14064+3825	8.0 10.3	42.6	17.78	2008.145	88
STT 276 AB-C	14082+3645	8.4 10.6	73.3	9.38	2008.145	89
STF1805	14100+0401	8.9 9.1	34.4	4.94	2008.186	90
STF1812 AB-C	14124+2843	7.8 9.4	109.1	14.32	2008.221	91
HO 543	14279+2123	9.5 9.6	237.3	4.94	2008.189	92
GLP 3	14327-1246	10.5 10.7	322.4	79.49	2008.145	93
STF1864 AB	14407+1625	4.9 5.8	112.4	5.43	2008.189	94
STF1864 AC	14407+1625	4.9 10.6	162.8	127.88	2008.189	94
KU 48 AB	14430+1310	10.4 10.6	137.4	6.42	2008.145	95
STF1885	14506-0001	8.7 9.1	144.5	3.95	2008.189	96
AG 196	14547+5038	10.0 10.7	139.1	27.16	2008.145	97
STF1896 AB	14584+4403	8.9 9.6	277.0	3.95	2008.189	98

* The companion star is the brighter component.
\# WDS CATALOG listing is Ba. B is optical. See discussion above.

Notes

1. In Orion. Position angle slightly increasing. Spect. A0.
2. In Gemini. Position angle slightly decreasing. Spect. B9, B9.
3. In Gemini. Position angle slightly increasing. Spect. G7III, K0.
4. In Auriga. Sep. increasing; p.a. decreasing. Spect. M4III, K.
5. 12 Lyncis. Common proper motion; p.a. increasing. Spect. A3V, A3V.
6. Psi or 56 Aurigae. Sep. decreasing; p.a. increasing. Spect. G0V.
7. In Lynx. Common proper motion. Sep. slightly decreasing. Spect. F5, F5.

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8. In Canis Major. Sep. & p.a. increasing. Spect. A2.
9. In Gemini. Separation and position angle increasing.
10. In Monoceros. Sep. dec.; p.a. inc. Common proper motion. Spect. F5, F5.
11. In Canis Minor. Relatively fixed. Spect. A0.
12. In Canis Minor. Relatively fixed. Spect. B9, B9.
13. In Puppis. Sep. increasing; p.a. decreasing. Spect. A1.
14. Pi or 80 Geminorum. Position angle increasing. Spect. M1III.
15. In Gemini. Separation increasing. Spect. K2.
16. In Puppis. Sep. & p.a. slightly decreasing.
17. In Gemini. Separation slightly increasing. Spect. K0.
18. In Gemini. AB = Sep. & p.a. inc. AC = p.a. dec. Spect. K2.
19. In Monoceros. Separation slightly decreasing.
20. In Gemini. Relatively fixed. Spect. K0.
21. In Lynx. Relatively fixed. Common proper motion. Spect. F5, F5.
22. In Cancer. Sep. inc; p.a. dec. Common proper motion. Spect. B9V, B9.
23. In Monoceros. Common proper motion. Sep. slightly dec. Spect. A5, A5.
24. In Lynx. Separation increasing. Spect. A0.
25. In Cancer. Position angle increasing. Spect. F8, G.
26. In Lynx. Position angle slightly increasing.
27. In Puppis. Position angle slightly decreasing.
28. In Lynx. Sep. increasing; p.a. decreasing. Spect. G5, F8.
29. In Lynx. Sep. & p.a. slightly increasing. Spect. G0.
30. In Lynx. Common proper motion; p.a. slightly increasing. Spect. G0, G0.
31. In Hydra. Sep. & p.a. decreasing. Spect. K0, G5.
32. Phi or 23 Cancri. Common proper motion. Sep & p.a. inc. Spect. A3V, A6V.
33. In Lynx. Relatively fixed. Common proper motion. Spect. G0, G0.
34. In Ursa Major. Relatively fixed. Common proper motion. Spect. G5.
35. In Hydra. Position angle increasing. Spect. G0.
36. In Hydra. Common proper motion; p.a. slightly increasing. Spect. K2, K2.
37. In Cancer. Relatively fixed. Common proper motion. Spect. G0V, G0V.
38. In Ursa Major. Relatively fixed. Spect A5, A5.
39. In Lynx. Relatively fixed. Common proper motion. Spect. G5
40. In Ursa Major. Relatively fixed. Common proper motion. Spect. G0.
41. In Ursa Major. AC = p.a. inc.; sep. dec. AD = cpm. Spect. AD = F5V, G5.
42. Alpha Lyncis. Sep. & p.a. increasing. Spect. K5, A2.
43. In Hydra. Sep. & p.a. slightly increasing. Spect. G5.
44. In Leo. Relatively fixed. Common proper motion.
45. In Ursa Major. Common proper motion; p.a. decreasing. Spect. F5V, F5V.
46. In Ursa Major. Common proper motion; sep. & p.a. increasing. Spect. G0, G0.

