CCD Astrometric Measurements of WDS 04346-7015 GL 203 AB

Jeremy Ha[1], Alex Falatoun[2], Shannon Detwiler[1], Sean Gillette[2], Pat Boyce[2], and Grady Boyce[2]

1. San Dieguito Academy HS, Encinitas, California
2. Boyce Research Initiatives and Education Foundation (BRIEF), California, USA

Abstract: The multi-star system 04346-7015 GL 203 AB was observed during the fall of 2017. It contains a primary and 2 secondaries. Our 2018 measurement of the AB system indicated a position angle of 347.8° and a separation of 6.77", compared to the most recent prior measurement in 2005 with a position angle of 351° and a separation of 6.5". We attempted to measure the AC pair but were unsuccessful.

Introduction

DoubleSTARS is a project offered through Boyce Research Initiatives and Research Foundation (BRIEF) for high school and community college students to gain hands-on experience in the scientific process.

Within the context of double stars, there are two types: optical double star and those that are gravitationally bound, known as binary stars. Optical doubles are stars that visually appear close to one another, however may be hundreds or thousands of lightyears apart without a gravitational connection. If, however, it can be determined that the stars are close enough together that there is a gravitational association, the stars are considered a binary star system. A method of detecting a physical association between stars is by measuring their position angle, θ, and separation distance, ρ, over time to determine their relative motions and determine whether a gravitational link exists.

The star system WDS 04346-7015 GL 203 AB (henceforth referred to as GL 203) was selected because it has only two measurements from 1999 and 2005, Table 1, and it has been more than 10 years since the last measurement, so another measurement would be beneficial to see possible changes that could lead to a determination of the nature of this star system. GL 203 is a triple star system in Dorado. The A, B, and C components have a magnitude of 14.71, 18.9, and 19.55 respectively.

Table 1. Historical measurements for WDS 04346-7015 GL 203 AB. Position angle is measured in degrees and separation distance in arcseconds.

WDS 04346-7015GL 203 AB			
Epoch	Components	θ (°)	ρ (")
1999	AB	352	6.4
2005	AB	351	6.5

The goal of this study was to measure the current separation distance and position angle from the selected double star systems. In obtaining these measurements, we can provide supporting evidence whether or not these systems are either physically associated or just aligned by chance along our line of sight.

Equipment, Observations, and Data Analysis Procedures

Equipment

CCD images were taken using the T27 (Figure 1) and T13 (Figure 2) telescopes, part of the iTelescope network. T27 is located in New South Wales, Australia and is the largest telescope on the iTelescope network. T27 is a Corrected Dall-Kirkham Astrograph with an aperture of 700 mm, a focal length of 4351 mm and a focal ration of f/6.6. Coupled with the FLI PL9000 CCD, it takes images at 0.53 arc-secs/pixel, a high resolution necessary for finding closely spaced stars.

Additional images were taken using the T13 telescope because its lower resolution allows for stars with separations greater than 900 arcseconds. Located in New South Wales, Australia, T13 is an Apochromatic Refractor with an aperture of 90mm, a focal length of 504 mm and a focal ratio of f/5.6. The CCD for the T13 is a SBIG ST2000 XMC with a resolution of 3.02 arc-secs/pixel housing an array of 1600 by 1200 pixels with a FOV of 60.5 x 80.7 arc-mins.

Results

Multiple images were taken with T27 for the close-

Figure 1. Planewave 27" (0.7m) CDK700WF. CDK Astrograph with TEL 0.70-m f/6.6 reflector and CCD in Siding Spring, Australia

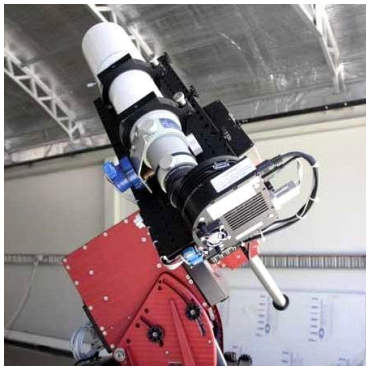

Figure 2. Takahashi SKY90. Apochromatic Refractor

ly spaced AB pair, and T13 for the significantly wider AC pair. We were unable to locate the AC pair with T13, and therefore these images were not used in this paper. The results of the images acquired with T27 are outlined in Table 2.

Analysis Procedures

All images were calibrated (flat-fielded and dark subtracted) by the iTelescope network. Each image was checked for oversaturation. After assessing the quality of the images, they were imported to MaximDL in order to assign World Coordinate System (WCS) positions using the Pinpoint Astrometry program, which compares the image to the Naval Observatory's Catalogue (UCAC4). Then, they were opened using Mira Pro x64, an astronomical image opening program. The AB stars acquired with T27 are outlined in Figure 3.

Discussion

Although there are only two recorded measurements for the AB pair, a small change in theta of 4° was observed with little change in rho since the initial 1999 measurement. These results are consistent with the existing trend of the AB pair.

The separation of the AC pair at 856.7" provided a challenge to measure. Imaging through T13 was unsuccessful at detecting the C component and it was not possible to identify in any image. An additional possible factor in failure to locate the C component is its reported magnitude of 19 and crowded star field. Thus, the AC component was not measured for this pair.

Table 2. *Position angle, separation distance, and uncertainties for GL 203 AB*

WDS 04346-7015 GL 203 AB					
Epoch	Number of Images	Mean θ (°)	σ_θ (°)	Mean ρ (″)	σ_ρ (″)
2017.87	2	347.82	0.715	6.77	0.018

Conclusion

The new data seems reasonable when referenced to past data. None of the images were able to clearly show the location of the C component. This was expected given it's extreme separation and minimal magnitude. More observations are needed for further confirmation of this assumption.

Acknowledgements

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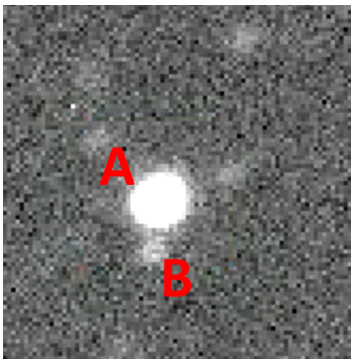

Figure 3. *T27 telescope with Luminance Filter at 270 seconds; captured using Mira Pro x64. This image shows the primary star and B component.*

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