Observations of the Binary Star Nu Draco

Jordan Fluitt[1], Everett Heath[1], Bobby Johnson[1], Grayson Ortiz[1], Hollie Charles[1], Reed Estrada[3], and Russell Genet[2]

1. Arroyo Grande High School, CA 93420
2. Cuesta College, San Luis Obispo, CA 93403
3. Central Coast Astronomical Society, San Luis Obispo, CA 93403

Abstract: Using a 22-inch Dobsonian reflector telescope and a Celestron Micro Guide eyepiece, four students from Arroyo Grande High School and Cuesta College, along with one members from the Central Coast Astronomical Society, made observations, and estimated the separation and position angle of the visual double star Nu Draco. The mean separation was found to be 62.0 arc seconds, while the mean position angle was found to be 139.5°. The results compared favorably with past observations.

Introduction

This research project was part of the Fall 2011 Cuesta College Astronomy Research Seminar held at Arroyo Grande High School. Observations were conducted at Santa Margarita Lake on October 29, 2011 (Besselian Epoch 2011.826), with a 22-inch Dobsonian telescope constructed by Reed and Chris Estrada.

The objectives of this project were to: give new students the opportunity to collect data in the field with an experienced astronomer (Reed Estrada); allow students to experience the process of analyzing data as well as the drafting, completing, and reviewing a scientific paper; and contribute data on this double star to the growing number of reports.

The binary star Nu Draco, 173215.88+551022.1 per the Washington Double Star Catalog, was chosen for its relatively bright magnitudes (both are magnitude 4.9) and its fairly wide separation of 63.4″ [Mason 2007].

The authors observed the binary star nu-1 and nu-2 in Draco, recording data during the observation, and later analyzing the data to form a scientific paper. Except for Estrada and Genet, all of the authors were new to astronomical observations.

Figure 1: From left to right: Hollie Charles, Jordan Fluitt, Everett Heath, Grayson Ortiz, Russ Genet, and Reed Estrada. They pause before making their observations at Santa Margarita Lake's Star Hill in Santa Margarita, California.

Nu Draco is composed of nu-1, an A6 dwarf star, and nu-2, an A4 dwarf star. Nu Draco is also known

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Table 1: Data observed and recorded for the binary star Nu Draco.

	Drift Time (seconds)	Separation (arc seconds)	Position Angle (degrees)
Mean	51.3	62	310.5
Standard Deviation	0.6	3.0	2.9
Standard Error	0.2	1.5	0.9
# of Observations	10	4	10

as a "metallic line" star due to its slow rotation rate. The period of rotation for the stars around one another is about 44,000 years [Kaler].

Equipment and Procedures

A 22-inch Dobsonian mount (constructed by Reed and Chris Estrada and shown above in Figure 1) was equipped with a Celestron Micro Guide (see Figure 2 below).

The drift method was used to determine the scale constant in arc seconds per division using the liner scale in the Celestron Micro Guide eyepiece. The primary star nu-1, with nu-2 positioned below it, was placed on the linear scale and allowed to drift across the 60-division linear scale. After each measurement, the pair was repositioned by gently moving the telescope. Ten recordings of drift time were taken with no outliers. The drift time was measured with an iPhone -4 stopwatch with a resolution of 0.1 seconds.

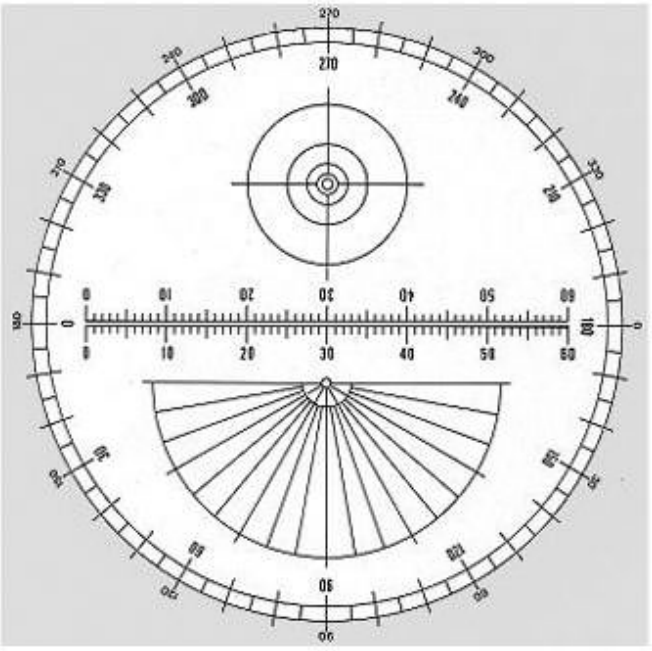

Figure 2: The illuminated reticle of the Celestron Micro Guide.

The position angles of the two stars were measured ten times on the 60 division scale. The eyepiece was rotated 180 degrees after each observation to reduce bias. The telescope was readjusted manually after each recording in order to reset the star's position in the eyepiece. The separation of the stars was estimated by counting the number of graduations while holding the telescope steady and manually adjusting it to counteract the rotation of the Earth. We made these measurements four times.

Observations and Results

The values of the times it took the stars to drift across our eyepiece were consistent with no outliers, yielding an average of 51.33 seconds in 10 trials. We determined the scale constant to be 7.34 arc seconds per division using the formula:

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

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, d is the declination of the star, and D is the number of divisions on the linear scale (60)

The average position angle was found to be 139.5 degrees, and the average separation was found to be 62.0 arc seconds. The separation was found by multiplying each value we measured by our scale constant of 7.34 arc seconds per division.

Discussion and Conclusion

During the class, the group made observations on the position angle and separation of the double star, Nu Draconis. Afterwards, the data were compiled into a scientific paper that described the equipment, observational methods, and processes that were used.

Our observations compare favorably with those

reported by Haas [Haas 2006]. Where our separation was 62 arc seconds, hers was 63 arc seconds. Where our position angle was 310.5 degrees, hers was 311 degrees.

Our observations also compare favorably with the last (2010) observation of Nu Draco reported in the Washington Double Star Catalog [Mason 2010], which was made in 2010. The last observation measured 311 arc seconds as their separation, while we measured 310.5. Where the last observation's separation was 62, ours was also 62.

All of our goals were met with this project. The students learned to make scientific observations alongside an experienced astronomer, they collected data and wrote a scientific paper, and they contributed data on the star.

Acknowledgements

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