# Divinus Lux Observatory Bulletin: Report #12

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**Abstract:** This report contains theta/rho measurements from 98 different double star systems. The time period spans from 2007.570 to 2007.748. 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.

In my previous article, I made a reference to the work of Charles Lada in regards to the frequency of the occurrences of binary star systems. As a postscript to my eleventh report, I might also mention that as I have been working with the double star listings in the WDS catalog, I've noticed that a substantial number of these doubles appear to be optical in nature. This assessment is based upon the divergent proper motions of the various pairs that I have measured over the past several years. Because of the importance of trying to avoid filling the WDS catalog with even more such listings, it should probably become standard practice to submit only doubles, which display an apparent common proper motion, as new possible pairs. As is well known, while common proper motion is not a sufficient condition, it is a necessary condition in determining whether a given double star is also binary in nature.

Many of the existing optical double listings were submitted during the 19th and early 20th centuries when the proper motions of many of the stars were unknown. Hence, it would not be appropriate to be overly critical about the cataloging of these double stars in the past. However, with the resources that are now currently available, most of the obvious optical doubles can, and probably should be, identified as such and not be submitted as new double stars. For this reason, I have realized the necessity to become more meticulous with my own research in this regard.

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.

Consistent with previous reports, several double stars are being highlighted, in this article, for significant theta/rho shifts resulting from proper motion by one or both of the components. To begin with, a decrease of 3.5% in the rho value, for BU 680 AC, appears to have occurred since 1985. Proper motion by the "A" component is responsible for this. Secondly, proper motion by the reference point star, for HJ 951, has caused a 3.5% increase in the rho value since 1997. Thirdly, a combination of only one set of published measurements in 1925 and proper motion by both components, in regards to STF 2952 AC, has caused significant variances from current measurements. The rho value has decreased by almost 34" and the theta value has increased by about 14.5 degrees. The 1925 measurements may have been inaccurate because the proper motion vectors indicate that the theta value should be decreasing. Next, proper motion, mostly by the companion star, for SKF 16, is responsible for an increase of 8.5 degrees in the theta

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value since 1981. Similarly, proper motion by the companion star has caused a rho value shift in regards to B 1918. An increase of 6.5% has been measured since the 1998 listing was published. Lastly, a large proper motion by the reference point star, for LDS 3346, has been responsible for a 4 degrees increase in the theta value and a 2.7% increase in the rho value, since 1998.

Regarding H 18 AD, it is apparent that a large proper motion by the "A" component has caused significant increases in the rho parameter since the first measurements were performed in 1781. However, the 1998 rho values in the 2001.0 and the 2006.5 versions of the WDS catalog differ by 4 seconds. Consequently, the rho value in the table shows a 4% increase over the value listed in the 2001.0 catalog, but the table value is 1.9% less than the rho value in the 2006.5 catalog. Since the rho value is increasing at a rate of approximately .06" per year, one or both of the catalog versions appear to be in error. The 1781 rho value could also be inaccurate. These components were measured several times because the rho value in the table is not in good agreement with the rho values in either of the catalogs, based upon the rate of a .06" increase per year. Perhaps additional measurements would help to bring more accuracy to this rho value.

Proper motions in opposite directions, by both components of two optical double stars, are responsible for noteworthy increases in the rho values for these systems. In regards to STF 85 AB, the rho value has increased by 2.4% since 1998. For H 12 AD, the rho value has increased by 3.5%, or 9.5 arc seconds, since 1923. In this second case, the passage of over 80 years, since the 1923 measurement was published, has contributed to this large increase in the rho value.

In contrast to the systems mentioned above, orbital motion appears to be the cause for an increase of 2.5 degrees in theta value, for STT 547 AB, since 1998. These components share a common proper motion

Because of the paucity of measurements that exist for LMP 23 AB-C, and those having been made over 35 years ago, the theta measurement appearing in the table departs significantly from the catalog value. Hence, a difference of 9 degrees is being reported from the last published measurement in 1970. While the proper motion vector for the "C" component suggests that the theta value should be increasing, the value in the table is less than the 1970 value. Additional measurements might help to establish accurate values for both the theta and rho parameters.

