

Divinus Lux Observatory: Report #16

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Abstract: This report contains theta/rho measurements from 97 different double star systems. The time period spans from 2008.432 to 2008.721. 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.

Occasionally, when the researcher is making rho measurements of known visual binary stars, the desire may emerge to convert the arc second measurements into astronomical units, so that the apparent separation of the binary can be visualized. Fortunately, if the distance to the binary is known with a fair amount of certainty, some algebraic equations exist that can serve as conversion tools, thereby allowing one to obtain a good approximation. As an example of this process, the apparent separation in astronomical units, for STF 1321 AB (09144+5241), will be calculated using a 20.32 cm aperture telescope.

To begin with, the formula $Aau \approx 15r/D$ (Couteau 1981) is applied, in which r = the distance to the system in parsecs and D = the aperture of the telescope in centimeters. Performing the calculation using the value of 6.19 parsecs from the Hipparcos catalog, and 20.32 centimeters for the aperture, a value of 4.57 astronomical units is obtained. This value represents an approximation of the resolving power of the telescope at the distance of 6.19 parsecs.

Tanguay (1998) states that the true resolving power of a telescope is actually represented when the edges of the two Airy disks are in contact, which yields a resolving power value of .75" for a 20 cm telescope. Hence, if one applies the formula $AU = \rho/R \times Aau$ to the current WDS catalog rho value of 17.1" for STF 1321 AB, a value of 104.2 au will be obtained. In this formula, ρ = the rho value (17.1"), R

= the resolving power of the telescope (.75"), and $Aau = 4.57$.

If the researcher substitutes the semi major axis value of 16.73" as presented in Sky Catalog 2000.0 in place of the listed 17.1" rho value, the calculation yields a value of 101.9 au. By utilizing this semi major axis value, along with the listed period of 975 years, and inserting these into the well known formula $M_1 + M_2 = a^3/p^2$ (Newton's form of Kepler's third law), the combined masses of STF 1321 AB can be calculated as 1.11 solar masses. For the sake of comparison, www.solstation.com lists a mass range for this pair at 1.03 to 1.33 solar masses.

In essence, by making some basic calculations like those presented above, the researcher is able to add depth to the data that is being worked with. Even though the researcher could probably locate this information in a publication without having to make the above calculations, this could be one way for making binary star research more fun and interesting. By working through such calculations as these for oneself, a greater appreciation can be gained for some of the methodology that is employed when this type of information does appear in published form.

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 (WDS) Catalog, with published measure-

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ments that are no more recent than ten years ago. Several systems are included from the 2006.5 version of the WDS Catalog as well. While almost all of the theta/rho measurements, in this report, were right in line with catalog values, there were 2 double stars

that displayed noteworthy shifts, which appear in the following table.

First of all, disparate proper motions, by both components of HJ 931, are responsible for decreases of 4% in the rho value and almost 2 degrees for the theta

