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Abstract: This report contains theta/rho measurements from 85 different double star systems. The time period spans from 2006.345 to 2006.899. 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 previous two articles, in this series, have included a discussion pertaining to the measuring program of 10th magnitude double stars, which has become more of a research priority at Divinus Lux Observatory. As has been mentioned before, many of these pairs have shown up on the "neglected doubles" list, which has been the rationale for targeting 10th magnitude double stars. While this particular emphasis has been in process, it has become apparent that there are many neglected 11th magnitude pairs that are also in great need of current measurements. These pairs appear in the Hipparcos/Tycho star charts, and some of them have been observed in the field of view of my telescope.

Several of these neglected double stars bear the "HJ" prefix, for example, and have not been measured since 1820! I must confess to a degree of frustration when I recover such pairs, because my instrumentation will not allow me to measure 11th magnitude double stars. The illumination from my reticle micrometer overpowers 11th magnitude pairs too intensely to permit these types of measurements with a 20-cm aperture.

Hence, the purpose for pointing this out is to encourage those, with the instrumental capabilities, to consider placing an emphasis upon measuring such pairs. I think that it would be unfortunate if these neglected double stars, which could be easily measured by researchers with larger telescopes, would never receive any attention. An even worse scenario would be for some of these double stars to eventually become lost from the record. As Ron Tanguay has previously stated, since most of the larger observatories are no longer dedicating resources towards this kind of research, it is going to be up to a few dedicated individuals to provide these greatly needed measurements. Because this is the current situation in the field of double star astronomy, I believe that this work could prove to be intrinsically rewarding, all the more, for those who are willing to commit to it.

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. There are also some noteworthy items that are discussed pertaining to the following table.

As has been mentioned in previous articles, this one contains measurements of several pairs that have shown significant theta/rho shifts because of proper motion. To begin with, a decrease in the rho parameter, amounting to 12.3% since 1996, has occurred for HJ 1339. Proper motion by both component stars is responsible for this change. Proper motion by the "A" component, in STF 2424 AB, has also caused a significant parameter shift. In this case, a 2 degrees increase in the theta value has occurred since 1996. In a like manner, proper motion by the reference point star, in S 756, has caused a noticeable parameter shift over the past 10 years. For this double star, a 3.2% increase in the rho value has occurred. In addition, proper motion by the "A" component, in BUP 27 AD, is responsible for a 9.4% decrease in the rho value since 1903.

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An increase of almost 3% in the rho value has also occurred for STF 85 AB, since 1991. Proper motions by both component stars, in opposite directions, are responsible for this shift. Also worthy of mention is that it appears STF 502 AB has displayed a decrease in the theta value of approximately 27 degrees since 1940. Proper motion by the “A” component appears to be the cause. Also pertinent to the STF 502 multiple star system is the fact that the entries in the WDS Catalog, for LDS 5514 AB and LDS 5514BC, seem to be duplications of the components for the STF 502 system. The coordinates, reported parameters, and magnitudes for these two multiple stars match up fairly closely.

Four systems are being noted as having possible anomalous measurements in the WDS catalog. For HJ 1582 AC, the theta/rho measurements that appear in this report more closely match those listed for 1896, rather than for those in 1996. In addition, the rho measurement for HJ 1529 lines up more closely with the listed measurement for 1892 than it does for the 1996 listing. Next, the rho measurement for BLL 51 is more in line with the measurement reported in 1879 than the one in 1996. The Hipparcos/Tycho catalogs seem to confirm the values that are listed in this report for these first three systems. Finally, the rho value in this report, for BU 839 AC, coincides more closely with the 1881 listing than it does for the listing in 1996. However, for this system, the Hipparcos/Tycho catalogs fail to lend support for this observation, even though the proper motion vector for the “A” component suggests a more moderate increase for the rho parameter. Because of these discrepancies, additional measurements by others would help to determine if these deviations are real.

