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Abstract: This report contains theta/rho measurements from 97 different double star systems. The time period spans from 2004.902 to 2005.290. 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.

At the point in time when this article has been written, 2,678 theta/rho measurements of double stars have been completed at Divinus Lux Observatory. In addition, 88 new discoveries, including some new double stars and some additional components for currently cataloged systems, have been recorded. This work has been accomplished as the result of a double star research project that has been in progress since April of 2001.

The reason for mentioning this is to highlight the fact that a substantive double star measuring program can be conducted with the use of modest instrumentation. The intent is not to boast about what has been accomplished at Divinus Lux Observatory to date, but to encourage any reader of this article who may still have doubts about the possibly of conducting valuable research in double star astronomy with limited equipment. There is much more research that needs to be done by those who have the inclination for it, and this need is too large to be filled by any one individual, including myself.

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. Exceptions to this stipulation include the following: STF 305 AB, STF 742, STF 982 AB, STF 1110 AB, STF 1196 AB-C, STF 1321 AB, STF 1424 AB, STF 1785, STF 1888 AB, STF 1954 AB, STF 1788AB, STF 2032 AB, and STF 2021 Aa-B. The reason for these exceptions is because the theta/rho shifts for these visual binaries are large enough to warrant more frequent measurements. There are also some noteworthy items that are mentioned in reference to the following table.

To begin with, the reader may wonder why STF 17 is included as part of the STF 16 multiple star system. The reason is that STF 16 and STF 17 share the same reference point star, Theta 2 Orionis, and the coordinates for both systems are identical. To confuse matters even more, the companion star for STF 17 is also the reference point star for the STF 748 multiple star system. Considering the overlapping that has occurred with these designations, one might question whether it is meaningful to retain the label of STF 17, or whether this should be eliminated or reconfigured. In addition, while the STF 16/17 multiple star system has the appearance of being relatively fixed among all of the brighter components, the position angle measurement for STF 17, which is listed in the table, indicates an increase of 2 degrees since the last published measurements in 1995. While care was taken to be as accurate as possible, the p.a. listing in the table needs additional confirmation since this measurement appears to be so anomalous.

Anomalous position angle measurements appear to be a factor for five additional double star systems. For WFC 64, the theta catalog measurements for 1933 appear to be at a variance from other position angle decreases that have been recorded, which were caused by proper motion. A decrease of 5 degrees in the theta value, from 1899 to the present, seems consistent with proper motion shifts, while the 1933 measurements indicate an increase of 5 degrees since 1899. More measurements for this system would help to confirm that the position angle is actually decreasing.

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The second position angle anomaly pertains to WFC 60. In this case, the theta measurements have varied from 291 to 294 degrees from 1894 to the present, but this system is supposed to be relatively fixed. Because of the array of values that have been recorded over the past one hundred years, this is another double star that needs additional measurements in order to determine the theta value more accurately.

Thirdly, various theta/rho values have also been recorded for WFC 284. From 1897 to the present, theta values have ranged from 157 to 161 degrees, while rho values have ranged from 7.8" to 8.4". Because only a meager number of measurements exist for this common proper motion pair, this is another system that needs additional study.

The fourth position angle anomaly that I would like to highlight is in reference to STF 3118 AC. In this case, catalog p.a. measurements from 1897and 1991, and from the Hipparcos/Tycho data, seem to agree within a degree. However, when I measured this pair, a value was obtained that was 3.5 degrees greater than from these other sources. My position angle measurements for STF 3118 AD displayed no such variance, and the micrometer was recalibrated while measuring AC to provide a reality check. Since the cause for this phenomenon has not been determined, additional measurements of the AC components would help to either confirm the catalog value of 334 degrees, or the value of 337.5 degrees that I have obtained.

The final p.a. irregularity to be noted is in reference to STF 1807. WDS CATALOG measurements for this double star include a value of 26 degrees in 1831 and 24 degrees in 1995. The Hipparcos/Tycho listing indicates a value of 27.5 degrees, while the theta measurement that appears in this report is listed at 28.1 degrees. Additional measurements would, hopefully, help to establish which theta value is the most accurate.

