Astrometric Measurements of WDS 05481+2106 BU 92

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Abstract

The double star WDS 05481+2106 BU 92 was observed using Las Cumbres Observatory global telescope network (LCOGT) on February 26, 2020. The position angle was 170.55° and the separation was 9.64″.

Introduction

The objective of this research is to expand on already existing data to determine if WDS 05481+2106 (BU 92) is a binary system. This system has been recorded in the Washington Double Star catalog with two components (A and B). The pair was first observed in 1873 by Sherburne Wesley Burnham and most recently in 2015 (Sordigliano, 2021). Between these years, WDS 05481+2106 (BU 92) was observed a total of 20 times and has reportedly increased in separation by 4.7 arcseconds. Thus, the system was chosen as an interesting target which could be viewed by the Las Cumbres Observatory telescope network.

Materials and Methods

BU 92 was chosen out of many other candidates for the following reasons. It was one of the many systems that could be observed between November to February at a right ascension between 12 to 18 hours, and a declination between +70 and -75 degrees. It can be viewed with sufficient resolution using one of the LCOGT 0.4-meter remote telescopes and is listed in the WDS catalog. These telescopes can resolve double stars with separations greater than 5.0 arcseconds. The magnitude range was selected for the primary star between 9 and 11, with a delta magnitude of 3 or less. Finally, according to Dave Rowe's Gaia Double Star Selection tool, the system chosen displayed a chance of being gravitationally bound according to his calculated gravitationally bound index.

The telescope used to observe BU 92 was the 0.4 m LCOGT telescope at McDonald Observatory, in Texas. The CCD camera was an SBIG-6303. A Sloan r (red) filter was used. Twelve exposures of 6 seconds each, were taken on February 26, 2020. Data was analyzed using AstroImageJ (Collins, 2017).

Historical data on BU 92 was requested from Dr. Brian Mason at the US Naval Observatory.

Data

Historical data is shown in Table 1 below.

Table 1 Historical Values of Position Angle and Separation Distance for 05481+2106 BU 92

Epoch	Position Angle (degrees; θ)	Separation (arcsec; ρ)
1873.13	170.2	8.88
1875.45	171.7	8.5

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1892.03	169.9	9.24
1892.16	170.3	9.12
1892.99	167.4	9.075
1894.12	168.5	9.398
1895.04	166.9	9.188
1903.909	169.6	9.06
1916.09	169.2	9.42
1919.16	171.5	9.26
1991.795	169.0	10.3
1999.96	170.4	9.60
2000.978	170.5	9.578
2001.11	170.8	9.80
2010.5	169.4	9.66
2013.058	170.46	9.663
2013.971	170.39	9.656
2015.0	170.390	9.662
2015.002	170.39	9.661

Table 1. Historical Values of Position Angle and Separation Distance for 05481+2106 BU 92

Data collected by the LCOGT telescopes on February 26, 2020 is shown in Table 2, along with the mean position angle and separation (170.55°, 9.64″), standard deviation (0.27°, 0.05″) and standard error of the mean (SEM; 0.077°, 0.014″).

Image #	**Position Angle** (degrees; θ)	**Separation** (arcsec; ρ)
1	170.59	9.71
2	171.09	9.58
3	170.63	9.69
4	170.42	9.67
5	170.55	9.68
6	170.66	9.65
7	170.56	9.59
8	170.71	9.62
9	170.77	9.55
10	170.35	9.65
11	170.23	9.62
12	170.06	9.64
Mean	170.55	9.64
Standard Deviation	0.27	0.05
SEM	0.077	0.014

Table 2. Raw Data and statistics for WDS 05481+2106 (BU 92) measured on February 26, 2020.

Discussion

The position angle and separation of WDS 05481+2106 were measured on February 26, 2020. The position angle is 170.55° and the separation is 9.64″.

The historical data was plotted using Richard Harshaw's Plot Tool (Harshaw, 2020), as shown in Figure 1. There is no consistent pattern in the data, which shows a noisy distribution between 8.5 and 10 arcseconds over the past 142 years.

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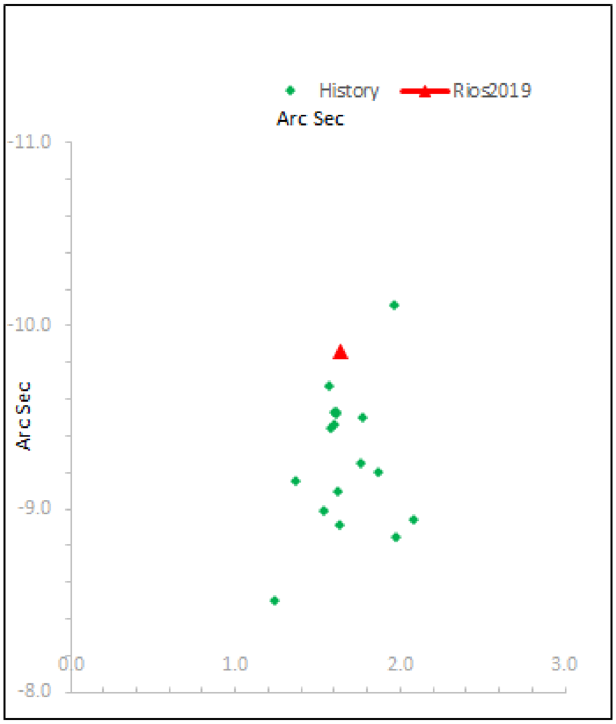

Figure 1: Historical data was plotted using Richard Harshaw's Plot Tool. There is no clear pattern within the historical data, suggesting that the stars are either not a binary system or the orbital period is so long that no trend is yet detectable.

Gaia parallaxes and proper motions are provided in Table 3.

Component	Parallax (mas)	RA proper motion (mas/year)	DEC proper motion (mas/year)
A	1.0721	4.034	-5.126
B	0.8197	4.247	-8.258

Table 3: Gaia parallax and proper motion data.

The Gaia parallax values are similar for the A and B components of this double star, however, because they are less than 5 mas the values are not highly reliable. The fact that they are in the same general ballpark indicates that they may be close to each other. Component A is at a distance of 933 parsecs while component B is at a distance of 1220 parsecs. Their minimum separation can be calculated by multiplying the distance (933 parsecs) by the measured separation (9.64″) to get 8994 AU. While this is not an impossible value for a gravitationally bound pair, as shown by mathematical modeling (Knapp, 2020) it is highly unlikely, as most binaries have a separation closer to 1000 AU and very few are known with separations greater than 3000 AU (Harshaw, 2018).

The proper motion values of both components in both right ascension and declination are also similar, with a slight difference of 3.13 mas/year, in declination proper motion. These stars may be a common proper motion pair but not a true binary.

Conclusion

After analyzing the data collected, the star system has shown no evidence of being a binary system. However, combining parallax and proper motion data, along with 142 years of observations suggests that they are a common proper motion pair, moving through the sky together.

Acknowledgements

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