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47. In Ursa Major. Position angle increasing. Spect. F0, F.
48. In Leo Minor. Relatively fixed. Common proper motion. Spect. M0.
49. In Leo. Relatively fixed. Spect. A0, A0.
50. In Leo. Common proper motion; p.a. slightly increasing. Spect. F2, F2.
51. Gamma Leonis. AB = cpm. AC/AD = sep. inc. Spect. K0III, K0III, M5, G5.
52. In Leo Minor. AB = p.a. dec.; cpm. AC = sep. inc. Spect. F8, G0, F5.
53. In Sextans. Relatively fixed. Common proper motion. Spect. G0.
54. In Leo Minor. Sep. & p.a. increasing. Spect. K2III, K2III.
55. In Hydra. Position angle slightly increasing. Spect. K5.
56. In Hydra. Position angle decreasing. Spect. A5, K0.
57. In Hydra. Position angle slightly decreasing. Spect. K0III, A0.
58. In Hydra. Separation increasing. Spect. A0, G0V.
59. In Ursa Major. Sep. increasing; p.a. decreasing. Spect. F2, F2.
60. In Leo Minor. Sep. decreasing; p.a. increasing. Spect. M2III.
61. In Leo. Relatively fixed. Common proper motion. Spect. F8.
62. 54 Leo Minoris. Common proper motion; sep. & p.a. inc. Spect. A1V, A2V.
63. In Leo Minor. Common proper motion; p.a. increasing. Spect. K0.
64. In Ursa Major. Common proper motion; sep. inc; p.a. dec. Spect. F8V, K.
65. In Ursa Major. Relatively fixed. Common proper motion. Spect. F6V, F9V.
66. 81 Leonis. Position angle increasing. Spect. F2V.
67. In Leo. Common proper motion; p.a. increasing. Spect. G0, G0.
68. In Leo. Position angle slightly increasing. Spect. A3V, A3V.
69. In Virgo. Common proper motion; sep. increasing. Spect. K0, F5.
70. In Ursa Major. Common proper motion; p.a. increasing. Spect. F8V, F9V.
71. 2 Canes Venaticorum. Relatively fixed. Spect. M1III, F7V.
72. In Canes Venatici. Sep. & p.a. increasing. Spect. A2.5V, F8.
73. In Coma Berenices. Relatively fixed. Common proper motion. Spect. G5, G5.
74. In Canes Venatici. Common proper motion; p.a. decreasing. Spect. F9V, K.
75. In Canes Venatici. Sep. & p.a. decreasing; cpm. Spect. F3V, F3V.
76. In Corvus. Common proper motion; p.a. increasing. Spect. F5V, F5V.
77. In Canes Venatici. Sep. & p.a. decreasing. Spect. G9III, F0.
78. In Ursa Major. Common proper motion; p.a. decreasing. Spect. A5, A5.
79. In Canes Venatici. Separation decreasing. Spect. M1III.
80. In Coma Berenices. Common proper motion; sep. & p.a. dec. Spect. F0, F0.
81. In Virgo. Relatively fixed. Common proper motion. Spect. G5, F8.
82. In Virgo. Position angle slightly increasing. Spect. A2V.
83. In Virgo. Common proper motion; sep. & p.a. decreasing. Spect. F7V, F7V.
84. In Canes Venatici. Sep. & p.a. decreasing. Spect. F0IV.
85. In Canes Venatici. Sep. & p.a. decreasing. Spect. F8, K0.

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86. In Canes Venatici. Sep. & p.a. increasing. Spect. K0, K0.
87. In Bootes. Relatively fixed. Common proper motion. Spect. F5, K0.
88. In Canes Venatici. Position angle decreasing. Spect. K0.
89. In Bootes. Common proper motion; p.a. slightly increasing. Spect. G4III, F8.
90. In Virgo. Common proper motion; p.a. inc.; sep. dec. Spect. F5, F5.
91. In Bootes. Relatively fixed. Common proper motion. Spect. F2V, F2.
92. In Bootes. Common proper motion; sep. decreasing. Spect. F8, F8.
93. In Libra. Sep. & p.a. increasing. Spect. G6V.
94. Pi or 29 Bootis. AB = sep. dec.; p.a. inc. AC = sep. & p.a. inc. Spect. B9, B9.
95. In Bootes. Common proper motion; p.a. decreasing. Spect. K0, K.
96. In Virgo. Relatively fixed. Common proper motion. Spect. F5, F5.
97. In Bootes. Separation slightly increasing. Spect. G5, F8.
98. In Bootes Common proper motion; p.a. decreasing. Spect. F8, F8.