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| NAME | RA DEC | MAGS | PA | SEP | DATE | NOTES |
|--------------|------------|-----------|-------|--------|----------|-------|
| STF2336 | 18328+1349 | 9.1 10.2 | 8.1 | 6.91 | 2008.432 | 1 |
| STF 37 AB-CD | 18443+3940 | 5.0 5.2 | 173.5 | 209.35 | 2008.432 | 2 |
| STF 37 AI | 18443+3940 | 5.0 10.4 | 137.9 | 150.10 | 2008.432 | 2 |
| STF 39 AB | 18501+3322 | 3.6 6.7 | 149.9 | 45.43 | 2008.432 | 3 |
| BU 293 AE | 18501+3322 | 3.6 10.1 | 317.4 | 67.15 | 2008.432 | 3 |
| BU 293 AF | 18501+3322 | 3.6 10.6 | 18.3 | 85.91 | 2008.432 | 3 |
| BU 52 AB | 19038+2602 | 7.8 10.2 | 297.8 | 51.35 | 2008.432 | 4 |
| STF2522 | 19258+2846 | 7.7 8.8 | 339.0 | 4.44 | 2008.432 | 5 |
| AG 231 | 19296+1800 | 9.9 10.0 | 242.0 | 4.44 | 2008.489 | 6 |
| STF2619 AB | 20011+4816 | 8.8 8.8 | 239.0 | 3.95 | 2008.432 | 7 |
| STF 50 Aa-C | 20136+4644 | 3.8 7.0 | 174.1 | 106.65 | 2008.432 | 8 |
| STF 50 Aa-D | 20136+4644 | 3.8 4.8 | 324.6 | 333.78 | 2008.432 | 8 |
| AG 255 | 20263+3728 | 10.0 10.5 | 286.0 | 4.94 | 2008.489 | 9 |
| STF2697 | 20344-0029 | 7.6 9.8 | 356.8 | 29.63 | 2008.489 | 10 |
| STF2705 AB | 20377+3322 | 7.4 8.0 | 262.0 | 2.96 | 2008.432 | 11 |
| HJ 1601 | 20596+3703 | 10.0 10.4 | 143.2 | 6.42 | 2008.489 | 12 |
| STF2753 | 21050+3526 | 7.4 10.7 | 335.6 | 29.63 | 2008.454 | 13 |
| HJ 275 | 21072+1524 | 8.2 10.5 | 337.4 | 22.22 | 2008.454 | 14 |
| H 47 | 21124-1500 | 8.2 8.2 | 309.5 | 3.95 | 2008.587 | 15 |
| HJ 931 | 21174+3203 | 9.4 10.6 | 358.3 | 9.88 | 2008.587 | 16 |
| STF 433 AC | 21179+3454 | 4.4 10.0 | 183.8 | 21.73 | 2008.454 | 17 |
| FOX 259 | 21195+4253 | 9.9 10.5 | 305.9 | 12.34 | 2008.587 | 18 |
| S 786 | 21197+5303 | 6.8 9.1 | 299.5 | 47.89 | 2008.454 | 19 |
| STF2789 AB | 21200+5259 | 7.6 7.9 | 113.9 | 6.42 | 2008.587 | 20 |

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| NAME | RA DEC | MAGS | PA | SEP | DATE | NOTES |
|--------------|------------|-----------|-------|--------|----------|-------|
| STF2793 AB-C | 21251+0923 | 7.4 9.0 | 241.7 | 26.66 | 2005.454 | 21 |
| WAL 139 AC | 21290+3224 | 9.5 10.3 | 250.9 | 41.48 | 2008.454 | 22 |
| A 770 AB-E | 21308+4827 | 8.7 10.6 | 14.4 | 98.26 | 2008.454 | 23 |
| KU 132 Aa-B | 21334+3058 | 10.1 10.6 | 256.7 | 53.82 | 2008.454 | 24 |
| HO 164 AB | 21410+3504 | 9.4 9.7 | 70.0 | 4.44 | 2008.587 | 25 |
| SCA 92 AC | 21464-0505 | 10.7 10.7 | 252.8 | 82.46 | 2008.454 | 26 |
| STT 455 | 21567+1607 | 8.5 10.2 | 270.9 | 9.88 | 2008.454 | 27 |
| STF2872 A-BC | 22086+5917 | 7.2 8.0 | 315.5 | 21.73 | 2008.508 | 28 |
| STF2867 AB | 22100+0757 | 8.2 9.3 | 208.6 | 10.37 | 2008.508 | 29 |
| HJ 1741 AB | 22112+5049 | 5.4 10.4 | 285.6 | 36.04 | 2008.587 | 30 |
| HJ 1741 AD | 22112+5049 | 5.4 9.9 | 270.9 | 73.57 | 2008.587 | 30 |
| SCA 125 | 22206-0031 | 9.4 10.7 | 70.9 | 103.43 | 2008.495 | 31 |
| SCA 126 | 22218-0150 | 9.7 10.6 | 331.3 | 83.44 | 2008.495 | 32 |
| HJ 965 | 22290+3432 | 8.9 10.1 | 146.2 | 34.07 | 2008.587 | 33 |
| FRK 11 | 22301+4921 | 6.4 10.6 | 90.1 | 66.66 | 2008.495 | 34 |
| STF2917 AB | 22306+5332 | 8.2 8.5 | 70.0 | 4.44 | 2008.508 | 35 |
| ES 1468 | 22342+4341 | 9.2 10.5 | 327.6 | 5.93 | 2008.495 | 36 |
| AG 284 | 22387+3718 | 9.8 9.9 | 230.1 | 26.17 | 2008.495 | 37 |
| CHE 366 | 22416+2947 | 10.0 10.2 | 6.9 | 21.73 | 2008.495 | 38 |
| HJ 1806 | 22451+4449 | 9.2 10.3 | 334.7 | 6.91 | 2008.495 | 39 |
| HDS3229 | 22451+3841 | 8.6 10.6 | 330.3 | 20.24 | 2008.495 | 40 |
| HJ 969 | 22459+3358 | 9.7 10.6 | 25.6 | 5.93 | 2008.508 | 41 |
| STT 480 | 22461+5804 | 7.6 8.6 | 116.5 | 30.61 | 2008.508 | 42 |
| BU 1518 | 22496-1059 | 10.3 10.4 | 204.0 | 6.42 | 2008.587 | 43 |
| STT 597 AB | 22514+1358 | 8.3 10.6 | 327.7 | 201.45 | 2008.508 | 44 |
| STF2949 | 22519+3002 | 9.6 10.6 | 182.9 | 11.36 | 2008.508 | 45 |
| HJ 972 | 22530+3140 | 9.6 10.7 | 207.0 | 28.14 | 2008.508 | 46 |
| STF2696 | 23010+2646 | 8.4 9.7 | 36.0 | 3.95 | 2008.585 | 47 |
| HDS3286 | 23035+4123 | 9.2 10.4 | 353.0 | 17.78 | 2008.585 | 48 |