Two possible common proper motion pairs, which do not appear to have been previously cataloged, are also listed in the table. The first one, identified as ARN 98 (21578+5234), is located near the STT 456 multiple star system in Cygnus. The second, listed as ARN 99 (22843+4524), can be found near HJ 1815 in Lacerta.

Some errors, which have appeared in the WDS catalog, are also being noted. First of all, regarding BU 696 AD and AE, the theta/rho measurements have been listed between the wrong components. The "AD" measurements that are listed in the catalog are actually for "CD" and the "AE" values represent measurements for "AD." No "E" component exists for this quadruple star system. Also being noted is a quadrant flip, which appears to have occurred, for the 1998 theta measurements pertaining to ROE 59 AC. A value of 15 degrees would be needed, rather than 195 degrees, in order for the orientation of the theta value of the "AB" components to remain at 213 degrees. The theta value of the "AC" components is listed as 13 degrees for measurements published in 1902.

Next, two double stars have been identified that have coordinates that are slightly different from what are listed in the catalog. The first one, CHE 435, is located near 23067-0412 rather than the listed coordinates of 23072-0411. This matches the coordinates for HJ 978 and the theta/rho measurements for CHE 435 also closely match those for HJ978. Hence, CHE 435 appears to be a duplication of HJ 978 should probably be removed from the WDS catalog. The second double star that has a coordinate variance from the catalog listing is HJ 1808. The catalog coordinates are listed as 22454+4903, but this pair appears closer to the coordinates of 22464+4903. In this case, HJ 1808 is not a duplicate entry, but the coordinate variance might partially explain the reason for only one set of published measurements appearing in the catalog, with those being in 1901.

*Table begins on next page.*

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| NAME | RA DEC | MAGS | PA | SEP | DATE | N | NOTES |
|---|---|---|---|---|---|---|---|
| STF2769 | 21105+2227 | 6.7 7.4 | 300.9 | 18.27 | 2007.608 | 1n | 1 |
| SKF 16 | 21245+1003 | 10.0 10.2 | 59.5 | 53.82 | 2007.608 | 1n | 2 |
| ES 35 AC | 21406+5419 | 8.6 10.7 | 29.1 | 21.23 | 2007.608 | 1n | 3 |
| ARN 98** | 21578+5234 | 10.1 10.5 | 264.9 | 35.55 | 2007.608 | 1n | 4 |
| HJ 951 | 22014+3243 | 9.5 10.5 | 60.5 | 12.84 | 2007.608 | 1n | 5 |
| STT 228 AB | 22019+0446 | 8.0 9.8 | 23.3 | 85.91 | 2007.608 | 1n | 6 |
| S 802 AB | 22024-1658 | 7.1 7.1 | 246.0 | 3.95 | 2007.608 | 1n | 7 |
| BU 696 AC | 22045+1551 | 7.7 8.9 | 322.1 | 63.20 | 2007.570 | 1n | 8 |
| BU 696 AD | 22045+1551 | 7.7 9.9 | 3.0 | 120.97 | 2007.570 | 1n | 8 |
| STF2887 | 22173-0042 | 9.8 9.8 | 29.6 | 7.90 | 2007.570 | 1n | 9 |
| HO 615 AB | 22213+2820 | 4.8 10.7 | 128.7 | 71.10 | 2007.570 | 1n | 10 |
| STF2910 | 22282+2332 | 9.0 9.6 | 332.3 | 5.43 | 2007.570 | 1n | 11 |
| STF2915 | 22326+0725 | 9.4 9.5 | 126.5 | 14.81 | 2007.570 | 1n | 12 |
| HJ 1808 | 22464+4903 | 10.5 10.5 | 317.8 | 10.86 | 2007.608 | 1n | 13 |
| ARN 99** | 22483+4524 | 8.4 10.4 | 229.4 | 37.53 | 2007.608 | 1n | 14 |
| STF2945 | 22497+3119 | 9.0 9.1 | 299.7 | 3.95 | 2007.570 | 1n | 15 |
| STF2952 AB | 22542+2801 | 7.7 10.4 | 138.3 | 17.28 | 2007.608 | 1n | 16 |
| STF2952 AC | 22542+2801 | 7.7 10.4 | 244.4 | 165.90 | 2007.608 | 1n | 16 |
| BU 847 | 22546+2020 | 9.0 10.3 | 35.0 | 6.91 | 2007.570 | 1n | 17 |
| STT 485 AB | 23027+5514 | 6.5 10.1 | 48.1 | 18.76 | 2007.647 | 1n | 18 |
| STT 485 AC | 23027+5514 | 6.5 10.4 | 79.9 | 56.29 | 2007.647 | 1n | 18 |
| STT 242 | 23065+4655 | 7.8 8.6 | 31.1 | 79.99 | 2007.647 | 1n | 19 |
| CHE 435 | 23072-0411 | 9.2 10.7 | 288.9 | 14.81 | 2007.573 | 1n | 20 |
| STF2978 | 23075+3250 | 6.3 7.4 | 143.8 | 8.39 | 2007.647 | 1n | 21 |
| LMP 23 AB-C | 23096+0045 | 10.1 10.5 | 89.8 | 238.98 | 2007.647 | 1n | 22 |
| S 825 AB | 23100+3651 | 7.6 8.1 | 319.9 | 66.66 | 2007.647 | 1n | 23 |
| STF2988 | 23120-1156 | 7.8 7.8 | 98.0 | 3.46 | 2007.647 | 1n | 24 |
| STT 494 | 23208+2158 | 8.2 8.7 | 82.0 | 3.46 | 2007.647 | 1n | 25 |
| STF 3007 AC | 23228+2034 | 6.7 10.7 | 306.3 | 99.74 | 2007.647 | 1n | 26 |
| LDS 816 A-BC | 23328-1651 | 8.6 10.6 | 352.3 | 338.71 | 2007.573 | 1n | 27 |
| STF 3028 | 23386+3502 | 7.1 10.0 | 200.3 | 14.81 | 2007.573 | 1n | 28 |
| HJ 991 AB | 23417+2226 | 10.4 10.7 | 342.3 | 16.79 | 2007.573 | 1n | 29 |
| H 24 | 23460-1841 | 5.6 6.4 | 135.8 | 6.91 | 2007.647 | 1n | 30 |

