Measurement of Star System 02442+4914 STF 296AB

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Abstract: Position angle (theta) and separation (rho) measurements were obtained from multiple images of the star system WDS 02442+4914 STF 296 AB using a 17" telescope in the iTelescope network. From our 2018 measurements, STF 296 has a position angle of 304.9° degrees and separation of 20.6" arcseconds. Data recorded for STF 296 showed consistent accuracy in comparison to the current historical data.

Introduction

Double Star system WDS 02442+4914 STF 296 AB was imaged with telescopes equipped with CCD cameras to measure the position angle (theta) in degrees and separation (rho) in arcseconds. Measurements were compared with data provided by Washington Double Star Catalog (WDS).

To select double star system candidates for research, a variety of catalogs were used to find stars that fit specific criteria: the star systems had to be a minimum of six arc seconds apart, and the difference in brightness had to be no more than six orders of magnitude. The Washington Double Star Catalog, the Sixth Catalog of Orbits of Visual Binary Stars, and Stelle Doppie were all utilized to find pairs based on this criterion.

Background

From data and observations recorded in the Stelle Doppie database (Stelle Doppie Web), STF 296 is a confirmed binary star system. The US Naval Observatory has information pertaining to the data collected that was used to form a proposed orbit in their 6th Orbital Catalog (USNO Web). This star system was discovered and first measured by Friedrich Georg Wilhelm von Struve in 1782. It has been observed 79 times and was last observed in 2015. As a result of the data contained within these observations, a general orbit has been predicted, Figure 1. This paper provides a 2018 measurement to add additional data to this orbit by plotting our measurement with the historical data and comparing it to the plotted orbit provided by the US Naval Observatory.

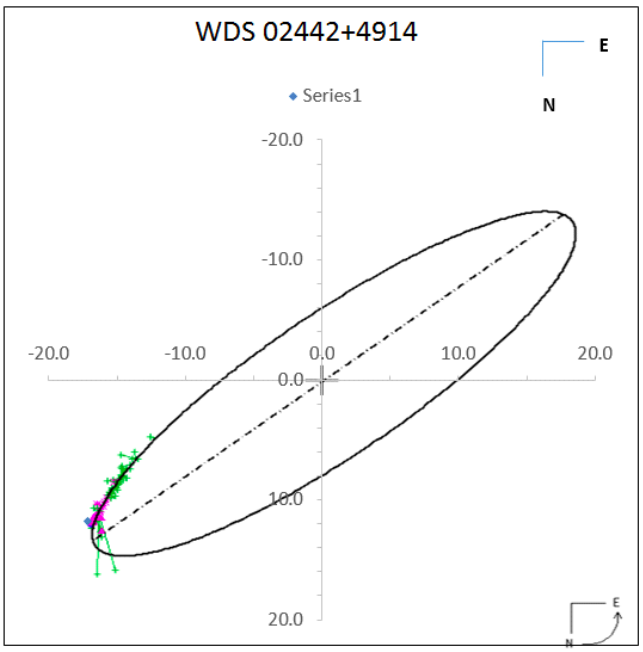

Figure 1. Proposed orbit for WDS 02442+4914 provided with historical data from Mason of the USNO

Equipment

Images were photographed using iTelescope T-21 in Mayhill, New Mexico. T-21, a deep field telescope, has a 17" platform with a FLI-PL6303E CCD camera and has a resolution of 0.96 arc-secs/pixel and an aperture of 431 mm. It operates within the iTelescope network and was selected due to its position in/visibility of

the Northern hemisphere. Dark, Flat, and Bias calibration images were provided by the iTelescope network for all images taken with T-21.

Procedures and Methods

Imaging the Stars

Images were ordered from T-21 on the iTelescope network, with exposure lengths and light filters specified for all images. Once complete, the requested images were then delivered to the Boyce Astro Research Computer (BARC) Server on a remote desktop for further processing. Additional images were acquired from a Celestron C11 SCT taken in Tierra del Sol by our mentor, Mr. Allen Priest.

Processing and Measuring the Stars

Once all the images had been taken and transferred to the BARC server, they were imported into MaxImDL to be calibrated and plate solved. The process of plate solving was conducted in order to properly orient the image in the sky with the correct Right Ascension and Declination. The PinPoint Astrometry program (included in MaximDL) was used to complete the plate-solving process by comparing stars in our images against the United States Navy UCAC-4 catalog.

The plate solved images were then imported into MiraPro to measure the position angle in degrees and the distance in arcseconds between the two stars. This was accomplished using its distance and angle function, which is able to locate the centroid of each stellar candidate. The measurements and data gathered from MiraPro were copied into Excel for statistical analyses: mean, standard deviation, standard error, and standard error percentage. Once all the data was collected from our processed images, historical data was ordered from the US Naval Observatory and is given in Table 2.

Results

The results of these image processes are outlined in Table 1. Images through a Hydrogen-alpha filter are shown in Figure 2.

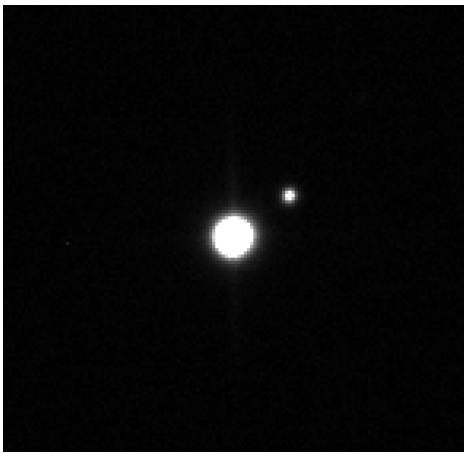

Figure 2: Hydrogen Alpha 30 Sec iTelescope)

After processing the images, the current separation between the A/B components of the system was determined to be 20.6 ± 0.6 arcseconds and the current position angle is 304.9 ± 1.4 degrees.

Discussion

The main purpose of studying this double star system was to observe any changes in data (i.e: theta or rho), if there were any, and to confirm whether or not the current proposed orbit is relatively accurate. After finding the plot for the most recent observation, the current proposed orbit seems to be the correct astronomical trajectory and is not contradicted by the newest data plot. This double star system is a confirmed physical system according to Stelle Doppie (Stelle Doppie Web), and our data did not provide any indication that it should instead be reclassified as an optical double star system.

Table 1. Theta and Rho Measurements made on 2018.923

Images	Theta (deg)	Rho (as)
1	305.3	20.9
2	302.3	19.5
3	307.0	21.4
Mean	304.9	20.6
Std. Dev.	2.8	1.0
Std. Error	1.4	0.6

Table 2. Some Historical Measurements

Date Observed	Theta (deg)	Rho (as)
1782.64	290	13.52
1845.23	295.3	15.06
1899.67	299.5	17.25
1924.898	300.8	18.43
1999.8	304.8	20.52
2018.33	304.9	20.6

Conclusion

The data collected from the star system STF 296 AB did in fact support the already proposed orbit. Our data point was consistent with the change that was to be expected in the system's movement over time. There is no current indication that this double star system is in fact an optical double.

Acknowledgements

We would like to thank the United States Naval Observatory for providing access to historical measurement data through the Washington Double Star Catalog. In addition, we thank Pat and Grady Boyce of the Boyce Research Initiatives and Education Foundation (B.R.I.E.F) for providing access to the educational materials and for providing the funding which allowed us to use the iTelescope robotic telescope system along with other software tools. We are grateful to Mr. Priest, our advisor, mentor, and teacher, for helping us to pursue all aspects of this amazing learning experience.

References

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Stelle Doppie Web: https://www.stelledoppie.it/index2.php