As has been mentioned in past reports, this one also contains theta/rho shifts, which are listed in the table, that have been caused by the proper motions of one or both of the component stars in a given system. One such double star to fit this category is HJ 2352. Because of proper motion by the reference point star, the separation value has increased by 2.2% since 1991.

A large proper motion by the "A" component of STF 1263 AB is responsible for increases of almost 2 degrees in position angle and 7+ seconds in separation since 1995. This double star is in an obvious optical alignment. Proper motions by the "AB" components toward the "C" component, in the H27 multiple star system, are the cause for a 5% decrease in separation since 1991. Because "AB" is a close and faint pair, I was not able to cleanly resolve these two components. Consequently, my measurements more accurately reflect parameters for "AB-C" rather than for "AC." Therefore, the table lists the measurements for H 27 AC as H 27 (AB-C). Measurements for "AB-C" are not listed in the WDS CATALOG. Finally, S 598 AB has shown a decrease of 3 % in separation, since 1995, because of proper motion by the "A" component.

The last item that needs to be mentioned has to do with some measurements, which are recorded in the WDS CATALOG, that appear to be erroneous. These errors pertain to the listings for "AE" and "AF" in the STF 1543 multiple star system (11291+3920). These two listings are duplicates of the correctly listed measurements for "DE" and "DF." The Hipparcos/Tycho star charts confirm that "D" is the actual reference point star for these measurements, rather than "A."

Name	RA Dec	Mags	PA	Sep	Date	N	Notes
STF 305 AB	02475+1922	7.5 8.2	307.0	3.46	2005.096	1n	1
STF 654 AB	05133+0252	4.5 8.5	64.0	6.91	2004.902	1n	2
STF 696	05228+0333	5.0 6.8	29.1	32.59	2004.902	1n	3
STF 14 Aa-C	05320-0018	2.4 6.9	0.7	53.33	2004.902	1n	4
STF 718 AB	05323+4924	7.4 7.5	73.9	7.90	2004.902	1n	5
STF 16 AB	05354-0525	5.0 6.2	93.3	52.83	2004.902	1n	6
STF 16 AC	05354-0525	5.0 8.5	99.1	128.38	2004.902	1n	6
STF 17	05354-0525	5.0 5.1	316.1	133.31	2004.902	2n	6