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| NAME | RA DEC | MAGS | PA | SEP | DATE | N | NOTES |
|---|---|---|---|---|---|---|---|
| STF3040 | 23481+1009 | 9.5 9.7 | 217.8 | 4.44 | 2007.573 | 1n | 31 |
| STT 252 | 23549+2929 | 6.8 8.2 | 145.2 | 110.60 | 2007.647 | 1n | 32 |
| STI1248 | 00004+6026 | 10.3 10.7 | 48.4 | 12.34 | 2007.630 | 1n | 33 |
| STT 254 AB | 00013+6021 | 7.0 8.3 | 89.4 | 57.77 | 2007.707 | 1n | 34 |
| STT 254 Aa | 00013+6021 | 7.0 9.4 | 324.4 | 155.04 | 2007.707 | 1n | 34 |
| STT 254 Bb | 00013+6021 | 8.3 10.3 | 129.6 | 133.31 | 2007.707 | 1n | 34 |
| TOB 9 | 00040+4942 | 9.0 9.8 | 25.9 | 43.94 | 2007.630 | 1n | 35 |
| STT 547 AB | 00057+4549 | 8.8 9.0 | 184.5 | 5.93 | 2007.685 | 1n | 36 |
| STT 547 AF | 00057+4549 | 8.8 10.0 | 253.8 | 327.85 | 2007.685 | 1n | 36 |
| STF 1 | 00089+3713 | 8.9 10.7 | 285.9 | 9.88 | 2007.685 | 1n | 37 |
| ES 928 | 00093+5324 | 9.9 10.6 | 17.9 | 8.39 | 2007.630 | 1n | 38 |
| HJ 1944 | 00132-1711 | 7.5 9.0 | 335.1 | 66.16 | 2007.630 | 1n | 39 |
| ROE 59 AC | 00138+4648 | 10.4 10.7 | 15.2 | 104.68 | 2007.630 | 1n | 40 |
| HJ 1959 | 00226+2140 | 9.0 10.7 | 285.9 | 27.16 | 2007.630 | 1n | 41 |
| STT 11 | 00307+3208 | 7.5 7.7 | 318.5 | 197.50 | 2007.685 | 1n | 42 |
| STT 13 AB | 00318+3658 | 8.2 10.6 | 131.8 | 6.42 | 2007.630 | 1n | 43 |
| STT 13 AD | 00318+3658 | 8.2 10.6 | 174.3 | 42.46 | 2007.630 | 1n | 43 |
| H 18 AD | 00405+5632 | 2.2 8.8 | 281.8 | 68.14 | 2007.685 | 1n | 44 |
| LDS3195 AB | 00446-1856 | 10.7 10.2* | 242.0 | 146.64 | 2007.630 | 1n | 45 |
| ES 446 | 00458+4951 | 8.6 10.7 | 256.6 | 13.83 | 2007.630 | 1n | 46 |
| BU 232 AB-C | 00504+5038 | 8.4 9.9 | 298.6 | 24.69 | 2007.630 | 1n | 47 |
| STF 85 AB | 01044-0518 | 8.6 10.5 | 157.9 | 36.04 | 2007.707 | 1n | 48 |
| STF 88 AB | 01057+2128 | 5.3 5.5 | 159.3 | 29.63 | 2007.707 | 1n | 49 |
| STF 90 AB | 01058+0455 | 6.4 7.2 | 84.3 | 33.08 | 2007.707 | 1n | 50 |
| STF 91 | 01072-0144 | 7.4 8.6 | 316.0 | 4.44 | 2007.707 | 1n | 51 |
| BU 236 | 01121+4700 | 9.1 9.2 | 113.9 | 5.43 | 2007.633 | 1n | 52 |
| SKI 1 | 01121-1338 | 9.1 10.0 | 250.8 | 8.39 | 2007.707 | 1n | 53 |
| STF 97 | 01122+5132 | 8.7 9.1 | 102.1 | 4.44 | 2007.633 | 1n | 54 |
| STF 111 | 01180-0420 | 9.4 10.5 | 329.1 | 20.74 | 2007.633 | 1n | 55 |
| HJ 2039 AB-C | 01220-0927 | 9.1 10.6 | 244.1 | 51.35 | 2007.633 | 1n | 56 |
| STT 16 | 01227+1712 | 7.2 10.1 | 137.1 | 71.10 | 2007.633 | 1n | 57 |
| GAL 307 A-BC | 01230-1258 | 7.8 10.4 | 313.0 | 40.49 | 2007.633 | 1n | 58 |
| ES 759 | 01348+5209 | 10.5 10.7 | 91.0 | 10.37 | 2007.707 | 1n | 59 |

