

Measurements of BU109 in Cetus – Follow Up

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Abstract: As was detailed in a paper published in Vol. 11 No.3, July 1, 2015 in the *Journal of Double Star Observations*, the data within WDS 2014.96 for BU 109 in Cetus was suspect. Since our discussions with the WDS in late 2014 and prior to the publication of this paper, updates were made for BU 109 based on the existing available data. In the July 2015 paper, we discussed that further research by way of new imagery allowing more detailed photometry and astrometry would be initiated. This current paper is the results of the new photometry and astrometry.

Introduction

Given that the measurements for our first report were the results of a single image, we felt that it would be more appropriate and would also provide better results if new measurements were obtained based on several new photographs. Having created these more accurate results, the hope is to publish this new data in the hope that it would become the most current data for BU 109. Given that BU 109 is currently (August 2015) very

high in the Australian sky and, with his familiarity with the remote iTelescope facilities at Siding Spring, Wilfried Knapp used 2 telescopes, the iT17 (431mm) and the iT27 (700mm) to acquire the new imagery and then process the data to extract the new positional and magnitude data. A summary of WDS 2014.96 data is shown in Table 1. A summary of current WDS data at the end of August 2015 is shown in Table 2.

Table 1. WDS 2014.96 values for BU 109

Name	WDS ID	RA	Dec	Sep	PA	M1	M2
BU 109AB	00405-1631	00:40:28.560	-16:30:59.800	97.5	356	6.6	9.1
BU 109AC	00405-1631	00:40:28.560	-16:30:59.800	94.9	355	6.6	9.4
BU 109BC	00405-1631	00:40:27.740	-16:29:14.503	11.7	160	9.1	9.4

Table 2. WDS end of August 2015 values for BU 109

Name	WDS ID	RA	Dec	Sep	PA	M1	M2
BU 109AB	00405-1631	00:40:28.560	-16:30:59.800	105.6	354	6.6	10.4
BU 109AC	00405-1631	00:40:28.560	-16:30:59.800	94.9	355	6.6	10.7
BU 109BC	00405-1631	00:40:27.740	-16:29:14.503	11.7	160	10.4	10.7

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Table 3. Vmag, Bmag, and B-V results based on images for BU 109 B and C processed with AAVSO VPhot.

		Err	Std	SNR	Date	N
BU109B	Vmag					
BU109 iT17 5x6s B-V report 1	11.123	0.007	0.003	252	2015.627	5
BU109 iT17 5x6s B-V report 2	11.090	0.007	0.001	250	2015.632	5
Mean / RMS	11.107	0.007			2015.630	
BU109C	Vmag					
BU109 iT17 5x6s B-V report 1	11.210	0.008	0.003	239	2015.627	5
BU109 iT17 5x6s B-V report 2	11.277	0.008	0.001	220	2015.632	5
Mean / RMS	11.244	0.008			2015.630	
BU109B	Bmag					
BU109 iT17 5x6s B-V report 1	11.821	0.026	0.026	156	2015.627	5
BU109 iT17 5x6s B-V report 2	11.814	0.037	0.037	157	2015.632	5
Mean / RMS	11.818	0.032			2015.630	
BU109C	Bmag					
BU109 iT17 5x6s B-V report 1	11.966	0.027	0.026	143	2015.627	5
BU109 iT17 5x6s B-V report 2	11.962	0.037	0.037	138	2015.632	5
Mean / RMS	11.964	0.032			2015.630	
BU109B	B-V					
BU109 iT17 5x6s B-V report 1	0.698				2015.627	5
BU109 iT17 5x6s B-V report 2	0.724				2015.632	5
Mean	0.711				2015.630	
Standard deviation	0.013					
BU109C	B-V					
BU109 iT17 5x6s B-V report 1	0.756				2015.627	5
BU109 iT17 5x6s B-V report 2	0.685				2015.632	5
Mean	0.721				2015.630	
Standard deviation	0.036					

Further Research

As our first report was based on measurements with only one single image, we decided to do a follow up with results based on more images to have a better foundation for our results. As BU109 is currently rather high in the Australian sky and iTelescope has with Siding Spring a location here, we took this opportunity to take images in several sessions with two different telescopes.

To aim for utmost Vmag precision we took with telescope iT17 images with V- and B-filter. as this telescope offers B-V transformation coefficients. The transformed results we got are given in Table 3.