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Name	RA Dec	Mags	PA	Sep	Date	N	Notes
STF 742	05364+2200	7.4 7.8	274.5	3.95	2005.096	1n	7
STT 65 AB	05379+0058	7.5 8.0	31.5	79.99	2004.904	1n	8
S 502	05547+1351	7.9 8.3	131.1	45.92	2004.904	1n	9
STF 873	06126-0118	9.7 10.4	293.2	8.89	2004.945	1n	10
A 666 AB-C	06133-0624	8.4 9.1	320.7	230.09	2004.945	1n	11
STT 71	06145+1148	7.1 7.6	312.7	89.86	2004.904	1n	12
BRT 376	06160-0745	9.4 9.4	115.3	5.93	2004.945	1n	13
STT 73 AB	06194+1326	6.9 7.6	44.0	72.09	2004.904	1n	14
HJ 386 AB	06219+2731	9.7 10.4	64.9	21.73	2004.945	1n	15
HJ 386 AC	06219+2731	9.7 9.6##	166.1	56.29	2004.945	1n	15
S 517 AB	06222-1636	8.7 8.7	192.1	22.71	2004.948	1n	16
HJ 728	06265-0150	9.1 10.1	264.2	27.16	2004.945	1n	17
HJ 731	06308-0939	8.9 10.0	34.0	11.85	2004.945	1n	18
WFC 56	06314-1234	6.8 9.9	171.1	19.26	2004.967	1n	19
BAL1315	06321+0130	9.9 10.4	140.0	12.84	2004.945	1n	20
HJ 2322	06337+0155	9.9 9.9	319.5	16.79	2004.948	1n	21
STF 918 AB	06340+5228	7.2 8.2	333.9	4.94	2004.904	1n	22
STF 918 AC	06340+5228	7.2 10.3	24.7	145.16	2004.904	1n	22
HJ 734	06359-0927	9.8 9.8	33.0	7.90	2004.948	1n	23
STF 940	06373+3826	8.7 10.2	294.2	10.37	2004.945	1n	24
AG 118	06391+0220	8.8 10.3	306.3	35.55	2004.964	1n	25
S 528 AB	06393+3135	8.7 10.3	27.0	82.95	2004.945	1n	26
WFC 60	06398-0358	10.1 10.2	291.5	9.88	2004.964	1n	27
ABH 50 AD	06406+0947	8.5 9.0	137.1	103.69	2004.948	1n	28
POU1883 AB	06414+2336	9.5 10.4	24.8	17.78	2004.964	1n	29
STF3118 AC	06415+0950	9.8 7.5##	337.5	94.80	2004.964	1n	30
STF3118 AD	06415+0950	9.8 9.9	31.8	128.38	2004.964	1n	30
GAL 410	06426-0934	8.5 9.9	26.0	19.75	2004.964	1n	31
J 2009	06449+0728	8.6 9.9	37.9	7.90	2004.964	1n	32
STF 959	06450+1346	9.8 10.1	175.1	11.85	2004.964	1n	33
BAL1717	06456+0219	9.7 9.9	10.2	8.89	2004.964	1n	34
WFC 64	06461+3323	10.1 9.7##	18.4	4.44	2004.964	1n	35
STF 965 AD	06473+1055	8.9 9.4	58.4	41.97	2004.964	1n	36
STF 970	06478-1143	9.1 9.6	127.9	20.24	2004.964	1n	37
STF 962	06482+2642	9.2 9.5	242.1	25.68	2004.948	1n	38
HJ 2347	06513+0533	9.8 10.2	21.7	21.73	2004.964	1n	39
HJ 2352	06540+0034	9.8 10.4	26.8	23.70	2004.967	1n	40
STF 988	06540-1002	9.4 9.7	265.0	33.58	2004.967	1n	41

