Astrometric Observation of Delta Cepheus

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Abstract: Members of a Cuesta College astronomy research seminar used a manually-controlled 10-inch Newtonian Reflector telescope to determine the separation and position angle of the binary star Delta Cepheus. It was observed on the night of Saturday, October 29, 2011, at Star Hill in Santa Margarita, California. Their values of 40.2 arc seconds and 192.4 degrees were similar to those reported in the WDS (1910).

Introduction

The students of Cuesta College's Astronomical Research Seminar made astrometric observations of Delta Cepheus (AC) on October 29, 2011, at Star Hill by Santa Margarita Lake in California, with a 10-inch, manually controlled Newtonian reflector. The equatorially-mounted telescope has a synchronous motor clock drive. The telescope was built by an amateur astronomer and refurbished by Chris Estrada.

Drift Time

The drift time was determined by orienting the eyepiece with the celestial coordinates. Once orientation was completed, we aligned the star, Alpheratz, at one end of the linear scale, turned off the right ascension motor, and determined the time it took for this star to travel to the other end of the linear scale. The time was recorded when the star was bisected by the last division mark.

The mean value for the drift time (Table 1) was used to calculate the scale constant, which was subsequently used to determine the separation in arc seconds. The scale constant was determined by the equation .

Figure 1: The observing team. Top left to right: Chris Estrada, Glenn Warren, Russ Genet. Bottom left to right: Kim Crisafi, Naomi Warren, Betsie Wilson, Stephany Jones, and Jackie King

Table 1: Data for the drift time; twelve measurements were made.

	Drift time (seconds)
Mean	61.3
Standard Deviation	0.7
Standard Error of the Mean	0.2

$$Z = \frac{15.0411\, t \cos(d)}{D}$$

where Z is the scale constant in arc seconds per division, 15.0411 is the number of arc seconds per second of the Earth's rotation, t is the average drift time in seconds, d is the declination of the star, and D is the number of divisions on the linear scale (60).

Separation and Position Angle Observations

The distance between the binary stars was estimated by each observer to the nearest tenth of a scale division. Angular separation was determined by multiplying the mean of the distances by our measured scale constant of 11.5 arc seconds per division. The separation was estimated twice by each of six observers for a total of twelve values.

The position angle was found by placing the brighter binary star at the center of the eyepiece, then aligning the eyepiece so that the linear scale bisected both stars, then turning off the synchronous motor and observing and recording point at which the star crossed the inner protractor. Results of the measurements are in Table 2.

Table 2: Data for the separation and position angle; twelve measurements were made for both separation and position angle.

	Separation (arc seconds)	Position Angle (degrees)
Mean	40.2	192.4
Standard Deviation	4.5	1.8
Standard Error of the Mean	1.1	0.5

Discussion and Conclusion

We estimated the separation to be 40.2 arc seconds, which compared favorably with the value of 40.7 arc seconds reported in 2010 in the Washington Double Star Catalog. Our position angle was measured as 192.4 degrees which also compared favorably with the last observation recorded in the Washington Double Star Catalog which found the position angle to be 191 degrees.

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Reference

Mason, Brian, 2007, *The Washington Double Star Catalog*. Astrometry Department, U.S. Naval Observatory.