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| NAME | RA DEC | MAGS | PA | SEP | DATE | N | NOTES |
|---|---|---|---|---|---|---|---|
| STT 20 AB | 01376+2233 | 7.8 8.8 | 315.7 | 88.88 | 2007.633 | 1n | 60 |
| GAL 312 | 01434-1127 | 9.1 10.7 | 326.8 | 43.45 | 2007.633 | 1n | 61 |
| STF 162 Aa-D | 01493+4754 | 6.5 9.9 | 96.0 | 138.74 | 2007.633 | 1n | 62 |
| STF 179 | 01532+3719 | 7.5 8.1 | 160.0 | 3.46 | 2007.685 | 1n | 63 |
| GAL 315 | 01572-1015 | 6.4 10.6 | 133.8 | 29.63 | 2007.707 | 1n | 64 |
| H 12 AB | 01579+2336 | 4.8 6.6 | 47.2 | 37.53 | 2007.707 | 1n | 65 |
| H 12 AD | 01579+2336 | 4.8 9.8 | 84.7 | 270.58 | 2007.707 | 1n | 65 |
| S 409 AB | 01581+4123 | 7.6 9.6 | 83.2 | 28.64 | 2007.685 | 1n | 66 |
| BAL 9 | 02003-0138 | 9.8 10.3 | 336.3 | 5.93 | 2007.652 | 1n | 67 |
| LDS3346 | 02076-0037 | 6.9 10.5 | 342.1 | 81.47 | 2007.748 | 1n | 68 |
| STF 215 | 02091+4048 | 9.0 10.3 | 60.2 | 19.75 | 2007.748 | 1n | 69 |
| STF 227 | 02124+3018 | 5.2 6.6 | 69.0 | 3.95 | 2007.748 | 1n | 70 |
| ES 1306 | 02234+4441 | 10.3 10.5 | 275.1 | 9.38 | 2007.652 | 1n | 71 |
| B 1918 | 02244-1810 | 8.8 9.8 | 116.9 | 5.43 | 2007.726 | 1n | 72 |
| HJ 1240 | 02258-1038 | 8.0 10.3 | 265.2 | 10.86 | 2007.652 | 1n | 73 |
| HJ 2137 | 02283+4314 | 9.1 10.6 | 132.7 | 27.65 | 2007.652 | 1n | 74 |
| MLB1061 AC | 02324+3905 | 10.0 10.7 | 311.3 | 24.69 | 2007.652 | 1n | 75 |
| AG 303 AB | 02340+4409 | 10.2 10.7 | 292.4 | 15.80 | 2007.652 | 1n | 76 |
| AG 42 | 02343+4017 | 9.0 9.5 | 143.8 | 6.42 | 2007.748 | 1n | 77 |
| BAL 279 | 02425-0119 | 10.0 10.2 | 41.4 | 5.93 | 2007.668 | 1n | 78 |
| STF 300 | 02446+2928 | 7.9 8.0 | 314.5 | 3.46 | 2007.748 | 1n | 79 |
| STF 307 AB | 02507+5554 | 3.7 8.5 | 302.2 | 28.64 | 2007.748 | 1n | 80 |
| ROE 67 AB | 02517+3854 | 8.9 10.6 | 129.8 | 26.66 | 2007.652 | 1n | 81 |
| GAL 79 | 02535-1151 | 10.5 10.7 | 354.4 | 5.93 | 2007.652 | 1n | 82 |
| STF 330 | 02572-0034 | 7.2 9.0 | 192.4 | 8.89 | 2007.652 | 1n | 83 |
| A 208 AC | 02584-0135 | 8.9 10.7 | 279.2 | 133.81 | 2007.652 | 1n | 84 |
| AG 305 | 03063+5100 | 10.2 10.3 | 100.4 | 11.36 | 2007.726 | 1n | 85 |
| ALI 514 | 03113+3805 | 10.7 10.7 | 209.8 | 11.85 | 2007.726 | 1n | 86 |
| ES 1310 AD | 03131+4440 | 10.4 9.0* | 234.8 | 98.26 | 2007.726 | 1n | 87 |
| STF 372 AB | 03193+4559 | 10.1 10.5 | 291.6 | 7.90 | 2007.726 | 1n | 88 |
| HJ 3246 AC | 03207+1736 | 9.9 9.9 | 138.3 | 172.81 | 2007.726 | 1n | 89 |
| STF 378 | 03245+5826 | 9.5 10.6 | 314.2 | 18.76 | 2007.726 | 1n | 90 |
| STF 384 AC | 03285+5954 | 7.9 10.6 | 341.9 | 116.53 | 2007.726 | 1n | 91 |