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Name	RA Dec	Mags	PA	Sep	Date	N	Notes
STT 79	06541+0641	7.1 7.5	88.8	115.54	2004.904	1n	42
STF 982 AB	06546+1311	4.7 7.8	145.4	7.41	2004.948	1n	43
STF 992	06556-0929	8.6 9.8	301.2	13.83	2004.967	1n	44
STF 993	06558-1152	8.9 8.9	240.3	36.54	2004.967	1n	45
H 27(AB-C)	06561+2005	9.5 9.7	152.9	23.70	2004.981	1n	46
RST3475 A-BC	06564-1016	9.7 10.1	158.9	19.75	2004.967	1n	47
KU 92	07006+0921	9.6 10.0	322.1	46.41	2004.967	1n	48
WFC 73	07024-0508	9.7 9.9	201.2	8.89	2004.981	1n	49
STF1002 AB-C	07042+5626	9.4 10.0	318.1	30.61	2004.967	1n	50
ES 900	07042+4957	9.7 10.2	52.2	9.88	2004.981	1n	51
J 1465	07046-0717	9.7 10.1	289.3	8.89	2004.981	1n	52
STF1015	07049-0547	9.4 9.4	198.5	4.94	2004.981	1n	53
J 702 AC	07098+0526	9.6 10.0	168.9	61.23	2004.981	1n	54
HJ 2359	07099+5806	9.4 10.0	19.3	30.61	2004.984	1n	55
STF1020	07119+5730	8.7 10.4	284.9	12.84	2004.984	1n	56
STF1025 AB	07128+5548	8.2 8.5	129.8	26.66	2004.967	1n	57
WFC 77	07143+0307	5.3 9.9	319.2	51.35	2004.967	1n	58
HJ 419	07221-0402	9.2 10.5	40.3	7.90	2004.984	1n	59
STF1080	07223+0429	10.0 10.4	221.1	22.22	2004.984	1n	60
STT 84 AB	07254+5633	7.5 7.7	324.0	113.56	2004.967	1n	61
STF1101	07287-1349	9.5 9.7	88.5	6.42	2004.984	1n	62
ENG 31 AB	07299+4940	5.4 10.0	304.4	179.73	2005.060	1n	63
STF1114	07337+0917	9.2 9.9	53.0	6.42	2004.984	1n	64
HJ 56	07343-0313	9.5 9.8	148.9	6.91	2004.984	1n	65
STF1110 AB	07346+3153	1.9 3.0	62.2	4.44	2004.967	1n	66
STT 87	07389+4229	7.7 7.5##	177.3	62.21	2004.967	1n	67
STT 89	07510+3137	6.8 7.7	83.4	77.03	2004.967	1n	68
STF1178	08034-1312	9.2 9.3	329.1	5.43	2005.060	1n	69
STF1196 AB-C	08122+1739	5.2 5.8	70.0	5.93	2004.981	1n	70
S 565 AB	08247+4200	6.0 8.5	176.1	83.94	2004.981	1n	71
S 566	08265+2754	5.6 10.6	21.4	139.24	2004.981	1n	72
STF1263 AB	08452+4140	8.5 9.2	22.8	128.38	2004.981	1n	73
SHJ 101	09018+2754	6.1 9.1	329.6	103.69	2005.041	1n	74
STF1321 AB	09144+5241	7.6 7.7	94.3	17.28	2005.041	1n	75
S 598 AB	09287+4536	5.4 7.7	161.5	70.11	2005.041	1n	76
STF1424 AB	10200+1950	2.2 3.2	125.5	4.44	2005.041	1n	77
STF1472	10470+1302	8.4 9.4	34.5	42.36	2005.156	1n	78
STF1543 AD	11291+3920	5.4 7.6	252.8	343.65	2005.156	1n	79

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Name	RA Dec	Mags	PA	Sep	Date	N	Notes
STT 114	12002+3644	7.5 8.3	83.2	86.90	2005.156	1n	80
STF1740	13237+0243	7.1 7.3	74.9	26.66	2005.216	1n	81
H 70 AC	13309+2414	7.6 8.2	256.5	75.05	2005.216	1n	82
STF1785	13491+2659	7.2 8.0	178.0	3.46	2005.216	1n	83
STF1788 AB	13550-0804	6.6 7.2	98.7	3.46	2005.274	1n	84
STF1807	14113-0320	8.4 8.7	28.1	7.41	2005.216	1n	85
STF1833 AB	14226-0746	7.5 7.5	174.3	5.93	2005.216	1n	86
STF1873	14448+0742	7.9 8.3	92.5	6.91	2005.255	1n	87
STF1888 AB	14514+1906	4.7 6.8	312.9	6.42	2005.255	1n	88
STF1919	15127+1917	6.6 7.3	10.6	23.70	2005.255	1n	89
STF1939	15275-1058	8.2 9.2	130.8	9.88	2005.255	1n	90
STF1954 AB	15348+1032	4.1 5.1	172.9	4.44	2005.255	1n	91
STF2021 Aa-B	16133+1332	7.3 7.7	356.1	4.44	2005.290	1n	92
STF2032 AB	16147+3352	5.6 6.4	237.7	7.41	2005.290	1n	93
H 38	16229+3220	6.4 9.7	16.5	31.58	2005.290	1n	94
STF2044	16242+3702	8.3 8.7	339.8	8.39	2005.290	1n	95
WFC 284	16255+1944	10.6 10.5##	339.8	7.90	2005.290	1n	96
STF2098 AB	16457+3000	8.7 9.5	144.5	14.32	2005.290	1n	97
STF2098 AC	16457+3000	8.7 8.8	128.7	66.16	2005.290	1n	97

Companion star is the brighter component.

