Double Star Systems WDS 00026+1841 SHY 378AB and WDS 00002-2519 COO 273: An Investigation

Skylar Larsen[1,3], Sophie Reich[1,3], Ally Serrano[1,3], Josh Gailey[1,3], Pat Boyce[2], Grady Boyce[2], and Kent Smith[1]

1. Mt. Everest Academy, San Diego, CA
2. Boyce Research Initiatives and Education Foundation (BRIEF), San Diego, CA
3. Cuesta College, San Luis Obispo, CA

Abstract: Position angle (theta) and separation (rho) measurements were obtained for two double stars, WDS 00026+1841 SHY 378AB and WDS 00002-2519 COO 273. SHY 378AB was measured with a theta of 2.67° and rho 549.9". COO 273 was measured with a theta of 10.38° and a rho of 8.31".

Introduction

The research objective was to measure and report theta and rho for the components of two double star systems, WDS 00026+1841 (SHY 378AB) and WDS 00002-2519 (COO 273), and compare them to historical measurements.

SHY 378AB is a double star system with a first recorded measurement in 1991, and a last reported in 2000 with a separation of 550.1". With only four historical measurements, this star has been referenced in multiple catalogs including the Hipparcos, Tycho, and Washington Double Star (WDS) catalogs (Mason, Hartkopf 2016). Notes within the WDS state that this is a Common Proper Motion (CPM).

WDS COO 273 is a double star system with 10 total measurements with the first measurement made in 1910 and last in 2000 when theta was reported at 10.4° and rho at 8.5. While the WDS does not contain any indication relative to the nature of this double star, the historical data indicates a possible linear pair.

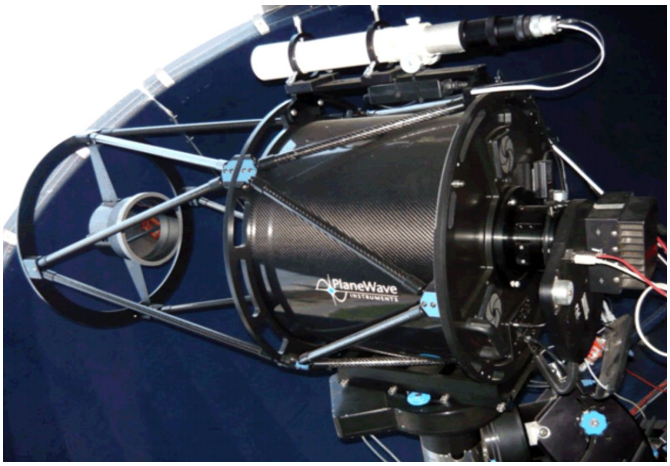

Figure 1. iTelescope T11.

Materials and Methods

The images taken during the investigation utilized the observatory systems provided by the iTelescope network. CCD imaging is an accurate method of measuring double stars, and the most efficient method of measurement for current circumstances (Genet, John-

Figure 2. iTelescope T27.

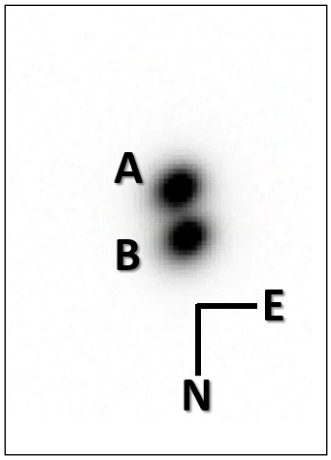

Figure 3. *Ha Image of COO 273.*

son, and Wallen 2010). iTelescope T11 in Mayhill, New Mexico, with a system resolution of 0.81"/pixel, Figure 1, and iTelescope T27, near Coonabarabran, Australia, with a system resolution of 0.53"/pixel, Figure 2, were used for the observations.

The images for star COO 273 were acquired on two separate dates, T27 on 2016.7981, and T11 on 2016.8027, using a Hydrogen Alpha (Ha) filter. Images for SHY 378AB were also acquired on two separate dates, 2016.8000 and 2016.8903, using only T11 through both luminance and red filters.

Individual images were downloaded for analysis and measurement. MaximDL was used to plate solve each image for the stars' Right Ascension and Declination coordinates by placing World Coordinate System (WCS) data into each image to ensure accuracy of theta and rho measurements. Mira Pro x64 was used to provide the theta and rho measurement for each image.

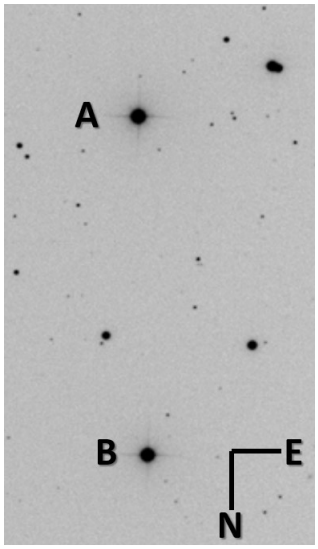

Figure 4. *SHY 378AB image from iTelescope T11.*

Data and Results

Final measurements of theta and rho for COO 273, Figure 3, from the images acquired with iTelescope T11 are shown in Table 1. Table 2 reports the same data for the iTelescope T27 system.

SHY 378 AB, Figure 4, was only imaged with a single telescope, T11. The statistics for this double star are outlined in Table 3. For this pair, the separation was large enough that light limiting filters were not necessary to assure separation for measurements.

Discussion

A comparison between the COO 273 historical records and the 2016 measurement are outlined in Table 4. Note that there are two 2016 measurements which re-

Table 1. Measurements and Statistics of COO 273 T11 Theta and Rho.