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|---|---|---|---|---|---|---|---|
| KR 20 | 03309+5558 | 9.9 10.3 | 297.7 | 7.41 | 2007.726 | 1n | 92 |
| BU 532 AC | 03332-1003 | 8.6 7.3* | 310.9 | 79.99 | 2007.726 | 1n | 93 |
| STF 417 | 03335-0233 | 8.7 10.6 | 180.3 | 25.68 | 2007.726 | 1n | 94 |
| SMA 37 AB | 03339+4351 | 9.5 10.7 | 287.8 | 31.60 | 2007.726 | 1n | 95 |
| ROE 76 AC | 03340+4048 | 9.1 10.5 | 156.1 | 87.39 | 2007.726 | 1n | 96 |
| HJ 3583 | 03377-2028 | 10.2 10.5 | 86.8 | 11.85 | 2007.726 | 1n | 97 |
| HJ 2201 | 03412-0517 | 8.3 10.7 | 41.7 | 38.51 | 2007.726 | 1n | 98 |

* Companion star is the brighter component.
** Not listed in the WDS CATALOG.

Notes

1. In Vulpecula. Relatively fixed. Spect. A1V, A4V.
2. In Equuleus. Sep. decreasing; p.a. increasing. Spect. K3.
3. In Cygnus. Sep. increasing. Spect. M8, A.
4. In Cygnus. Possible common proper motion. Near STT 456 system.
5. In Pegasus. Sep. increasing; p.a. decreasing. Spect. F5.
6. In Pegasus. Sep. increasing; p.a. decreasing. Spect. G5, G0.
7. In Aquarius. Sep. dec.; p.a. inc. Common proper motion. Spect. A2V, A2V.
8. In Pegasus. AC = Sep. & p.a. inc. AD = p.a. inc. Spect. AC = G0V, K0.
9. In Aquarius. Common proper motion; p.a. increasing. Spect. K0.
10. 32 Pegasi. Slight increase in position angle. Spect. B9III.
11. In Pegasus. Common proper motion; p.a. decreasing. Spect. K0IV, K0IV.
12. In Pegasus. Sep increasing; p.a. decreasing. Spect. F0, F0.
13. In Lacerta. Sep. & p.a. increasing.
14. In Lacerta. Possible common proper motion. Near HJ 1815. Spect. B8, A0.
15. In Pegasus. Position angle increasing. Spect. F0, F0.
16. In Pegasus. AB = c.p.m.; p.a. inc. AC = sep. dec. Spect. AB = F8V, F8V.
17. In Pegasus. Common proper motion; p.a. decreasing. Spect. G5.
18. In Cassiopeia. AB = sep. & p.a. dec. AC = sep. inc. Spect. B9III.
19. In Andromeda. Relatively fixed. Spect. B3, B9.
20. In Aquarius. Relatively fixed. Common proper motion. Spect. F2.
21. In Pegasus. Common proper motion; p.a. decreasing. Spect. A3V, A3.
22. In Pisces. Position angle decreasing. Spect. G2.
23. In Andromeda. Relatively fixed. Spect. K2, K2.
24. In Aquarius. Common proper motion; p.a. decreasing. Spect. G8III, G8III.

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25. In Pegasus. Relatively fixed. Spect. F0, F0.
