

# Ludwig Schupmann Observatory Measures of Large $\Delta m$ Pairs - Part Two

James A. Daley

Ludwig Schupmann Observatory  
New Ipswich, NH

Email: rigel@net1plus.com

**Abstract:** This report, the second in this 3 part series, presents recent measurements in theta and rho space of 50 components in 25 mostly large  $\Delta m$  systems. A comparatively small number of these pairs are physical.

## Introduction

Difficulties attending CCD measurements of large  $\Delta m$  pairs are described in an article by the author in a previous article (Daley, 2007). The specialized tail-piece optics used to make the measures reported here is also covered in that article and in a later article (Daley, 2008). Keen-eyed observers such as S. W. Burnham, Alvan Graham Clark and the Herschel's, William and John, were dominant in the discovery of these contrasting component pairs. They usually employed the biggest reflectors and refractors of the time. It is only recently, with the introduction of the CCD, that amateurs with small telescopes have an opportunity to measure these systems.

## The Measures

The following data is listed in the conventional way. From left to right: the discoverer's designation, WDS identifier (Epoch 2000 RA & Dec), WDS mags rounded off to the first place (LSO unfiltered CCD "red" magnitudes in bold italics are  $\Delta m$  inferred from known stars in the system), LSO position angle in degrees, LSO separation in seconds of arc, decimal date of observation, number of nights observed and a notes column. In the notes column entries such as 5m83 signifies 5 previous measures, the last being 83 years ago. Other self explanatory items, perhaps of interest, appear in this column.

There is no note section as all-in-all the work, although tedious, was without surprise; the optical components, for the most part, showing giant motions

and the binaries displaying small but detectable position changes in most cases, the motions being reasonably consistent with previous measures- old and recent. Most measures are the mean of at least 12 CCD frames.

Among the few discoveries is an interesting red cpm pair in UMa (DAL 43, 12hr 05m 47.4988s +53° 54' 55.491"). Photometric measures (currently incomplete) of this wide pair will be presented in a future article.

## Some CCD Images

Figure 1 shows STF 1110 (Castor), a popular fast moving pair. Both the A and B components are clearly resolved behind the foil. The slightly overexposed image of the eclipsing red pair YY Gem, which is physical with Castor, and the faint optical component "D" are well shown in this 10 second unfiltered exposure.

Figure 2 shows an image of BU 103 (upsilon Gem) with the primary highly attenuated behind the occulting foil strip. Relying on the one discovery measure 97-years ago, careful graphing demonstrates that the apparent motion of the secondary is precisely what is predicted by the proper motion of the primary, thus the companion is almost certainly optical.

Finally, Figure 3 is an image of Sirius utilizing a square aperture mask and no occulter. Although interesting, it would be a challenge to measure. However, the intersection of the diffraction spikes may give a reasonably good location of the primary as the mask is positioned very close to the objective's first

**Ludwig Schupmann Observatory Measures of Large  $\Delta m$  Pairs - Part Two**

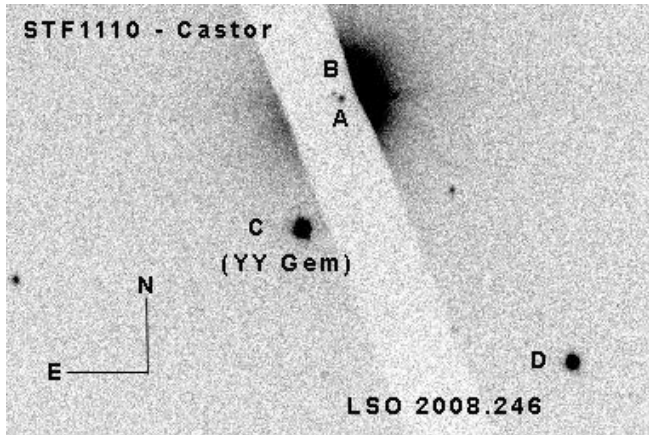


Figure 1: Castor (STF1110) with A B components visible through filter.