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| NAME | RA DEC | MAGS | PA | SEP | DATE | NOTES |
|--------------|------------|-----------|-------|--------|----------|-------|
| STT 242 | 23065+4655 | 7.8 8.6 | 31.0 | 79.99 | 2008.585 | 49 |
| HJ 979 | 23083+2207 | 8.8 10.7 | 217.3 | 18.27 | 2008.585 | 50 |
| BU 717 AC | 23177+4901 | 4.8 10.7 | 131.4 | 217.25 | 2008.585 | 51 |
| STT 498 AB | 23313+5225 | 7.6 10.2 | 244.1 | 17.28 | 2008.587 | 52 |
| STF3024 | 23320+4349 | 8.6 9.3 | 309.0 | 4.94 | 2008.587 | 53 |
| BGH 72 | 23323-1337 | 8.6 9.1 | 154.5 | 120.97 | 2008.585 | 54 |
| HJ 1892 | 23341+5947 | 9.6 10.4 | 94.7 | 6.91 | 2008.585 | 55 |
| HJ 1893 | 23350+4731 | 9.6 9.9 | 249.2 | 4.94 | 2008.585 | 56 |
| ES 859 AB | 23375+4832 | 8.3 10.6 | 217.5 | 88.88 | 2008.585 | 57 |
| AG 429 | 23527+2920 | 9.4 10.3 | 270.5 | 6.42 | 2008.587 | 58 |
| AG 296 | 23557+3830 | 10.1 10.2 | 55.2 | 5.93 | 2008.585 | 59 |
| HJ 5435 AB | 23574-1606 | 9.4 10.7 | 8.2 | 14.81 | 2008.585 | 60 |
| STF3049 AC | 23590+5545 | 5.0 10.3 | 66.1 | 106.16 | 2008.585 | 61 |
| HJ 1929 AB-C | 00039+2759 | 8.7 9.5 | 287.4 | 5.43 | 2008.607 | 62 |
| STF3056 AB-C | 00047+3416 | 7.1 9.5 | 3.3 | 25.68 | 2008.607 | 63 |
| STF3056 AB-D | 00047+3416 | 7.1 10.5 | 238.2 | 95.29 | 2008.607 | 63 |
| STF 4 | 00099+0827 | 9.4 9.5 | 275.5 | 5.43 | 2008.607 | 64 |
| STF 3 | 00100+4623 | 7.8 9.0 | 83.0 | 4.94 | 2008.607 | 65 |
| STF 22 AB-C | 00174+0853 | 7.1 7.6 | 234.4 | 3.95 | 2008.607 | 66 |
| STF 78 | 00591+0523 | 10.2 10.4 | 243.1 | 4.94 | 2008.607 | 67 |
| STT 11 AB-C | 01072+3839 | 7.6 8.7 | 164.1 | 59.74 | 2008.609 | 68 |
| STF 101 | 01139-0737 | 7.5 10.2 | 346.5 | 20.74 | 2008.607 | 69 |
| ES 119 AC | 01180+5355 | 8.2 10.7 | 276.8 | 44.44 | 2008.607 | 70 |
| STI1560 | 01192+5821 | 9.9 10.2 | 324.8 | 13.83 | 2008.609 | 71 |
| BU 1102 A-BC | 01274+6017 | 7.9 10.6 | 264.9 | 63.20 | 2008.609 | 72 |
| EGB 1 | 01397+4602 | 9.5 10.4 | 144.6 | 5.93 | 2008.609 | 73 |
| STF 155 AB | 01443+0929 | 7.8 8.0 | 326.0 | 4.94 | 2008.609 | 74 |
| KPR 1 AC | 01443+0929 | 7.8 8.4 | 283.9 | 191.58 | 2008.609 | 74 |
| STF 180 AB | 01535+1918 | 4.5 4.6 | 0.4 | 7.41 | 2008.609 | 75 |