26. In Pegasus. Sep. increasing; p.a. decreasing. Spect. G2V.
27. In Aquarius. Relatively fixed. Common proper motion. Spect. K5.
28. In Andromeda. Sep. & p.a. decreasing; common proper motion. Spect. A2, A2.
29. In Pegasus. Position angle decreasing.
30. 107 Aquarii. Common proper motion; sep. inc.; p.a. dec. Spect. F2V, F2V.
31. In Pegasus. Relatively fixed. Common proper motion. Spect. F5, F5.
32. In Pegasus. Slight increase in position angle. Spect. B9, K0.
33. In Cassiopeia. Sep. decreasing; p.a. increasing. Spect. K0, K.
34. In Cassiopeia. AB, Aa, & Bb = sep. slightly dec. Spect. A, B, a = N1, B5, G5
35. In Cassiopeia. Position angle decreasing. Spect. F0, A2.
36. In Andromeda. A, B, & F = cpm. AB = p.a. increasing. Spect. K6, M0, M2.
37. In Andromeda. Relatively fixed. Spect. A5.
38. In Cassiopeia. Relatively fixed. Common proper motion.
39. In Cetus. Separation increasing; p.a. decreasing. Spect. K0, G0.
40. In Andromeda. Position angle slightly increasing.
41. In Andromeda. Sep. increasing; common proper motion. Spect. K2, G5.
42. In Andromeda. Relatively fixed. Common proper motion. Spect. F2, F5.
43. In Andromeda. AB & AD = sep. inc.; p.a. dec. Spect. AB = G0, G0.
44. Alpha or 18 Cassiopeiae. Sep. & p.a. increasing. Spect. K0III, K0.
45. In Cetus. Sep. & p.a. increasing. Spect. M2.
46. In Cassiopeia. Separation increasing. Spect. K5.
47. In Cassiopeia. Sep. decreasing; p.a. increasing. Spect. F5, G.
48. In Cetus. Separation increasing. Spect. G0.
49. Psi or 74 Piscium. Common proper motion; p.a. dec. Spect. B9.5V, A0V.
50. 77 Piscium. Relatively fixed. Common proper motion. Spect. F3V, F5V.
51. In Cetus. Sep. increasing; p.a. decreasing. Spect. F9V, F5.
52. In Andromeda. Separation increasing. Spect. A0.
53. In Cetus. Common proper motion. Sep. & p.a. slightly dec. Spect. F0, A8V.
54. In Cassiopeia. Relatively fixed. Common proper motion. Spect. A0, A0.
55. In Cetus. Relatively fixed. Common proper motion. Spect. F7.
56. In Cetus. Sep. & p.a. increasing. Spect. F0.
57. In Pisces. Separation increasing. Spect. F5V, F2.
58. In Cetus. Relatively fixed. Common proper motion. Spect. K0IV.
59. In Perseus. Relatively fixed. Spect. G5.
60. In Pisces. Sep. decreasing; p.a. increasing. Spect. F6V, F5.
61. In Cetus. Sep. increasing; p.a. decreasing. Spect. G0, G0.
62. In Perseus. Separation increasing. Spect. A2, F8.

