Ludwig Schupmann Observatory Measures for the Year 2011

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Abstract: Thirty-one CCD measures, of which twenty-one are large Δm pairs, are reported. Doubles of the greatest observational difficulty include Sirius AB (of course) and the highly neglected binary, o UMa (BU 1067AB). This last pair shows direct pa motion of about 5◦ with little change in separation since its discovery in 1889. Other large Δm objects presented challenges as well, and, as in the above mentioned pairs, often required special shaped-pupil masks (in combination with a stellar coronagraph) to removed diffracted light from the region in the pairs' position angle.

1. The Measures

The measures are presented in Table 1 in the conventional manner. From left to right: discoverer's designation, WDS identifier (Epoch 2000 RA&Dec), WDS magnitudes, LSO (Ludwig Schupmann Observatory) position angle in degrees, LSO separation in seconds of arc, decimal date of observation, number of nights the objects was observed and finally a column of brief notes and indicated numbered notes detailing objects of special interest.

Astrometry of the large Δm pairs employed a homemade stellar coronograph (Daley 2007). The telescope employed is a 9-inch Schupmann medial refractor which (in coronograph mode) operates with an effective focal length (EFL) of 164 inches. Measurements of "normal" doubles were made with the coronograph removed and the telescope EFL increased to 286 inches with a Barlow lens. An ST7 CCD camera was used for all measures.

2. Detailed Notes

1. H 6 39 - Components "B" & "C" have only the discovery measure of 1891, so this is a confusing observation. They are both trailing-off almost perfectly parallel to the proper motion vector of the primary with equal position shifts, so are clearly optical.

Component "D" is rather more interesting, as it is showing a large motion since the last measure of 1912. The path is angled widely (53◦) to the proper motion direction of Betelgeuse itself and, when plotted with the first measure, appears slightly concave to the primary suggesting orbital motion. To confirm this will take some years but worth keeping up with!

The very wide component "E" shows a continuing, almost exact, southerly relative motion since discovery. LSO's measure confirms this drift when compared with a year 2000 result.

2. BU 690 - The primary star, μ Cephei, is one of the most extreme stars known with indications that its "surface" would reach almost to Jupiter if it were to replace the Sun. As with the H 6 39 objects above, the two faint Burnham components were measured using LSO's stellar coronagraph. The LSO measure of "B" shows little relative motion with about 1◦ of direct PA change since 1946. Component "C" may be a background star, as a small PA correction in the 1924 measure brings it in line with a trailed-off direction due to the primary's proper motion. Brightness-wise, component "C" was found to be rather faint, consistent with the WDS listed magnitude.

Component "B" is listed as 0.5 magnitudes brighter than "C". However, a direct comparison

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Table 1: LSO Measurements of Double Stars