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| NAME | RA DEC | MAGS | PA | SEP | DATE | NOTES |
|--------------|------------|-----------|-------|--------|----------|-------|
| STF 180 AC | 01535+1918 | 4.5 8.5 | 81.6 | 216.26 | 2008.609 | 75 |
| HDS 259 | 01545+5954 | 8.3 10.1 | 211.8 | 16.79 | 2008.609 | 76 |
| ES 2144 | 01567+3505 | 10.1 10.6 | 143.2 | 6.42 | 2008.609 | 77 |
| STI1786 | 02088+5823 | 9.9 10.7 | 321.4 | 15.80 | 2008.626 | 78 |
| STF 225 AC | 02132+5412 | 8.1 10.4 | 160.5 | 152.57 | 2008.626 | 79 |
| ES 764 AB | 02249+5153 | 9.6 10.6 | 62.6 | 35.55 | 2008.626 | 80 |
| STF 293 AD | 02443+5704 | 9.3 8.7* | 343.6 | 187.63 | 2008.626 | 81 |
| HJ 655 | 02476+1014 | 9.1 10.2 | 308.5 | 23.70 | 2008.626 | 82 |
| STF 304 | 02488+4911 | 7.5 10.7 | 289.2 | 26.17 | 2008.626 | 83 |
| AG 55 AB-C | 02502+0641 | 9.9 10.3 | 178.1 | 45.92 | 2008.626 | 84 |
| A 2341 AD | 02544+0946 | 9.6 10.6 | 308.3 | 126.40 | 2008.626 | 85 |
| HJ 2162 AB | 02548+4332 | 10.5 10.7 | 39.5 | 12.84 | 2008.626 | 86 |
| ES 464 | 03213+4743 | 10.1 10.6 | 67.4 | 6.91 | 2008.626 | 87 |
| ARG 55 AB | 03247+4417 | 9.4 10.7 | 199.2 | 26.17 | 2008.721 | 88 |
| SMA 38 | 03348+4408 | 10.2 10.7 | 68.3 | 21.67 | 2008.721 | 89 |
| STF 400 AB-C | 03350+6002 | 6.8 10.7 | 235.8 | 92.33 | 2008.721 | 90 |
| A 1707 AC | 03419+4331 | 7.6 10.4 | 144.9 | 64.68 | 2008.721 | 91 |
| AG 72 | 03428+3016 | 10.4 10.7 | 281.5 | 6.42 | 2008.721 | 92 |
| HL 7 AE | 03449+2407 | 3.7 10.6 | 345.5 | 186.14 | 2008.721 | 93 |
| ES 770 AB | 03494+5214 | 10.2 10.4 | 232.5 | 69.62 | 2008.721 | 94 |
| HDS 486 | 03530+4557 | 8.5 10.2 | 311.1 | 16.75 | 2008.721 | 95 |
| S 440 AB | 03566+5042 | 5.3 10.5 | 30.7 | 75.54 | 2008.721 | 96 |
| STT 68 AB | 03597+4809 | 7.8 9.2 | 176.1 | 39.00 | 2008.721 | 97 |

* Companion star is the brighter component.