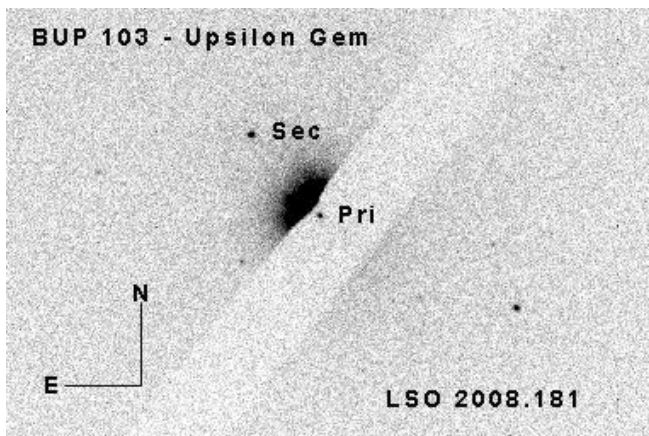


Figure 2: Image of  $\upsilon$  Gem, almost certainly an optical double (see text).

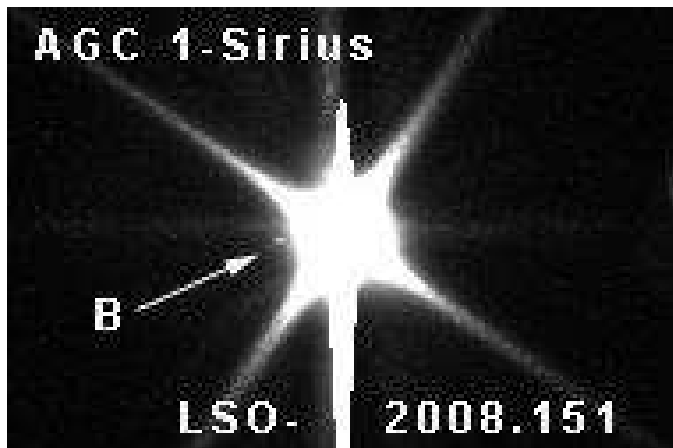


Figure 3: Image of Sirius and B component taken with no occulter

surface. A set of occulted images of Sirius were used for the included LSO measure and may be presented in a future article. As with the other images, North is up and East is left.

All images shown here are single frames (no stacking).

This ongoing measurement program is guided by an observation list generated by Brian Mason based on LSO's instrumentation capability and, in general, covers a  $\Delta m$  range of 8 to 12 with the primary component no fainter than 4.5. Measurements are performed with a 9-inch aperture Schupmann medial telescope, a tailpiece stellar coronagraph and an unfiltered ST-7XE CCD.

**References**

- Daley, J.A. (2007), "A Method of Measuring High Delta m Doubles", JDSO, vol 3, pg 159 - 164.
- Daley, J.A. (2008), "Ludwig Schupmann Observatory Measures of Large  $\Delta m$  Pairs - Part One", JDSO, vol 4, 34 - 39.