The rho values for three additional double stars might also have anomalous catalog measurements. For KU 64 AB, the rho value in this report, in the Hipparcos/Tycho catalogs, and the 1894 catalog listing, suggest a separation of around 33”.5, which contrasts with the 1996 catalog value of 35”.7. Similarly, in regards to HJ 1834 AD, this report, the Hipparcos/Tycho Catalogs, and an 1895 catalog listing suggest a rho value of around 58”.3, while the 1996 catalog value is 60”.8. Thirdly, the 1996 rho measurement for STF 3037 AC is listed as 39”.5, while this report and the Hipparcos/Tycho catalogs indicate a value of around 27”.65. This rho value is more closely aligned with measurements in 1832 for this common proper motion pair. Once again, additional measurements by others would help in determining accurate rho values for these pairs.

This report lists two divergent theta measurements for which there are no apparent explanations. In regards to S 798AC, the theta measurement in the table is listed as 320.8 degrees, but the other catalogs, referenced above, indicate that this value is 318 degrees. The calibration of the micrometer was rechecked and additional measurements were made, but this discrepancy remained. It would be interesting to know the theta value that might be measured by others. The same comment also pertains to STT 20AB. In this case, the same referenced catalogs indicate a theta value of around 316 degrees, while the measurement listing in this report reflects a value of 318.8 degrees.

Orbital motion may be the cause of shifts in the theta value for two common proper motion pairs. A two degrees decrease is noted for STF 2429 since 1996, and a four degrees decrease has been measured for STF 2481 A-BC during the same time period.

Also included in this report are listings for three possible common proper motion pairs that do not appear to have been previously cataloged. The first, labeled as ARN 87, is located at 01563+3758. This double star appears in the same field of view, at low power, as the ES 228 multiple star system. The second pair, labeled as ARN 88, has coordinates of 01286+1440, and it is located near AG 18. The third double star, designated as ARN 89, can be located at 03150+5436.

One correction to the WDS catalog is also being pointed out. In reference to the STF 1999 system, the catalog theta measurement for the ”AD” components is reversed. The measurement is actually for “DA,” and the “D” component is also the “A” component for the STF 1998 system. Because STF 1998 and STF 1999 are listed as separate systems, and certainly appear that way telescopically, perhaps the “AD” measurement has little utility. This may be especially true since the rho measurement for “AD” is almost 280.0".

A second possible correction to the WDS catalog is being suggested for HJ 1721. The rho measurement listed in this report, and in the Hipparcos/Tycho catalogs, indicate a value of around 12.34” instead of the 17.4” value that is listed in the catalog for 1996. The proper motions of the component stars don’t appear to be large enough to support this larger rho value. Perhaps a typographical error has occurred in this case.

Thirdly, an error exists for the catalog listing

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pertaining to ES 228 AB-C. The theta/rho measurements designated for this system are actually those for the "CD" components, rather than for the "AB-C" components. The current "neglected doubles" listing correctly shows the parameters as belonging to the "CD" components. The table below gives corrected theta/rho values for "AB-C."

Fourth, a typographical error may have also occurred for STF 2982. The rho values in this report, in the Hipparcos/Tycho catalogs, and for the year 1831 all cluster around 32".6. The WDS catalog value for 1996 is listed as 36".6. Because this double star is a relatively fixed pair, it is unlikely that the 1996 listing is valid.

Finally, it appears that HU 1651 (01283+5329) is a quadrant flip of STF 123 AB. The coordinates and magnitudes of the components are the same. Furthermore, the parameters are similar when proper motion and the apparent quadrant flip are taken into account. HU 1651 was last listed as measured in 1902 and does not appear in the table. STF 123 AB was last measured in 2003

