

Astrometric Measurements of the Double Star STFA 43AB

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Abstract: At my observatory in Phelan, CA, observations were made of the visual double star STFA 43AB (Albireo) with an 8-inch Celestron telescope using a 12.5 mm Celestron Micro Guide astrometric eyepiece. A total of 10 drift times were observed to calibrate the scale constant. The last observations reported in WDS were made in 2009, at which time the position angle was 55° and separation 34.6 arc seconds. My 2010 results compared favorably with 2009 results.

Introduction

STFA 43AB (Albireo) is a double star at right ascension 19 hr 30 min 43.29 sec, and declination $+27^\circ 57$ min 34.9 sec. STFA 43AB was the first double star that I observed. STFA 43A is a red star with a catalog magnitude of 3.19, and STFA 43B is a beautiful blue color listed as a magnitude of 4.68 (Mason *et al.*, 2010).

To this day professional and amateur astronomers still argue if STFA 43AB is a binary pair or not. The first observations published on STFA 43AB were made in 1755, by astronomer James Bradley (1693-1762). The position angle was reported to be 57.57 degrees and the separation was 34.20 arc seconds (WDS, Mason 2009). R.F. Griffin (1999) suggests that Albireo is a true double star. With twenty plus years observing STFA 43AB, Griffin defended its double star because his observations showed that Albireo's position angle has moved within one degree. Griffin's experience led him to suggest that nearly all double stars with close separations were likely to be a binary star.

My observations of Alberio were made with a Celestron 8-inch Schmidt-Cassegrain telescope graciously loaned to me by the Central Coast Astronomical Society, and a 12.5 mm Celestron Micro Guide



Figure 1: The author with the Celestron C-8 loaner telescope from the Central Coast Astronomical Society he used to make his first astrometric measurements of a visual double star.

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astrometric eyepiece kindly provided by Celestron. These were used to measure the position angle and separation of STFA 43AB. The goals for my project were to: (1) observe, analyze, and report; and (2) provide an educational experience culminating in a published paper.

Observations and Analysis

Observations were made on the night of August 6, 2010 (B2010.581). Ten independent runs were made to measure the average drift time by positioning Albireo's primary star to drift along the linear scale of the astrometric eyepiece. A stopwatch that recorded to the nearest 0.01 seconds was started when the primary star reached the 0-division mark, and stopped when it reached the 60-division mark. After the drift times were recorded, the scale constant was determined to be 9.94 arc seconds per/division, with a standard deviation of 0.05, arc seconds/division and a mean error of 0.005 arc seconds/division.

Ten separation runs were made. Each run consisted of aligning both stars on the linear scale and counting the division marks that separated the two. Between each run the stars were repositioned along the linear scale to minimize bias (Frey and Frey 2010). Based on these ten independent measurements the separation was determined, on average to be 34.10 arc seconds, with a standard deviation of 0.1 arc seconds and mean error 0.03 arc seconds.

The large outer scale and the linear scale were used to measure the position angle. With the drive motor turned off, both stars were aligned on the linear scale, and each run was started with the primary star on the 30-division mark (which marks the center of the eyepiece's angle scale). As soon as the primary star was aligned, the stars were allowed to drift freely towards the outer circular scale. The stars' crossings of the outer scale were recorded to the nearest degree. The eyepiece was rotated 180° every other run to reduce bias (Frey and Frey 2010). As with the separation measurement, ten independently different runs were completed. The average position angle was found to be 55.90°, with a standard deviation of 0.2°

and a mean error 0.06°.

My observed separation and position angle compared favorably to the latest (2009) observations of STFA 43AB reported in the Washington Double Star Catalog. There was a separation difference of 0.5 arc seconds and a position angle difference of 1° between my observed values and the 2009 reported values.

Conclusion

From the measurements reported in 1755 and 2009 my position angle and separation differed by only 1.67 degrees and 0.10 arc seconds. It has been 255 years since the first publication on STFA 43AB and 12 years since Griffin's paper was published. My observations in 2010 suggested that the argument over Albireo's place in the astronomical world could still be controversial. From this project I was able to observe, analyze, and report my estimations, and achieve my educational goal including how to publish scientific papers.

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