Discoverer	RA+DEC	Mags	PA	Sep	Date	n	Brief Note
STF 180AB	01535+1918	4.52, 4.58	0.6	7.44	2011.981	1	γ Ari
BUP 64	04363-0321	3.93, 13.3	171.3	51.48	2011.082	1	ν Eri
BUP 66AB	04382+1231	4.3, 13.3	314.2	52.24	2011.082	1	90 Tau
BUP 66AC	04382+1231	4.3, 10.4	309.3	123.14	2011.082	1	
STT 560AB	04498+0658	3.22, 11.31	169.2	73.70	2011.079	1	π3 Ori
DAL 50AC	04498+0658	3.22, 13.1	3.3	22.17	2011.079	1	
STF 14AC	05320-0018	2.41, 6.83	0.2	52.25	2011.216	1	δ Ori
STF 738AB	05351+0956	3.51, 7.45	44.2	4.42	2011.222	1	λ Ori
STF 738AD	05351+0956	3.51, 9.63	271.6	77.50	2011.222	1	
BUP 81	05362-0112	1.7, 10.7	57.6	179.34	2011.085	1	ρ Ori
STF 774AB	05407-0157	1.88, 3.70	164.1	2.34	2011.216	1	ζ Ori
H 6 39AB	05552+0724	0.9, 14.5	113.3	37.99	2011.115	1	Betelgeuse
H 6 39AC	05552+0724	0.9, 14.2	287.5	64.21	2011.115	1	
H 6 39AD	05552+0724	0.9, 13.5	345.0	71.16	2011.115	1	Note 1
H 6 39AE	05552+0724	0.9, 11.0	154.4	175.81	2011.109	1	
H 6 88AB	05595+4457	1.90, 10.86	155.1	13.38	2011.148	1	β Aur
BAR 29AC	05595+4457	1.90, 14.1	41.7	187.16	2011.148	1	
AGC 1AB	06451-1643	-1.46, 8.5	88.0	9.27	2011.183	1	Sirius
HL 3AE	06451-1643	-1.46, 14.5	47.0	188.32	2011.214	1	
BU 1411AF	06451-1643	-1.46, 13.8	60.8	125.71	2011.214	1	
DIC 1AD	07393+0514	0.46, 12.0	323.7	116.26	2011.244	1	Procyon
BU 1067AB	08303+6043	3.44, 15.3	195.8	7.12	2011.271	1	ο UMa
HJ 2733AB	14275+7542	4.3, 13.4	128.3	23.87	2011.362	1	5 UMi
HJ 2733AC	14275+7542	4.3, 9.9	132.3	59.33	2011.362	1	
BU 616AB	14321+3818	3.0, 12.7	121.4	50.55	2011.364	1	γ Boo
STF2758AB	21069+3845	5.35, 6.10	151.7	31.33	2011.847	1	61 Cyg
BU 690 AB	21435+5847	4.2, 12.3	263.3	19.44	2011.836	1	μ Cep
BU 690 AC	21435+5847	4.2, 12.7	297.5	41.89	2011.836	1	Note 2
DAL 21	22343+5716	12.9, 13.8	306.9	7.26	2011.890	1	
STI 2826	22345+5717	12.6, 13.0	353.4	7.82	2011.890	1	
HJ 301 AB	22467+1210	4.2, 12.4	94.7	10.97	2011.882	1	ξ Peg

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(unfiltered CCD) was performed which showed "B" to be 1.46 magnitudes brighter than "C" (4-plate average). In this unfiltered coronagraph mode the photometric response approximates R-band. Is "B" an orange or red star, thus accounting for the large instrumental magnitude difference?

To answer this a couple of nights were devoted to photometric measures of component "B" with standard VRI-bands in the long FL mode where these filters are available. To provide a zone free of diffracted light for "B", a shaped-pupil aperture mask was employed (Slepian 1965). This form of aperture provides two very dark, oppositely disposed, sectors close to the saturated primary, thus leaving "B" in the clear. I have found this type entrance pupil mask useful in large Δm work. Results of the photometric work are as follows: V − R = 0.65, R − I = 0.61. A V-band magnitude yielded 12.2. This is very close to Burnham's visual estimate. These photometric measures are made under non-optimum s/n values with few useful plates for a particular color, thus no error estimate can be provided. Taken at face value, I estimate that "B" is a K2II giant and possibly a physical companion to μ Cephei. To confirm this may take the work of a professional observatory; however, I will give the object more attention as time permits.

References

Daley, J.A. 2007, JDSO 3, 159

Slepian, D. JSOA 55(9); 1110-1116, 1965 (for practical details see http://www.orfe.Princeton.edu/~rvdb/tex/tpf/ApJOptimal.pdf)

Jim goes hiking in the Wapack National Wildlife Refuge in New Hampshire.

Jim's health, due to chemotherapy treatment of his non-Hodgkin's Lymphoma, is improving slowly and he has been running and hiking some.

This manuscript was mailed to the USNO and transcribed by Brian Mason who added this "about the author" portion and who, along with our many readers, wishes Jim a speedy and complete recovery.