Notes

1. In Aries. Common proper motion; p.a. decreasing. Spect. G0, G0.
2. Rho or 17 Orionis. Separation slightly decreasing. Spect. K2III, K3III.
3. In Orion. Sep. & p.a. increasing. Spect. B1V, B3V.
4. Delta or 34 Orionis. Relatively fixed. Spect. B4, B0.
5. In Auriga. Relatively fixed. Common proper motion. Spect. F5, F5.
6. Theta 2 or 43 Orionis. Relatively fixed system. Spect. O9.5V, B, B8, O6.
7. In Taurus. Common proper motion, p.a. increasing. Spect. F8.
8. In Orion. Relatively fixed. Spect. B6V, B9.
9. In Orion. Relatively fixed. Spect. O6, A0.
10. In Orion. Relatively fixed. Spect. G, G.
11. In Monoceros. Relatively fixed. Spect. G5, K0.
12. In Orion. Position angle slightly increasing. Spect. K0, A0.
13. In Monoceros. Sep. & p.a. increasing. Spect. A2.
14. In Orion. Possible common proper motion. Sep. decreasing. Spect. F6V, K1V.
15. In Gemini. AB = sep. inc. AC = cpm. Spect. AC = F2V, F5.
16. In Canis Major. Relatively fixed. Spect. A5.
17. In Monoceros. Sep. & p.a. increasing. Spect. K0, G.
18. In Monoceros. Relatively fixed. Spect. B8.
19. In Canis Major. Relatively fixed. Spect. B5.
20. In Monoceros. Relatively fixed. Spect. A0, A0.
21. In Monoceros. Position angle increasing. Spect. A0.

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22. In Auriga. AB = cpm, p.a. inc. AC = optical. Spect. AB = A3, A3.
23. In Monoceros. Relatively fixed. Spect. B9.
24. In Auriga. Relatively fixed. Spect. A5.
25. In Monoceros. Relatively fixed. Spect. B9.
26. In Auriga. Separation slightly increasing. Spect. F5.
27. In Monoceros. Relatively fixed. Common proper motion.
28. In Monoceros. Relatively fixed. Spect. B3V, B8.
29. In Gemini. Position angle decreasing. Spect. A, A.
30. In Monoceros. AC & AD = sep. decreasing. Spect. AC = A2, B5.
31. In Monoceros. Relatively fixed. Spect. A0, A0.
32. In Monoceros. Sep. increasing; p.a. decreasing. Spect. A2.
33. In Gemini. Relatively fixed. Common proper motion. Spect. G5.
34. In Monoceros. Relatively fixed. Spect. A0.
35. In Gemini. Position angle decreasing.
36. In Monoceros. Sep. & p.a. decreasing. Spect. G0, F0.
37. In Canis Major. Relatively fixed. Common proper motion. Spect. F8, G.
38. In Gemini. Relatively fixed. Spect. G0, A0.
39. In Monoceros. Position angle increasing. Spect. F0.
40. In Monoceros. Sep. & p.a. increasing. Spect. F8.
41. In Monoceros. Relatively fixed. Common proper motion. Spect. A2, A0.
42. In Monoceros. Relatively fixed. Spect. G5, A0.
43. 38 Geminorum. Sep. increasing; p.a. decreasing. Spect. F0, F0.
44. In Monoceros. Position angle increasing. Spect. G0.
45. In Canis Major. Position angle increasing. Spect. F0, F.
46. In Gemini. Sep. & p.a. decreasing. Spect. A2, A0.
47. In Monoceros. Relatively fixed. Spect. K0, K0.
48. In Monoceros. Separation increasing. Spect. A, K7.
49. In Monoceros. Relatively fixed. Common proper motion. Spect. A0.
50. In Lynx. Relatively fixed. Common proper motion. Spect. G, F8.
51. In Lynx. Sep. & p.a. decreasing. Spect. F, A2.
52. In Monoceros. Sep. & p.a. increasing. Spect. A0.
53. In Monoceros. Position angle slightly increasing. Spect. A0, A0.
54. In Canis Minor. Relatively fixed. Spect. A0.
55. In Lynx. Position angle increasing. Spect. K2, G5.
56. In Lynx. Relatively fixed. Common proper motion. Spect. F5.
57. In Lynx. Sep. increasing; p.a. decreasing. Spect. K0, K0.
58. In Canis Minor. Relatively fixed. Spect. G5, G0.
59. In Monoceros. Common proper motion; p.a. decreasing. Spect. F5.
60. In Canis Minor. Relatively fixed. Common proper motion. Spect. A2, G0.
61. In Lynx. Position angle decreasing. Spect. K2, F8.
62. In Puppis. Relatively fixed. Spect. A5IV.
63. 22 Lyncis. Separation increasing. Spect. F6V.
64. In Canis Minor. Relatively fixed. Spect. G5.
65. In Monoceros. Position angle decreasing.
66. Castor or 66 Geminorum. Sep. increasing; p.a. decreasing. Spect. A0, A2V.
67. In Lynx. Sep. & p.a. decreasing. Spect. F5, F5.
68. In Gemini. Relatively fixed. Common proper motion. Spect. A6III, A5.
69. In Puppis. Relatively fixed. Common proper motion. Spect. K0III, K0III.
70. Zeta or 16 Cancri. Sep. increasing; p.a. decreasing. Spect. G0, G0V.
71. In Lynx. Sep. & p.a. increasing. Spect. K5III, K.
72. Phi 1 or 22 Cancri. Separation increasing. Spect. K5III.

