Astrometric Observations of WDS 09092+1514

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Abstract

The double star system WDS 09092+1514 (STF1317) was analyzed via images taken on May 25, 2022 at the Ball Observatory at Colorado Mountain College in Steamboat Springs, Colorado. The system was found to have an average position angle of 63.49° and an average separation of 7.54", both of which are consistent with previous measurements of the pair over the past 186 years. Proper motion and parallax data strongly suggest that this system is a physical pair.

1. Introduction

A candidate for observation was chosen from numerous systems already measured in the Washington Double Star (WDS) Catalog (Mason et al., 2001) using the following criteria: the stars had not been observed in the last five years, each star had to have a magnitude of between 8 and 12 with a delta magnitude of less than 3, the stars were at least 4 arc seconds apart, and the physical nature of the double was undetermined. Using Dave Rowe's Double Star Selection Tool (Rowe, 2022) and the WDS, the system WDS 09092+1514 (STF1317, HD78533, SAO98391, Tycho2 1401-00301-1) was selected.

The earliest observation of WDS 09092+1514 dates to 1829 by Friedrich Georg Wilhelm von Struve, and it has been observed 41 times between then and 2016. The primary star has a magnitude of 8.46 and the secondary has a magnitude of 9.91. The first observed separation was 7.6 arc seconds and the last was 7.8 arc seconds. Their delta magnitude is 1.45. According to the WDS, the spectral class of the primary and secondary star are both F (yellow-white). See Table 1 for a summary of Gaia DR2 data for the pair. Historical data for WDS 09092+1514 was procured from the United States Naval Observatory (USNO). Selected values are presented in Table 2. The Gaia data indicate a distance to the pair of 418 ly.

Table 1 Gaia DR2 Data for WDS 09092+1514

Star	A	B
G Magnitude	8.46	9.91
Temperature (K)	F5	F
Parallax (mas)	7.79	7.8
Proper motion RA (mas/yr)	6	2
Proper Motion Dec (mas/yr)	-7	-7

Table 2 Selected Historical Data for WDS 09092+1514

Observation Date	Position Angle, (degrees)	Separation, (arcseconds)
1829.85	59.4	7.59
1851.22	62.2	7.62
1866.43	61.3	7.54
1906.21	60.9	8.525
1929.19	63.8	7.101
1959.19	58.7	7.786
1983.2	62.5	7.762
1991.25	62.4	7.812
2000.219	63.1	7.774
2013.217	62.3	7.83
2016.252	62.559	7.766

Position angle data points from the 41 observations from the historical data of WDS 09092+1514 ranged from 58.7 to 63.8 degrees. For separation, the range was 7.101 to 8.835 arc seconds.

2. Equipment and Methods

Data for WDS09092+1514 was collected at the Ball Observatory, located at the Colorado Mountain College Alpine campus in Steamboat Springs, Colorado (40.492 N, 106.842 W, elevation 2090m) using an 11” f/10 Celestron Edge HD Schmidt-Cassegrain reflector with an SBIG 8300M camera (with clear filter in the filter wheel), controlled with The SkyX (TSX) software. Focus was attained manually using the aid of a Bahtinov mask. A full T-Point alignment was performed to calibrate telescope accuracy before taking data. Data was collected on May 25, 2022 (2022.397). Forty exposures were taken that night at 6 seconds each, with an average air mass of 1.13. Each image was plate solved using Nova.Astrometry.net (Lang, 2010), and then measured in AstroImageJ software (Collins 2017). See Figure 1 for an image of the authors and the Ball Observatory. Figure 2 shows a sample of collected data and Figure 3 shows WDS 09092+1514 from SIMBAD.