NAME	RA DEC	MAGS	PA	SEP	DATE	N	Notes
STF1999 AB	16044-1127	7.4 8.0	98.9	11.85	2006.345	1n	1
STF1999 DA*	16044-1127	4.3 7.4	171.0	278.48	2006.345	1n	1
STF2056	16316+0526	7.7 9.2	313.1	6.91	2006.345	1n	2
STF2085	16424+2136	7.4 9.1	309.7	6.42	2006.345	1n	3
STF2165 AB	17262+2927	7.7 9.4	61.2	9.88	2006.345	1n	4
STF2165 AC	17262+2927	7.7 10.3	250.9	95.79	2006.345	1n	4
STF2246	17554+3930	9.3 10.0	99.8	5.43	2006.345	1n	5
STT 165 AB	18060+0434	8.4 8.5	141.9	66.66	2006.403	1n	6
STF2280 Aa-B	18078+2606	5.8 5.8	183.5	13.83	2006.345	1n	7
HJ 1339	18404+4606	8.5 10.0	321.8	22.71	2006.403	1n	8
STF2429	18584+3625	8.3 9.9	285.2	5.43	2006.403	1n	9
STF2424 AB	18591+1338	5.3 9.3	301.1	19.75	2006.403	1n	10
STF2481 A-BC	19111+3847	8.2 8.3	199.1	4.44	2006.403	1n	11
STF2534	19277+3632	8.2 8.4	65.0	6.91	2006.403	1n	12
STF2552	19379+1922	8.5 9.1	194.9	5.43	2006.460	1n	13
STT 384 AC	19438+3819	7.6 9.8	296.8	59.25	2006.403	1n	14
STT 194	19536+5943	6.1 9.0	356.3	68.14	2006.479	1n	15
STT 390 AB	19551+3012	6.7 9.5	22.2	9.38	2006.403	1n	16
STF2611	19588+4721	8.3 8.4	27.4	5.43	2006.403	1n	17
STF2655 AB	20141+2213	7.9 8.0	2.7	6.42	2006.479	1n	18
STF2655 AC	20141+2213	7.9 10.0	155.5	60.24	2006.479	1n	18
S 756	20313+4913	5.4 10.2	327.2	60.24	2006.460	1n	19
HJ 1529	20334-0613	7.0 10.4	110.2	37.03	2006.460	1n	20
SCJ 26	20348+0514	8.3 10.0	88.5	24.69	2006.460	1n	21
BLL 51	20431+1705	9.4 8.5**	339.4	56.29	2006.479	1n	22

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NAME	RA DEC	MAGS	PA	SEP	DATE	N	Notes
HJ 1582 AC	20498+3833	8.2 10.5	326.0	28.64	2006.460	1n	23
STT 212	20535+3057	7.9 10.1	155.1	65.18	2006.460	1n	24
STF2762 AC	21086+3012	5.7 10.1	229.2	59.25	2006.479	1n	25
STT 216	21143+3418	7.4 8.1	46.7	100.73	2006.479	1n	26
BU 839 AC	21203+4921	8.1 9.6	200.3	21.73	2006.479	1n	27
HJ 1647 AB	21290+2211	5.9 10.2	177.8	41.48	2006.521	1n	28
S 798 AC	21442+0953	2.4 8.7	320.8	144.18	2006.521	1n	29
HJ 1721	22057+2954	7.8 9.3	265.8	12.34	2006.521	1n	30
KU 64 AB	22227+2849	10.1 10.6	159.9	33.58	2006.521	1n	31
STT 232 AB	22235+0351	9.2 9.4	193.8	75.05	2006.597	1n	32
AG 422	22324+5313	9.2 10.0	35.1	9.38	2006.521	1n	33
STF2922 Aa-B	22359+3938	5.7 6.3	185.6	22.71	2006.521	1n	34
A 1469 Aa-D	22359+3938	5.7 9.1	144.8	80.98	2006.521	1n	34
A 1469 Aa-E	22359+3938	5.7 7.2	238.8	333.78	2006.521	1n	34
HJ 1834 AD	22582+3022	8.5 9.5	271.0	58.26	2006.521	1n	35
STF2982	23095+0841	5.1 10.0	197.5	32.59	2006.597	1n	36
STF3037 AC	23461+6028	7.2 9.8	187.1	27.65	2006.655	1n	37
STF3037 AD	23461+6028	7.2 10.7	232.5	51.84	2006.655	1n	37
STF3037 AE	23461+6028	7.2 9.7	63.4	109.61	2006.655	1n	37
STF3039 AB	23469+2825	7.2 9.3	29.8	35.06	2006.597	1n	38
STF3042	23519+3753	7.6 7.7	86.9	5.93	2006.597	1n	39
HJ 1927	00032+4508	9.1 10.1	73.7	10.37	2006.597	1n	40
LDS 860	00096+1145	10.6 10.6	43.6	289.34	2006.879	1n	41
STF 4	00099+0827	9.4 9.5	275.2	5.43	2006.655	1n	42
HDS 44	00203+5412	8.9 10.3	32.1	12.34	2006.597	1n	43
STF 42 AB	00360+2959	8.3 9.0	21.2	6.42	2006.597	1n	44
BUP 9 AD	00473+2416	4.1 10.7	260.2	155.53	2006.879	1n	45
STF 61	00499+2743	6.3 6.3	294.0	4.44	2006.597	1n	46
BU 232 AB-C	00504+5038	8.4 10.0	298.3	25.18	2006.597	1n	47
STF 80 AB	00594+0047	7.6 8.9	337.3	28.64	2006.655	1n	48
STF 85 AB	01044-0518	8.6 10.5	159.1	36.04	2006.655	1n	49
STF 86 AB	01048-0528	8.7 9.2	138.5	16.29	2006.655	1n	50
STF 97	01122+5132	8.7 9.1	101.6	4.44	2006.655	1n	51
ARN 88 *	01286+1440	9.6 10.7	253.4	23.70	2006.885	1n	52