Table Notes

1. In Hercules. Separation slightly increasing. Spect. F0.
2. Epsilon Lyrae. AB-CD = sep. inc.; common proper mot. Spect. F1V, A4V.
3. Beta Lyrae. AB, AE, AF = relatively fixed. Spect. AB = B7V, B3.
4. In Lyra. Sep. increasing; p.a. decreasing. Spect. A0.
5. In Cygnus. Relatively fixed. Spect. A0, A0.
6. In Sagitta. Sep. & p.a. increasing. Spect. F8.
7. In Cygnus. Common proper motion; p.a. decreasing. Spect. G5, G5.

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8. 31 Cygni. Aa-C = relatively fixed. Aa-D = p.a. inc. Spect. K0, B9, A2.
9. In Cygnus. Separation slightly decreasing.
10. In Aquila. Sep. & p.a. decreasing. Spect. K2.
11. In Cygnus. Relatively fixed. Common proper motion. Spect. K0.
12. In Cygnus. Separation decreasing. Spect. A2.
13. In Cygnus. Sep. & p.a. decreasing. Spect. F0.
14. In Delphinus. Sep. & p.a. decreasing. Spect. F2II.
15. In Capricornus. Sep. increasing; p.a. decreasing. Spect. G3IV, G3V.
16. In Cygnus. Sep. & p.a. decreasing. Spect. G0, G0.
17. Nu or 66 Cygni. Sep. & p.a. increasing. Spect. B2V
18. In Cygnus. Relatively fixed.
19. In Cygnus. Sep. & p.a. slightly decreasing. Spect. K2, A0.
20. In Cygnus. Common proper motion; separation increasing. Spect. F8V, G5.
21. In Equuleus. Relatively fixed. Common proper motion. Spect. A5IV, F0.
22. In Cygnus. Separation slightly increasing. Spect. A2.
23. In Cygnus. Sep. increasing; p.a. decreasing. Spect. K0.
24. In Cygnus. Relatively fixed. Common proper motion. Spect. F8, G0.
25. In Cygnus. Sep. & p.a. increasing. Spect. K0.
26. In Aquarius. Separation increasing.
27. In Pegasus. Relatively fixed. Common proper motion. Spect. F8, F8.
28. In Cepheus. Relatively fixed. Common proper motion. Spect. B9.5V, A0.
29. In Pegasus. Relatively fixed. Common proper motion. Spect. G5III, G0.
30. In Lacerta. AB & AD = sep. increasing; p.a. decreasing. Spect. AD = A5V, K0.
31. In Aquarius. Position angle decreasing. Spect. K2.
32. In Aquarius. Relatively fixed. Common proper motion.
33. In Pegasus. Sep. & p.a. increasing. Spect. G5.
34. In Lacerta. Sep. increasing; p.a. decreasing. Spect. K2III.
35. In Lacerta. Relatively fixed. Common proper motion. Spect. F0IV, F0IV.
36. In Lacerta. Separation increasing. Spect. A3.
37. In Lacerta. Relatively fixed. Spect. A0, A0.
38. In Pegasus. Position angle decreasing. Spect. G5, F8.
39. In Lacerta. Common proper motion; p.a. decreasing. Spect. F8.
40. In Lacerta. Common proper motion; p.a. decreasing. Spect. A2V, A2V.
41. In Pegasus. Relatively fixed. Common proper motion.
42. In Cepheus. Relatively fixed. Common proper motion. Spect. F8, G0.
43. In Aquarius. Relatively fixed. Spect. F8.
44. In Pegasus. Sep. increasing; p.a. decreasing. Spect. K0.
45. In Pegasus. Relatively fixed. Common proper motion. Spect. F8.
46. In Pegasus. Sep. & p.a. increasing. Spect. F8.
47. In Pegasus. Relatively fixed. Common proper motion. Spect. A5, A5.
48. In Andromeda. Relatively fixed. Common proper motion. Spect. A2, A2.
49. In Andromeda. Relatively fixed. Spect. B3, B9.
50. In Pegasus. Relatively fixed. Common proper motion. Spect. K0, G.
51. 8 Andromedae. Separation slightly decreasing. Spect. M2III.
52. In Cassiopeia. Relatively fixed. Spect. F6V.