Figure 1: The Authors (McCudden, McNally and Tucker (l-r)) at the Ball Observatory

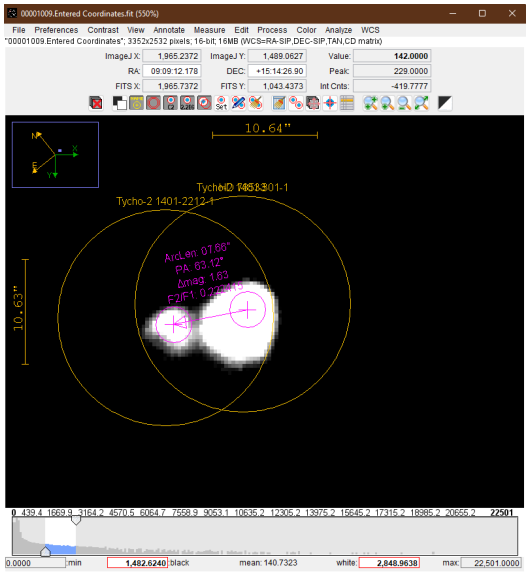

Figure 2: WDS09092+1514 Sample Data from the Ball Observatory

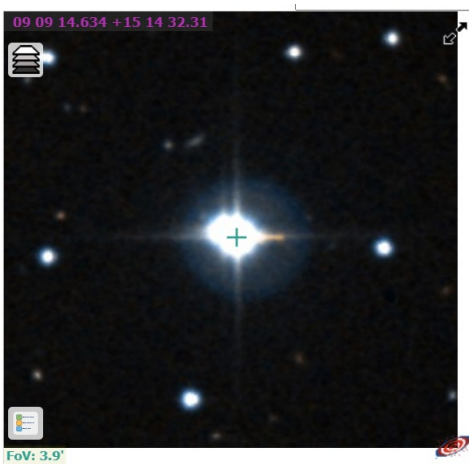

Figure 3: SIMBAD image of WDS09092+1514

3. Data & Results

Mean values of the data collected are given in Table 3. The data was entered into the Harshaw Plot Tool (Harshaw 2020) along with data from Gaia Data Release 2 (Gaia DR2 2018) to create a visual plot of our data (in red) and historical data (in green). See Figure 4.

Our measurements show the mean separation of the stars in WDS 09092+1514 to be 7.54″±0.11 and the position angle to be 63.49°±0.41. Results are shown in Table 3.

Table 3 WDS09092+1514 measurements

	Position Angle, (degrees)	Separation, (arcseconds)
Value	63.49	7.54
Uncertainty	0.41	0.11

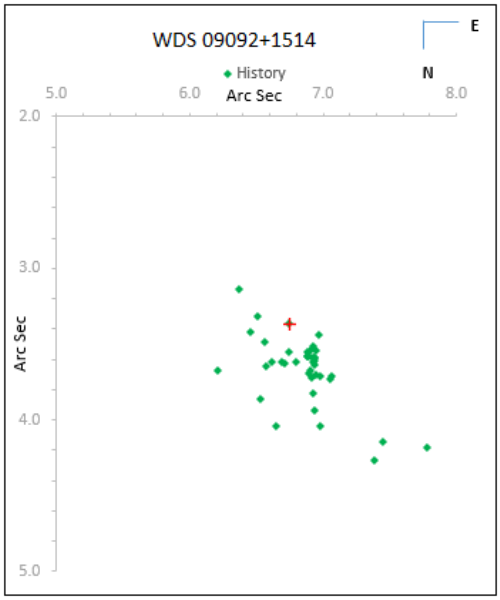

Figure 4: Harshaw Plot Tool results for WDS09091+1514

4. Discussion

The two stars have similar parallax and proper motion values as measured in GAIA DR 2 (Table 1), hinting that they might be a gravitationally-bound pair. Another strong indicator that this system is binary is seen in the Harshaw Statistical Tool (Harshaw 2014) which correlates the RA and Dec proper motions of the pair and in this case gives a value of 0.2 (see Table 4), a strong likelihood that the pair is gravitationally bound.

Table 4. Harshaw Statistical Tool Value.

WDS 09092+1514	Star A (mas/yr)	Star B (mas/yr)
RA Proper Motion	6	2
DEC Proper Motion	-7	-7
Harshaw Statistical Value	0.2	

5. Conclusions

While our data strongly suggests WDS 09092+1514 is a binary, further measurements need to be taken of the position angle and separation in order to reach a definitive conclusion concerning the nature of this star system.

Acknowledgements

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