*Table begins on next page.*

Ludwig Schupmann Observatory Measures of Large  $\Delta m$  Pairs - Part Two

Discoverer	RA & Dec	Mags	PA	Sep	Date	n	Notes
BU 554AB	05020+4349	3.0 14.0	225.2	29.72	2008.129	1	5m83, Epsilon Aur, binary
BU 554AC	05020+4349	3.0 11.3	275.5	43.44	2008.129	1	
BU 554AD	05020+4349	3.0 12.0	316.4	45.14	2008.129	1	5m83
STF 668A-BC	05145-0812	0.3 6.8	203.5	9.20	2008.120	2	Rigel
BU 555AD	05145-0812	0.3 <b>10.5</b>	1.1	44.60	2008.121	3	5m87, red mag of D
BU 558Aa-B	05320-0018	2.2 14.0	228.3	33.41	2008.129	1	Delta Ori
STF 14Aa-C	05320-0018	2.2 6.8	0.2	52.49	2008.129	1	binary
BU 1056AB-C	06024+0939	4.1 14.0	284.7	18.91	2008.151	1	7m53 Mu Ori
BU 1405AC	06041+2316	4.3 13.0	24.9	105.61	2008.153	1	1 Gem
J 2016AB	06119+1413	4.5 13.0	186.6	37.81	2008.153	1	Xi Ori
J 2016BC	06119+1413	12.3 2.3	150.5	4.68	2008.153	1	2m24
DAL 40AD	06119+1413	4.5 <b>11.4</b>	164.0	36.01	2008.153	1	new component, red mag
DAL 40AE	06119+1413	4.5 <b>11.8</b>	22.2	43.52	2008.153	1	new component, red mag
HJ 348AB	06149-0617	4.0 13.1	26.1	53.74	2008.162	1	1m 103, Gamma Mon
DAL 41AC	06149-0617	4.0 <b>13.6</b>	308.1	47.89	2008.162	1	new component, red mag
STF 900AB	06238+0436	4.4 6.6	28.9	12.50	2008.173	1	Epsilon Mon
STF 900AC	06238+0436	4.4 12.7	254.1	91.80	2008.173	1	
AGC 1AB	06451-1643	-1.5 8.5	97.2	8.07	2008.151	1	Sirius
BU 1411AF	06451-1643	-1.5 <b>9.5</b>	62.1	122.75	2008.271	1	4m33, estimated red mag
SHJ 77AC	07041+2034	4.0 7.7	347.0	101.27	2008.181	1	Zeta Gem
SHJ 77AD	07041+2034	3.8 12.0	353.5	67.75	2008.181	1	2m24,
SHJ 77CD	07041+2034	7.8 12.9	154.1	34.71	2008.181	1	
J 58	07119-0030	4.1 13.0	171.7	33.21	2008.181	1	Delta Mon
BUP 101AB	07272+0817	2.9 13.0	77.1	48.97	2008.192	1	Beta CMi
BUP 101AC	07272+0817	2.9 11.2	25.3	104.15	2008.192	1	
BUP 101AD	07272+0817	2.9 11.1	75.71	131.82	2008.192	1	
BUP 101AE	07272+0817	2.9	313.6	138.33	2008.192	1	
SLE 571AF	07272+0817	2.9 12.5	166.6	79.66	2008.192	1	
SLE 571AG	07272+0817	2.9 13.0	176.7	83.83	2008.192	1	
SLE 571FG	07272+0817	12.5 13.0	245.3	15.13	2008.192	1	

*Table continued on next page.*

Ludwig Schupmann Observatory Measures of Large  $\Delta m$  Pairs - Part Two

Discoverer	RA & Dec	Mags	PA	Sep	Date	n	Notes
DAL 41FH	07272+0817	12.5 <b>13.4</b>	53.7	3.96	2008.192	1	new component, red dm=0.9
LAM 4AB	07282+0856	4.3 13.3	233.7	26.62	2008.181	1	5m24, Gamma CMi
LAM 4AC	07282+0856	4.3 12.3	261.4	114.50	2008.181	1	1m97
STF1110AC	07346+3153	1.9 10.1	163.5	70.54	2008.246	1	Castor, C is YY Gem
STF1110AD	07346+3153	1.9 10.1	221.4	182.97	2008.246	1	
BUP 103	07359+2654	4.1 13.2	40.4	55.17	2008.181	1	1m97, Upsilon Gem
LAM 6AC	07393+0514	0.4 11.7	20.5	177.17	2008.246	1	51m24, Procyon
BU 1065AB	08165+0911	3.5 14.3	293.6	30.14	2008.194	1	Beta Cnc, binary
DAL 42AC	08165+0911	3.5 <b>12.2</b>	37.7	69.77	2008.194	1	new component
RST5507	08464-1333	4.3 13.7	266.4	27.12	2008.227	1	12 Hya
STF1273AB-D	08468+0625	3.5 12.5	199.7	18.03	2008.225	1	Eps Hya, Hyperbolic orbit
HJ 2489AB	09144+0219	3.9 9.8	241.0	20.30	2008.230	1	Theta Hya
HJ 2489AC	09144+0219	3.8 11.9	298.4	100.96	2008.230	1	2m46
B 2674AD	09144+0219	4.6 12.4	145.4	82.35	2008.230	1	
GAN 5	10079+1000	4.4 13.6	40.8	7.98	2008.230	1	7m74, 31 Leo, cpm
STF 6AB	10084+1158	1.4 8.24	307.3	176.98	2008.271	1	Regulus
BU 593AB	10106-1221	3.6 13.3	103.0	71.34	2008.271	1	5m86, Lambda Hydra
DAL 43	12058+5355	9.2 11.9	349.9	55.24	2008.408	1	discovery, red cpm pair
BLL 29	12154+5702	3.3 10.2	73.50	182.03	2008.399	2	Megrez
BUP 140AC	12154+5702	3.3 12.0	128.0	175.33	2008.399	2	