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NAME	RA DEC	MAGS	PA	SEP	DATE	N	Notes
STT 554 AC	01368+4124	4.1 10.3	290.8	271.56	2006.885	1n	53
STT 20 AB	01376+2233	7.8 8.8	318.8	88.88	2006.732	1n	54
HU 531 AB-C	01409+4952	9.8 9.9	280.1	5.93	2006.745	1n	55
HJ 1088	01423+5838	6.4 9.8	169.0	19.75	2006.789	1n	56
STF 176	01495+2842	8.6 10.5	330.5	23.70	2006.885	1n	57
BUP 27 AD	01531+2935	3.4 10.7	174.2	276.50	2006.885	1n	58
HDS 259	01545+5954	8.3 10.1	211.8	16.78	2006.789	1n	59
ARN 87 *	01563+3758	9.0 10.5	284.2	56.29	2006.745	1n	60
ES 228 AB-C	01569+3759	8.9 9.1	192.2	37.53	2006.745	1n	61
PWL 1 AC	02020+0246	4.1 8.2	63.3	404.88	2006.888	1n	62
PWL 1 AD	02020+0246	4.1 8.5	334.5	434.50	2006.888	1n	62
KUI 118	02084+2819	9.9 10.6	181.1	20.74	2006.888	1n	63
STF 239	02174 +2845	7.0 7.8	212.1	13.83	2006.732	1n	64
STF 240	02174+2353	8.3 8.6	52.2	4.94	2006.732	1n	65
KU 76	02235+2623	9.8 10.4	349.4	32.09	2006.888	1n	66
STF 258 AC	02239+3330	7.9 10.1	150.7	71.10	2006.888	1n	67
STF 258 CD	02239+3330	10.1 10.5	30.2	6.42	2006.888	1n	67
STF 280	02341-0538	7.8 7.9	345.6	3.46	2006.732	1n	68
STF 291 AB	02411+1848	7.7 7.5**	119.0	3.46	2006.789	1n	69
STF 291 AC	02411+1848	7.7 9.5	242.1	65.18	2006.789	1n	69
LDS2816	02588+4322	6.6 9.5	281.5	243.91	2006.899	1n	70
STF 336	03015+3225	6.8 8.2	8.0	8.39	2006.732	1n	71
STF 354	03081+2435	9.2 10.4	51.8	35.55	2006.899	1n	72
AG 63 Aa-B	03138+3733	9.8 10.2	127.4	5.43	2006.732	1n	73
ARN 89 *	03150+5436	10.4 10.5	14.7	34.56	2006.899	1n	74
KU 80	03232+2412	10.2 10.4	181.1	27.65	2006.899	1n	75
STF 426 AB	03408+3907	7.8 9.3	343.1	19.75	2006.789	1n	76
STF 434 AB	03440+3822	7.6 8.2	82.8	33.08	2006.789	1n	77
S 437 AB-C	03463+2411	8.1 7.6**	308.3	39.50	2006.789	1n	78
HDS 486	03530+4557	8.5 10.2	311.5	16.79	2006.789	1n	79
STF 502 AB	04112+2630	8.8 10.1	246.3	16.29	2006.803	1n	80
STF 502 BC	04112+2630	10.1 10.1	299.5	10.86	2006.803	1n	80
STF 512	04158+4524	8.7 8.7	217.9	5.43	2006.789	1n	81
BU 86 AB	04158+2331	9.6 10.1	50.5	4.44	2006.789	1n	82

