Speckle Interferometry Observation of Binary WDS 01528-0447

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Abstract On October 21, 2013 the binary star WDS 01528-0447 was observed on the 2.1-meter telescope at Kitt Peak National Observatory. The current position angle and separation was determined to be 39.32° and 0.373″ respectively. This position continued the trends of recent speckle observations, which appear to be diverging from the predicted path of the previously calculated orbit.

Introduction

As part of an eight-night run, the binary WDS 01528-0447 was observed on the 2.1 meter telescope at Kitt Peak National Observatory on October 21, 2013. A portable speckle interferometry camera was used to make the observation (Genet et al. 2013). Students from Saint Joseph High School, Cuesta Community College, and Arroyo Grande High School made the calculations in a Cuesta College research seminar. WDS 01528-0447 was chosen from the many binaries observed during the Kitt Peak run due to three recent speckle observations that sharply deviated from the predicted orbit. Would this deviation continue, or were these three observations just coincidental outliers?

The current position of the star was graphed against a plot of 22 past observations. The initial observation of this binary was in 1955 by Richard Alfred Rossiter.

Observations

Observations of WDS 01528-0447 were made as part of an eight night run at the Kitt Peak National Observatory (KPNO) in Tucson, AZ. This run was organized to look exclusively at close double stars using speckle interferometry. Observations were made by a team of astronomers led by Genet using a specially developed speckle interferometry system (Genet et al. 2013). The electron-multiplying CCD camera used on this run was an Andor Luca-R, which features a 1004x1002 pixel front illuminated CCD chip with 8 micrometer square pixels.

The 2.1 meter telescope has a focal ratio of f/7.6, which gives a focal length of 16 meters (52 feet). An eight times magnification Barlow was used to give us an effective focal length of 128 meters (416 feet). With this magnification, the speckles were clearly visible with our EMCCD camera.

WDS 01528-0447 was observed on Oct 21, 2013 (Besselian 2013.81). We used a Sloan i' filter to reduce atmospheric dispersion compared to shorter wavelengths. A total of 1000 images, each with an exposure time of 15 milliseconds, were taken of the system.

Methods

An Andor Luca-R electron-multiplying CCD camera was used to capture data for analysis. For WDS01528-0447, 1000 observations were made of 10 millisecond duration.

These frames were used to create a FITS data cube, a culmination of the 1000 frame observation. The FITS cube was loaded into the program REDUC in order to interpret the data. To create an autocorrelogram, the software's "Autocorrelation" option was used. Once in "Measure" mode, values for Δ and E (Adam et al. 2014) were entered so that we could determine measurements for the double (Figure 1).

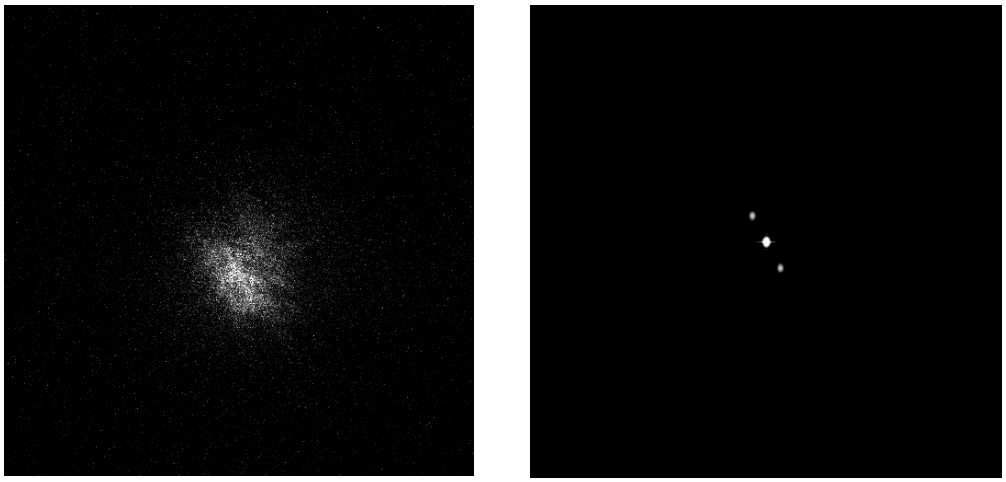

Figure 1. One image taken with the portable speckle interferometry camera system (left) and Autocorellelogram (right).