For utmost precise measurement of Sep and RA we took several images with telescope iT27 with a resolu-

tion of 0.53 arcseconds per pixel. As countercheck we measured also Vmag with this images (no B-V transformation coefficients available for iT27). The results are given in Table 4. The B-V color index of ~0.7 for both B and C components indicate a rather yellowish hue rather neutral for visual observation and imaging.

In Table 5 we list the average RA/Dec coordinates and measurement errors for the BU109 components based on Astrometrica plate solving results using the UCAC4 catalog using the same iT27 images listed in Table 4.

Using the formula provided by R. Buchheim (2008) new separation and position angles were calculated (shown in Table 6) based on the RA/Dec coordinates listed in Table 5.

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Table 4. Vmag results based on iT27 images for BU109 B processed with AAVSO Vphot

	Vmag	Err	Std	Err (SNR)	SNR	Date	N
BU109B							
BU109 iT27 1x2s	11.152	0.068	0.066	0.015	71	2015.635	1
BU109 iT27 stack 3x4s	11.144	0.015	0.014	0.005	217	2015.635	3
BU109 iT27 stack 5x2s	11.139	0.016	0.014	0.007	161	2015.635	5
BU109 iT27 stack 5x3s	11.161	0.016	0.015	0.006	176	2015.635	5
Mean / RMS	11.148	0.037				2015.635	
BU109C							
BU109 iT27 1x2s	11.290	0.068	0.066	0.017	62	2015.635	1
BU109 iT27 stack 3x4s	11.291	0.015	0.014	0.005	199	2015.635	3
BU109 iT27 stack 5x2s	11.288	0.016	0.014	0.007	149	2015.635	5
BU109 iT27 stack 5x3s	11.294	0.016	0.015	0.007	165	2015.635	5
Mean / RMS	11.291	0.037				2015.635	

Table 5. RA/Dec positions based on Astrometrica plate solving using the UCAC4 catalog

Name	Mean RA	RMS dRA	Mean Dec	RMS dDec
BU109 A	00:40:28.636	0.173	-16:31:00.427	0.143
BU109 B	00:40:27.755	0.173	-16:29:14.550	0.143
BU109 C	00:40:28.031	0.173	-16:29:25.238	0.143

Table 6. Separation and position angle based on RA/Dec coordinates given in Table 5.

Name	Sep	PA
BU109 AB	106.634	353.172
BU109 AC	95.587	354.778
BU109 BC	11.403	159.589

Specifications of the Used Telescopes

iT17: 431 mm CDK with 2912 mm focal length. CCD: FLI ProLine PL4710. Resolution: 0.92 arcsec/pixel. B and V filters: B-V transformation coefficients available. Located in Siding Spring, Australia. Elevation 1122 m.

iT27: 700 mm CDK with 4531 mm focal length. CCD: FLIPL09000. Resolution: 0.53 arcsec/pixel. V-filter: No B-V transformation coefficients available. Located in Siding Spring, Australia. Elevation 1122 m.

Conclusions

Since we have two tables with slightly differing Vmags for the B and C components of BU 109, the question arises as to which of the two should be relied on with regard to recommending changes to the visual magnitudes of the B and C components of BU 109. The field of view with the iT17 telescope (Table 3) was limited to 15 arcminutes, whereas the iT27 telescope (Table 4) offered us the advantage of a much larger 27 arcminute field of view. The larger field of view provided more reference stars with which to

check our photometry results, and consequently generated more consistent results. That consistency also makes us confident with regard to the declination and RA coordinates in Table 5, which were used to generate the revised separation and position angles shown in Table 6. For that reason, we place greater confidence in the photometry results in Table 4.

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- Washington Double Star Catalog
- iTelescope
- AAVSO VPhot
- AAVSO APASS
- UCAC4 catalog via the University of Heidelberg website
- Aladin Sky Atlas CDS, SIMBAD, VizieR
- 2MASS All Sky Catalog
- AstroPlanner
- Astrometrica

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References

- Buchheim, Robert, 2008, "CCD Double-Star Measurements at Altimira Observatory in 2007", *Journal of Double Star Observations*, **4**, 27-31.
- Knapp, Wilfried, et al., 2015, "Measurement of BU109 in Cetus", *Journal of Double Star Observations*, **11**, 154-157.