Image	Theta	Rho		
Hα	9.971°	8.27268"		
Hα	10.789°	8.34891"		
Mean			10.38°	8.31"

Table 2. Measurements and Statistics of COO 273 T27 Theta and Rho.

Epoch	Telescope	Image	Theta	Rho
2016.7981	T27	Hα 60 Seconds	10.586°	8.38709"
2016.7981	T27	Hα 60 Seconds	10.459°	8.38198"
Mean			10.52°	8.38"

Double Star Systems WDS 00026+1841 SHY 378AB and WDS 00002-2519 COO 273: An Investigation

Table 3. Statistics of SHY 378 AB data.

Epoch	Telescope	Image	Theta	Rho
2016.8000	T11	Luminance 60 seconds	2.673°	549.846"
2016.8903	T11	Luminance 60 seconds	2.671°	550.061"
2016.8903	T11	Luminance 60 seconds	2.669°	549.916"
2016.8903	T11	Red 120 Seconds	2.666°	549.877"
2016.8903	T11	Red 120 Seconds	2.668°	549.848"
Mean			2.67°	549.910"
Standard Deviation			± 0.00°	± 0.09"
Standard Deviation of the Mean			± 0.001°	± 0.018"

port the mean value for the T27 and T11 respectively. Figure 5 provides a graphical depiction of the data with the 2016 measurement denoted by a square symbol. The 2016 measurements are consistent with historical reports and trends that suggest a rectilinear pair.

Table 5 compares the WDS historical measurements with the 2016 mean measurement for SHY 378AB. Through the approximately twenty-five-year history of recorded measurements, there has been no appreciable change in either theta or rho. The 2016 measurement is consistent with the historical data.

Conclusions

Neither double star had significant deviations to existing historical data. COO 273's data points, with 2016 included, suggest a possible rectilinear pair. The data for SHY 378 AB is inconclusive to make any suggestion as to the nature of this double star.

Acknowledgments

Thank you to instructors Kent Smith, Russell Genet, and Norm Negus for their support. This research has made use of the Washington Double Star Catalog maintained at the U.S. Naval Observatory, and the "Aladin sky atlas" and the SIMBAD database, oper-

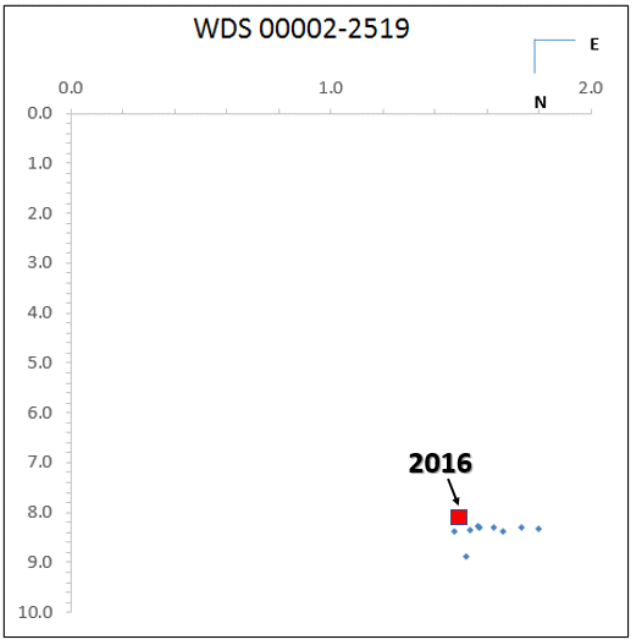

Figure 5. Graphical depiction of the historical data and 2016 measurements for COO 273

Table 4. Comparison of new measurement sample with prior measurements for star COO 273.

Epoch	Theta	Rho	Method
1910.75	9.7°	9.028"	Photograph w/ Astrograph
1910.84	11.8°	8.484"	Photograph w/ Astrograph
1932.91	11.1°	8.46"	Micrometer w/ Refractor
1933.73	12.2°	8.510"	Photograph w/ Astrograph
1945.87	11.2°	8.55"	Micrometer w/ Refractor
1964.33	10.7°	8.43"	Micrometer w/ Refractor
1980.000	10.0°	8.50"	Micrometer w/ Refractor
1991.78	10.7°	8.455"	Tycho Mission
1999.557	10.7°	8.463"	UCAC
2000.71	10.4°	8.50"	2MASS
2016.7981 T27	*10.52°*	*8.38"*	*CCD*
2016.8027 T11	*10.38°*	*8.31"*	*CCD*

Table 5. *Comparison of new measurement sample with prior measurements for star SHY 378AB.*

Epoch	**Theta**	**Rho**
1991.25	2.7°	550.073"
1991.51	2.7°	550.087"
1998.88	2.7°	550.077"
2000.900	2.7°	550.083"
2016.89035	*2.67°*	*549.910"*

ated at CDS, Strasbourg, France. iTelescope was the source of telescopes and images used for data creation and organization purposes. The Boyce Research Initiatives and Education Foundation (BRIEF) was the source of funding for the project; without BRIEF no research would have been possible. Software used is affiliated with the Mira software program.

References

Genet, R.M., Johnson, J.M., and Wallen, V., eds., 2010, *Small Telescopes and Astronomical Research*, Collins Foundation Press, Santa Margarita, California.

Mason, B. and Hartkopf, W. The Washington Double Star Catalog, December 2016. Astrometry Department, U.S. Naval Observatory. http://ad.usno.navy.mil/wds/wds.html.