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NAME	RA DEC	MAGS	PA	SEP	DATE	N	Notes
STT 49	04189+0146	7.8 7.8	145.5	100.73	2006.803	1n	83
STF 533AB	04244+3419	7.3 8.5	61.6	19.75	2006.789	1n	84
STF 572AB	04385+2656	7.3 7.2**	189.7	4.44	2006.789	1n	85

* Not listed in WDS CATALOG.

** Companion star is the brighter component.

Notes

1. In Scorpius. AB = cpm; pa. dec. DA = sep. dec. Spect. K0, K0, F8.
2. In Hercules. Common proper motion; p.a. decreasing. Spect. A3, A3.
3. In Hercules. Separation slightly increasing. Spect. A0IV, A0.
4. In Hercules. AB = sep. & p.a. inc. AC = sep. dec. Spect. AB = F0, Am.
5. In Hercules. Position angle decreasing. Spect. G0, G0.
6. In Ophiuchus. Relatively fixed. Spect. K0III, A0.
7. 100 Herculis. Relatively fixed. Common proper motion. Spect. A3V, A3V.
8. In Lyra. Sep. & p.a. decreasing. Spect. M2.
9. In Lyra. Common proper motion; p.a. decreasing. Spect. F0V, F0V.
10. 11 Aquilae. Position angle increasing. Spect. F6IV.
11. In Lyra. Common proper motion; p.a. decreasing. Spect. G6V, G7V.
12. In Cygnus. Position angle increasing. Spect. B9III, A0.
13. In Vulpecula. Relatively fixed. Common proper motion. Spect. A2, A2.
14. In Cygnus. Relatively fixed. Spect. B5V.
15. In Cygnus. Sep. & p.a. decreasing. Spect. A3V.
16. In Cygnus. Relatively fixed. Spect. B6V, B6V.
17. In Cygnus. Relatively fixed. Common proper motion. Spect. K0, K0.
18. In Vulpecula. AB = relfix; cpm. AC = sep. & p.a. inc. Spect. A2V, A0, K.
19. Omega or 46 Cygni. Sep. & p.a. increasing. Spect. M2III, G.
20. In Aquila. Position angle increasing. Spect. M3III.
21. In Delphinus. Sep. & p.a. slightly increasing. Spect. M5, M.
22. In Delphinus. Sep. increasing; p.a. decreasing. Spect. M5, K5.
23. In Cygnus. Relatively fixed. Spect. M
24. In Cygnus. Relatively fixed. Spect. B9V, A5.
25. In Cygnus. Sep. & p.a. increasing. Spect. B9V.
26. In Cygnus. Relatively fixed. Spect. B8, A2.
27. In Cygnus. Sep. slightly increasing; p.a. increasing. Spect. M6III.
28. In Pegasus. Position angle slightly increasing. Spect. M4.
29. Epsilon or 8 Pegasi. Sep. increasing; p.a. decreasing. Spect. K2II, F8.
30. In Pegasus. Sep. increasing; p.a. decreasing. Spect. M0, G.
31. In Pegasus. Relatively fixed. Spect. M5.
32. In Pegasus. Sep. & p.a. increasing. Spect. G5.
33. In Lacerta. Common proper motion. Slight increase in p.a. Spect. M2, M5.
34. 8 Lacertae. Aa-B = relfix. Aa-D & Aa-E = sep. dec. Spect. B2V, A0, A0, F0.
35. In Pegasus. Relatively fixed. Spect. M0, M0.
36. 57 Pegasi. Relatively fixed. Spect M2.