Data Analysis

After entering the calibration camera angle and pixel scale values, we were able to determine the astrometric measurements of the binary (Table 1). The resulting separation, ρ, of the pair was found to be 0.373", with a position angle, θ, of 39.32°. This new point fits the trend seen in the orbital plot of the motion, moving away from the predicted orbit.

Year	ρ	θ	Ap.	References
1939.45	0.24	301.8	0.7	Rst1955
1944.03	0.28	310.6	0.7	Rst1955
1949.02	0.23	327.6	0.7	Rst1955
1951.47	0.28	330.5	0.7	Rst1955
1961.70	0.34	353.6	0.9	B_1962d
1963.98	0.33	1.5	0.7	Hln1965
1964.00	0.30	355.8	0.4	Cou1964
1965.66	0.33	0.3	0.7	B_1967
1975.84	0.45	4.5	0.6	Hei1978b
1977.920	0.22	8.5	1	Hei1978a
1978.75	0.40	8.3	0.6	Hei1980a
1978.784	0.37	9.9	0.9	wor1989
1984.72	0.47	13.4	0.6	Hei1985a
1989.9410	0.462	18.9	4	Hrt1996b
1990.9185	0.492	17.5	4	Hrt1996b
1991.49	0.44	22.0	0.3	TYC2002
1994.99	0.46	22.8	0.6	Hei1996a
1995.9182	0.468	21.8	2.5	Hrt1997
2001.8680	0.44	26.1	0.7	WSI2002
2007.5994	0.419	31.3	3.8	Msn2011d
2008.5462	0.4226	33.1	4	ToK2010
2013	0.373	39.32	2.1	Adam et al.

Table 1. All observations of WDS 01528-0447.

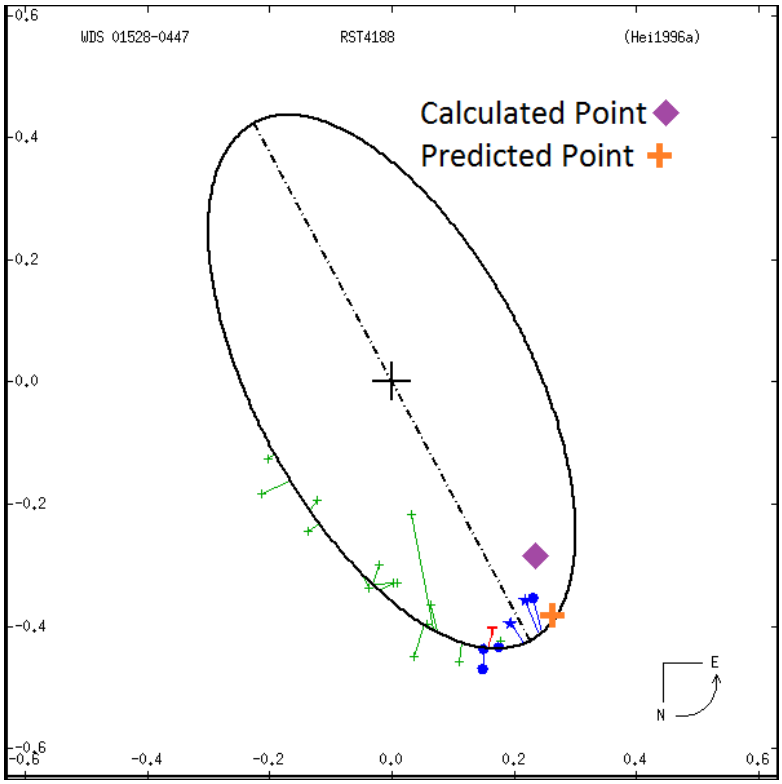

Figure 2. Orbital plot of all observations.

Conclusion

Our group of students successfully reduced data on one binary star from an eight night run at the Kitt Peak National Observatory. We found the position angle and separation of WDS 01528-0447 to be, respectively, 39.32° and 0.373". We graphically compared our data point to the past observations reported in the WDS (Figure 2). It is clear that the orbit was calculated with insufficient data, although, even with the current data set, it does not seem like a satisfactory orbit can be computed. This system should be observed more in the future so that a more satisfactory orbit can be computed.

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