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73. In Lynx. Sep. & p.a. increasing. Spect. K3V, G5.
74. 67 Cancri. Sep. & p.a. increasing. Spect. A8V, K7.
75. In Ursa Major. Sep. decreasing; p.a. increasing. Spect. K2, K2.
76. In Ursa Major. Separation decreasing. Spect. K0III, F8.
77. Gamma or 41 Leonis. Sep. & p.a. increasing. Spect. K0III.
78. In Leo. Sep. increasing; p.a. decreasing. Spect. K0, K0.
79. 57 Ursae Majoris. Separation decreasing. Spect. A2V, K0.
80. In Ursa Major. Position angle slightly increasing. Spect. A0, K2.
81. In Virgo. Relatively fixed. Common proper motion. Spect. G5V, G5V.
82. In Coma Berenices. Sep. increasing; p.a. decreasing. Spect. G2III, G5.
83. In Bootes. Position angle increasing. Spect. K4V, K6V.
84. In Virgo. Sep. & p.a. increasing. Spect. F8V, F8.
85. In Virgo. Common proper motion. Spect. F8, F8.
86. In Virgo. Common proper motion; p.a. increasing. Spect. G0V, G0V.
87. In Virgo. Relatively fixed. Spect. G5III, F5.
88. Xi or 37 Bootis. Sep. & p.a. decreasing. Spect. G8II, K5V.
89. In Serpens. Relatively fixed. Common proper motion. Spect. G1V, G5V.
90. In Libra. Common proper motion; p.a. decreasing. Spect. G0, G0.
91. Delta or 13 Serpentis. Sep. increasing; p.a. decreasing. Spect. F0IV, F0IV.
92. In Hercules. Position angle increasing. Spect. G9V.
93. Sigma or 17 Coronae Borealis. Sep. & p.a. increasing. Spect. G0V, G1V.
94. In Corona Borealis. Sep. & p.a. decreasing. Spect. A4V, A2.
95. In Hercules. Common proper motion; p.a. decreasing. Spect. K0, K0.
96. In Hercules. Common proper motion. Relatively fixed?
97. In Hercules. AB = cpm. AC = p.a. decreasing. Spect. F2V, F0, F0.