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37. In Cassiopeia. AC = cpm. AD = p.a. inc. AE = relfix. Spect. AE = K0, A0.
38. In Pegasus. Sep. increasing; p.a. decreasing. Spect. M0.
39. In Andromeda. Common proper motion; p.a. slightly dec. Spect. F5V, F5.
40. In Andromeda. Sep. & p.a. decreasing. Spect. F8, F5.
41. In Pisces. Relatively fixed. Spect. G5, G5.
42. In Pisces. Common proper motion; p.a. increasing. Spect. G5, G5.
43. In Cassiopeia. Position angle increasing. Spect. B3, B3.
44. In Andromeda. Sep. inc; p.a. dec.; common proper motion. Spect. G2V, G2V.
45. Zeta or 34 Andromedae. Sep. decreasing; p.a. increasing. Spect. K1II.
46. 65 Piscium. Relatively fixed. Common proper motion. Spect. F5III, F5III.
47. In Cassiopeia. Sep. decreasing; p.a. increasing. Spect. F5, G.
48. In Cetus. Sep. & p.a. increasing. Spect. K0, G5.
49. In Cetus. Separation increasing. Spect. G0.
50. In Cetus. Sep. increasing; p.a. decreasing. Spect. F2.
51. In Cassiopeia. Common proper motion; p.a. slightly inc. Spect. A0, A0.
52. In Pisces. Common proper motion. Spect. K2, F5.
53. 50 Andromedae. Sep. decreasing; p.a. increasing. Spect. F8V, F2.
54. In Pisces. Sep. decreasing; p.a. increasing. Spect. F6V, F5.
55. In Andromeda. Relatively fixed. Common proper motion. Spect. K1V, K1V.
56. In Cassiopeia. Slight increase in p.a. Spect. B7III, B9.
57. In Triangulum. Increase in p.a. Spect. K0III.
58. Alpha or 2 Trianguli. Sep. decreasing. Spect. F6IV.
59. In Cassiopeia. Sep. slightly increasing. Spect. B9IV, B9IV.
60. In Andromeda. Possible common proper motion. Near ES 228. Spect. K0.
61. In Andromeda. Sep. slightly increasing. Spect. G, G.
62. Alpha or 113 Piscium. AC = relfix. AD = sep. dec. Spect. A0, F8, G0.
63. In Triangulum. Relatively fixed. Common proper motion. Spect. G5.
64. In Triangulum. Relatively fixed. Common proper motion. Spect. F5V, G2V.
65. In Aries. Common proper motion; p.a. increasing. Spect. F0, F0.
66. In Aries. Decrease in p.a. Spect. A5, F5.
67. In Triangulum. AC = p.a. inc. CD = p.a. inc., cpm. Spect. A0, G, G.
68. In Cetus. Common proper motion; p.a. decreasing. Spect. K1III, K1III.
69. In Aries. AB = sep. inc. AC = sep. & p.a. inc. Spect. B9.5V, B9, F0.
70. In Perseus. Sep. slightly decreasing. Spect K0, F8.
71. In Perseus. Relatively fixed. Common proper motion. Spect. A7IV, A7IV.
72. In Aries. Sep. increasing; p.a. decreasing. Spect. F5.
73. In Perseus. Relatively fixed. Common proper motion.
74. In Perseus. Possible common proper motion pair.
75. In Aries. Slight increase in p.a. Spect. G5.
76. In Perseus. Common proper motion; p.a. increasing. Spect. A3, A3.
77. In Perseus. Sep. increasing; p.a. decreasing. Spect. K5III, A5.
78. In Taurus. Sep. & p.a. increasing. Spect. A3, K2.
79. Relatively fixed. Spect. B9, B9.
80. In Taurus. AB = p.a. decreasing. BC= p.a. slightly decreasing. Spect. F8V.
81. In Perseus. Common proper motion; p.a. decreasing. Spect. G5, G5.
82. In Taurus. Relatively fixed. Common proper motion. Spect. F5.
83. In Taurus. Separation slightly decreasing. Spect. G5, A2.
84. In Perseus. Relatively fixed. Common proper motion. Spect. B8V, F8V.
85. In Taurus. Sep. increasing; p.a. decreasing. Spect. F2V, F2V.