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53. In Andromeda. Common proper motion; p.a. decreasing. Spect. A0, A0.
54. In Aquarius. Relatively fixed. Common proper motion. Spect. G5, G0.
55. In Cassiopeia. Separation slightly increasing. Spect. A4I.
56. In Andromeda. Common proper motion; sep. & p.a. increasing. Spect. F0.
57. In Andromeda. Separation slightly decreasing. Spect. K0.
58. In Pegasus. Separation slightly increasing. Spect. F0.
59. In Andromeda. Common proper motion; separation slightly increasing.
60. In Cetus. Relatively fixed. Common proper motion. Spect. G0V.
61. Sigma or 8 Cassiopeiae. Separation decreasing. Spect. B1V.
62. In Pegasus. Sep. increasing; p.a. decreasing. Spect. F8.
63. In Andromeda. AB-C = sep. & p.a. inc. AB-D = sep. dec. Spect. K0.
64. In Pisces. Common proper motion. Sep. dec.; p.a. inc. Spect. G5, G5.
65. In Andromeda. Sep. increasing; p.a. decreasing. Spect. A4V, A3+.
66. In Pisces. Sep. & p.a. slightly decreasing. Spect. F5, F5.
67. In Pisces. Common proper motion; p.a. decreasing. Spect. F8, F8.
68. In Andromeda. Sep. decreasing; p.a. increasing. Spect. F8, A5.
69. In Cetus. Common proper motion; p.a. increasing. Spect. G5.
70. In Cassiopeia. Separation increasing. Spect. A2.
71. In NGC 457 star cluster in Cassiopeia. Increasing p.a. Spect. B2.
72. In Cassiopeia. Separation increasing. Spect. B3I.
73. In Andromeda. Relatively fixed.
74. In Pisces. AB = p.a. dec.; c.p.m. AC = sep. inc. Spect. F2, F5, F0.
75. 5 or γ Arietis. AB = p.a. inc.; sep. dec; c.p.m. AC = sep. dec. Spect. A, B9V, K.
76. In Cassiopeia. Separation increasing. Spect. B9IV, B9IV.
77. In Triangulum. Relatively fixed. Common proper motion.
78. In Perseus. Sep. & p.a. increasing. Spect. B6V.
79. In Perseus. Separation increasing. Spect. A0, G0.
80. In Perseus. Separation slightly decreasing. Spect. B8.
81. In Perseus. Sep. decreasing; p.a. increasing. Spect. K0, A2.
82. In Cetus. Relatively fixed. Common proper motion. Spect. F5.
83. In Perseus. Separation increasing. Spect. A0V.
84. In Cetus. Sep. decreasing; p.a. increasing. Spect. G0.
85. In Cetus. Separation slightly increasing. Spect. G5.
86. In Perseus. Position angle increasing.
87. In Perseus. Relatively fixed. Common proper motion.
88. In Perseus. Relatively fixed. Common proper motion. Spect. F5.
89. In Perseus. Relatively fixed. Common proper motion.
90. In Camelopardus. Relatively fixed. Spect. F3V.
91. In Perseus. Separation decreasing. Spect. G5.
92. In Taurus. Common proper motion; p.a. decreasing. Spect. F8.
93. 17 Tauri. Separation increasing. Spect. B5.
94. In Perseus. Position angle increasing.
95. In Perseus. Sep. increasing; p.a. decreasing. Spect. B9, B9.
96. 43 Persei. Relatively fixed. Common proper motion. Spect. F5IV.
97. In Perseus. Relatively fixed. Common proper motion. Spect. B9.

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value during the past 10 years. Secondly, a decrease in the theta value is also being noted for HJ 1741 AB. Since 1998, a 2.4 degrees shift has occurred because of proper motion by the "A" component.

References

Couteau, Paul, *Observing Visual Double Stars*, (Cambridge: The MIT Press, 1981) p.179.

Sky Catalogue 2000.0, Volume 2, Hirshfeld & Sinnott eds. (Cambridge: Sky Publishing Corporation, 1999) p. 178.

Tanguay, Ronald C., *The Double Star Observer's Handbook*, (Saugus, MA: The Double Star Observer, 1998) p. 62.

