

Student Measurements of STFA 10AB (Theta Tauri)

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Abstract: Eighth grade students at Vanguard Preparatory School measured the double star STFA 10AB using a 22-inch Newtonian Alt/Az telescope and a Celestron Micro Guide eyepiece. Bellatrix was used as the calibration star. The calculated means of multiple observations of STFA 10AB resulted in a separation of 45.18," a scale constant of 7.88 arcseconds per division, and position angle of 257.9°. These measurements were compared to the most recent values in the Washington Double Star Catalog.

Introduction

On March 11-13, 2016, eleven eighth grade students (Figure 1) observed the double star, η Tauri, at Vanguard Preparatory Double Star Workshop. The calibration star (Bellatrix) had a right ascension of 0.5 hours 25 minutes 7.86 seconds, and a declination of 6.3497. The Observations were made at 34° 29' 19.84" North latitude and 117° 09' 47.48" West longitude. Students were planning to measure the double star Theta Taurus on March 4-6, but the sky was cloudy and the weather was windy. The students used video recordings of Theta Taurus that had been recorded on Thursday, March 10 (B2016.191904), to determine the scale constant, separation, and position angle.

Equipment

The team used a 22-inch Newtonian Alt/Az telescope with a Celestron Micro Guide eyepiece attached to a Bell and Howell High Definition Video Camera shown in Figure 2.

Procedures

The star Bellatrix in the constellation Orion was used to calibrate the linear scale of the eyepiece. The students positioned Bellatrix on the edge of the linear



Figure 1: The authors from left to right in the back row: Sarah Lindorfer, Jenna Shattles, Gabriel Reder, Kaylie Michels, Jalyynn Givens, and Sean Gillette. The authors from left to right in the front row: Aiden Wilkin, Maisy Woodbury, Makenzie Mobley, Kayla Renteria, Sophia Aguilera, and Valerie Chavez.

scale, then the sidereal motor was disengaged to allow the star to drift parallel to the linear scale. Using a stop-

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Figure 2: Telescope used to record measurements used on March 10th, 2016.

watch that reads to the nearest hundredth of a second, the students determined the amount of time it took the star to drift. A total of fifteen drifts was recorded to determine the scale constant using the equation

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

Z is the scale constant in arcseconds per division; 15.0411 is the Earth's rotational rate in arcseconds per second; t is the average drift time in seconds (63.24); $\cos(dec)$ is the declination of the calibration star in degrees; and D is the number of division marks on the linear scale (60).

Observation and Analysis

The results the students got from the 22-inch Newtonian telescope and the eyepiece was a scale constant of 7.88 arcseconds per division. Theta Tauri (STFA 10AB) has an apparent magnitude of +3.14, a right ascension of 04h 28m 34.49603sec, and a declination of +15° 57' 43.8494". The stars are separated by 337 arcseconds and their position angle was 346° as listed in the WDS. Figures 3 and 4 show the appearance of q Tauri in our eyepiece. The stars are spectroscopic binaries and have closer companions.

15 observations were gathered to determine an average time of drift of 31.61, standard deviation of 0.44, and standard error of mean 0.11. Five separate measurements were gathered to determine an average of 45.18 arcseconds, a standard deviation of .46, standard

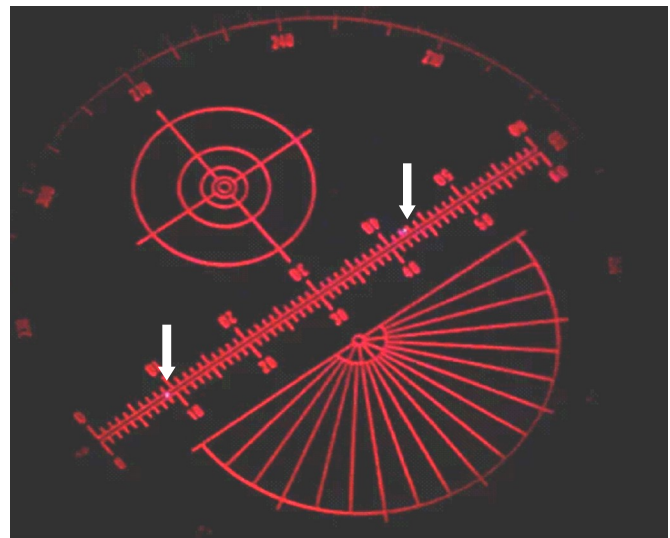


Figure 3: Separation of Theta Taurus in view of the 22-inch Newtonian Alt/Az telescope using a Celestron Micro Guide eyepiece. Arrows indicate the stars.

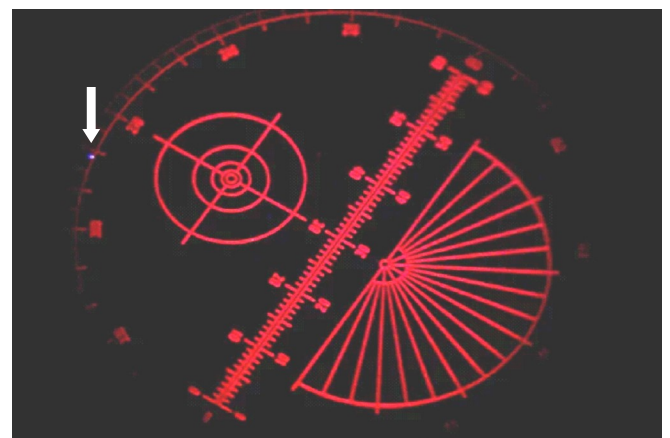


Figure 4: Position angle of Theta Taurus in view of the 22-inch Newtonian Alt/Az telescope using a Celestron Micro Guide eyepiece. Arrow indicates B component.

error of mean 0.2, with a published value of 337 difference of 18.82 and difference of 5.43%. Ten position angle measurements were gathered to determine an average of 257.9 standard deviation of 4.84, standard error of mean 1.53 with a published value of 346 and difference of 1.9 and 0.55%. The measurements are summarized in Table 1.

Conclusion

The students produced a small difference from the observations recorded in 2011 of one standard deviation. The students compared it to a published value of 337 difference of 18.82 and percentage of difference of 5.43%. The measured separation differs from the WDS

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value

Table 1: Measurements of STFA 10AB. Performed on 2016.175

Parameters	# Obs	Mean	SD	Standard Error of Mean	WDS Value	Difference	% Difference
Scale Constant a.s./division	15	7.88	44	0.11	NA	NA	NA
Separation (a.s.)	5	45.18	.46	.21	337	18.82	5.43%
Position Angle (degrees)	10	257.90	4.84	1.53	346	1.9	0.55%

by 4.2 standard deviations. An error may have occurred due to the students' level of experience.

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