

## New Measurements for WDS 01045-3024

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### Abstract

New measurements of the double star WDS 01045-3024 were made. Although we do not have the data needed for a firm conclusion, what we do have suggests that the two stars are likely a physical double. We came to this conclusion through multiple sources, such as the stars' history via the Washington Double Star Catalog, data on the system from the Gaia Mission, and the images we took

### 1. Introduction

WDS-01045-3024 PRO 3 is a double star system that has been observed 14 times from 1903 to the most recent observation in 2015. We chose this system since it has not been studied since 2015, leaving room for new data. Another reason that we chose this double star system is because the primary magnitude is 9.9, with a separation of only 7.2", which provided us the best chance to get a clear image based on the tools that were provided to us during our research.

### 2. Equipment and Methods

We made ten images of our double star system on November 2<sup>nd</sup>, 2021, but only five of them were useable due to the other five images being unclear. The images were taken via the Las Cumbres Observatory (LCO) system. The telescope used was at Siding Spring Observatory located in Sydney Australia. This telescope has eight filters, a 29.2 x 19.5 arcminute FOV, and an SBIG STL-6303 CCD camera. The photos that we took used the wideband filter on the telescope.

### 3. Data

The following tables and figures show the measurements we collected. Table 1 is the measurements that we obtained from each of the five images from the telescope. Table 2 shows the summary statistics of our measurements, which includes the average measurements, standard deviation, and standard error. Table 3 shows historical data obtained from Dr. Mason at the US Naval Observatory's Washington Double Star (WDS) Catalog. Table 4 shows the proper motion and parallax data of the star obtained from the Gaia mission. The final data, Figure 1, shows the visual graph of the historical movement of the secondary star relative to the primary star, which is positioned at the origin, also including our new data. The data that we collected is shown with a different marker style.

Table 1: Our measurements of WDS-01045-3024 Pro 3.

$\theta$ (°)	$\rho$ (")
278.8	7.08
278.8	7.07
278.4	7.04
278.7	7.07
278.4	7.08

Table 2: Average, standard deviation, and error values.

	$\theta$ ( $^{\circ}$ )	$\rho$ (")
Average	278.6	7.07
Standard deviation	0.2	0.03
Standard error	0.09	0.01

Table 3: Historical data received from the WDS catalog.

Year	$\theta$ ( $^{\circ}$ )	$\rho$ (")
1903.86	272.7	7.16
1913.80	275.8	6.48
1913.83	284.5	6.11
1998.87	278.2	7.01
1998.878	278.3	7.03
2010.5	277.6	7.04
2014.805	277.7	6.9
2015.0	278.2	7.08

Table 4: Proper motion and parallax data from Gaia.

Proper motion RA A (arcsec/yr)	Proper motion DEC A (arcsec/yr)	Proper motion RA B (arcsec/yr)	Proper motion DEC B (arcsec/yr)	Parallax A (mas)	Parallax B (mas)
18	-16	18	-12	2.86	2.79

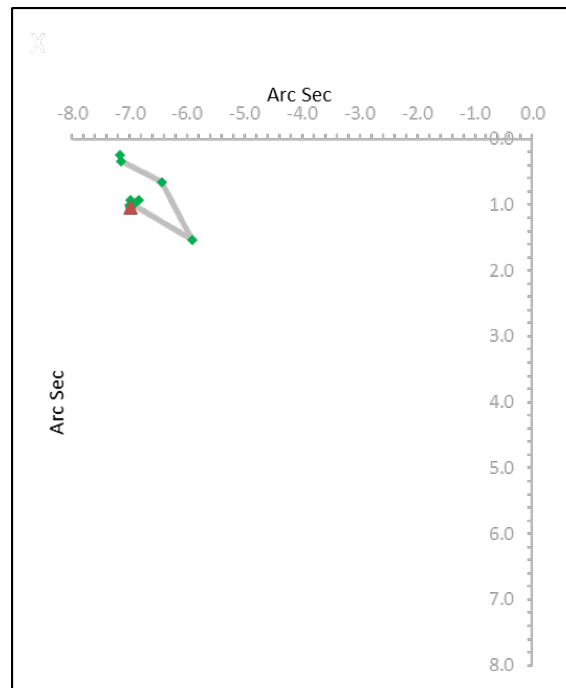


Figure 1: Graph of historical motion of the system.

#### 4. Discussion

The results that we achieved were very similar to those recorded in the history of the star, with the inaccuracy of older data points taken into account. Looking at Figure 1, we can see that the first few data points are scattered which is most likely due to the fact that they are much older measurements. The more modern data points including our measurements are part of a cluster of data points, which suggests that there has not been much movement of the star. Using the measurements we obtained along with the historical data we could not come to any definite conclusion, but because the proper motion and parallax of the two stars are similar, we were able to infer that the stars are most likely a physical double.

#### 5. Conclusions

Although the fact that the proper motion and parallax are similar suggests that the stars are physically related, inconsistency in the historical data makes any further conclusions impossible. Due to that small and irregular movement we believe we do not have enough evidence to conclude the stars are a binary system. However, we do recommend this double star be studied again in the future to observe how the system further evolves.

#### Acknowledgements

We made use of The Washington Double Star Catalog, which provided us with the star's historical information. We specifically would like to thank Dr. Brian Mason and the U.S. Naval Observatory for that data. This work presents results from the European Space Agency (ESA) space mission Gaia. Gaia data are being processed by the Gaia Data Processing and Analysis Consortium (DPAC). Funding for the DPAC is provided by national institutions, in particular the institutions participating in the Gaia Multilateral Agreement (MLA). The Gaia mission website is <https://www.cosmos.esa.int/gaia>. The Gaia archive website is <https://archives.esac.esa.int/gaia>. Our research made use of information supplied by Mr. Stonebraker, such as templates and examples. We also made use of the Stelle Doppie database and received information about our star from here as a starting point ([www.stelledoppie.it](http://www.stelledoppie.it)). Lastly, we would like to thank Las Cumbres Observatory for providing us with access to their telescopes to take our photos.

#### References

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