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63. In Andromeda. Relatively fixed. Common proper motion. Spect. F2V, F5.
64. In Cetus. Position angle slightly increasing. Spect. G5IV.
65. In Aries. AB = relfix; cpm. AD = sep.inc. Spect. F0IV, F7V, K0.
66. In Andromeda. Sep. & p.a. increasing. Spect. G5, G5.
67. In Cetus. Common proper motion; p.a. slightly increasing. Spect. F8, F8.
68. In Cetus. Sep. & p.a. increasing. Spect. G2V, K.
69. In Andromeda. Sep. & p.a. slightly increasing. Spect. F2V.
70. 6 Trianguli. Common proper motion; p.a. decreasing. Spect. G0III, F5V.
71. In Andromeda. Position angle slightly decreasing.
72. In Cetus. Sep. & p.a. increasing. Spect. G0, G5.
73. In Cetus. Sep. & p.a. increasing. Spect. F5.
74. In Andromeda. Sep. increasing; p.a. decreasing. Spect. F0.
75. In Andromeda. Sep. increasing; p.a. decreasing. Spect. G3V.
76. In Andromeda. Relatively fixed. Common proper motion. Spect. K3III, A2.
77. In Andromeda. Sep. increasing. p.a. decreasing. Spect. A2.
78. In Cetus. Common proper motion; p.a. increasing. Spect. G0, G0.
79. In Aries. Common proper motion; sep. & p.a. increasing. Spect. F0IV, F0.
80. Eta or 15 Persei. Sep. & p.a. slightly increasing. Spect. M3I, A0.
81. In Perseus. Sep. increasing; p.a. decreasing. Spect. F8.
82. In Eridanus. Common proper motion; p.a. decreasing.
83. In Cetus. Relatively fixed. Common proper motion. Spect. G8III, G8III.
84. In Eridanus. Sep. & p.a. decreasing. Spect. F0.
85. In Perseus. Relatively fixed. Common proper motion. Spect. F2, F2.
86. In Perseus. Relatively fixed. Common proper motion.
87. In Perseus. Sep. increasing; p.a. decreasing. Spect. K0.
88. In Perseus. Relatively fixed. Common proper motion. Spect. A9V, F0.
89. In Aries. Separation decreasing.
90. In Camelopardus. Relatively fixed. Common proper motion. Spect. B8, A.
91. In Camelopardus. Position angle increasing. Spect. F8.
92. In Camelopardus. Relatively fixed. Spect. A2.
93. In Eridanus. Relatively fixed. Common proper motion. Spect. F2, A3.
94. In Eridanus. Relatively fixed. Common proper motion. Spect. K0.
95. In Perseus. Relatively fixed. Common proper motion. Spect. A0.
96. In Perseus. Sep. & p.a. increasing. Spect. F5, F5.
97. In Eridanus. Relatively fixed. Common proper motion. Spect. F5.
98. In Eridanus. Sep. decreasing; p.a. increasing. Spect. F8.