A New Visual Binary System in Leo

Abdul Ahad
Luton, Bedfordshire, United Kingdom
ahad8307@gmail.com

Abstract: This paper highlights a new double star in Leo previously not listed in the WDS catalog. Upon analysis of astrophysical parameters, proper motions, radial velocities and distances of the component stars, it is concluded that this is a wide gravitationally-bound visual binary system.

Introduction

Using the search method and selection criteria I had outlined in earlier papers, this double star first came to my attention in the autumn of 2015 as an 11th magnitude pair. The system is located approximately 7° west of Regulus along the ecliptic in Leo at J2000 ICRS: 09 38 08.79, +13 20 08.3 (Figure 1). The A and B components are of apparent V-mags 11.06 and 11.50 in the Tycho 2 catalog and are designated TYC 827-706-1 and TYC 827-1383-1, respectively.

Figure 1: The Sickle of Leo imaged by the author with his Canon 300D DSLR camera, indicating position of the new binary.

Observations and Binarity Assessments

At the time of my initial observations in 2015, this was an unknown pair and apart from magnitudes and proper motions listed in various catalogs, there was no other data available in regards to the astrometric properties of the two stars and no hints as to likely order of distance or luminosity class on the H-R diagram. Nevertheless, I became convinced that this was a strong binary star candidate from my own assessments and proceeded to image the pair. A V-band image of 30-sec exposure was obtained on November 17, 2015 at 05:26 UTC using the 0.61-meter Cassegrain telescope of the Sierra Stars Observatory Network (SSON)[1]. I later visually observed this system with my own 4.75-inch f/8.33 refractor at approximately 23:00 UTC on January 15, 2016 utilizing a Super Plössl 10mm eyepiece on the telescope's 1000-mm focal length to produce a field sketch at x100 magnification (Figure 2).

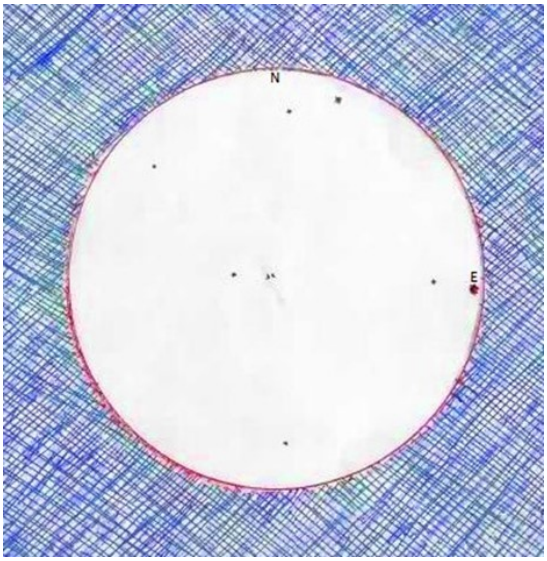

Figure 2: Field drawing made by the author using his 4.75" f/8.33 refractor at a magnification of x100.

From astrometric measurements on the SSON FITS image, I had determined:

- P. A. 64.0°
- Sep. 19.14" (epoch: 2015.880)

Photometric magnitudes of the component stars in various passbands, along with color indices, are shown in Table 1.

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	Gaia G-mag	B	V	Color Index B-V	J	K	Color Index J-K
A component	11.04	11.59	11.06	+0.53	10.13	9.84	+0.29
B component	11.28	12.01	11.50	+0.51	10.29	10.00	+0.29

Table 1: Magnitudes and Color Indices

	UCAC2 (2004)		Gaia DR2 (2018)	
	μ_α mas yr^{-1}	μ_δ mas yr^{-1}	μ_α mas yr^{-1}	μ_δ mas yr^{-1}
A component	-17.4	-7.9	-19.0	-7.9
B component	-16.0	-8.2	-19.4	-7.5

Table 2: Proper Motion of Components in UCAC2[3] vs Gaia DR2

More recent data releases from the Gaia astrometry mission[2] provide further support to the assertion that this is a physical system. Two sets of historical and current proper motions are compared in Table 2, showing a consistent similarity between components on independent measurements.

Trigonometrical parallaxes from Gaia DR2 are stated as 3.9137 ± 0.0477 and 3.9988 ± 0.0498 mas yr^{-1} for components A and B, indicating distances of 833.3 ± 10.0 and 815.6 ± 10.0 ly, respectively. Notwithstanding the relatively small margins of uncertainty of ±10 ly, which is just 1.2% of the average distance of 824.5 ly, we note that the two stars are thus placed virtually equidistant from Earth. Radial velocities are also found to be broadly similar, though far less reliable, and stated as -0.95 ± 0.71 and -1.33 ± 0.26 km sec-1.

Substituting apparent V-mags of 11.06 and 11.50 and distances deduced from Gaia parallaxes of 833.3 ly and 815.6 ly into the distance modulus, we project absolute magnitudes of +4.0 and +4.5 for the A and B components in this system. These in turn would suggest a pair of main sequence dwarves with surface temperatures, T_{eff} , considerably greater than that of the Sun, and I have determined spectral types of something like F7V and F8V[4]. These classifications are supported by B-V color indices of both stars at around +0.52, and further support comes from 2MASS J-K color indices of +0.29 as I had previously demonstrated in reference [5].

At an average calculated distance of the pair of 824.5 ly, the measured angular separation of 19.14" translates to a linear distance of: Tan (19.14") x 824.5 x 63240 ≈ 4838 AU between components A and B. This distance separation would be comfortably within upper bound of thresholds for gravitational interactions to take place between the component stars, as was previously shown by using the α Librae system as a reference yardstick [6].

Conclusions

Upon consideration of the various astrophysical parameters of this pair discussed in this paper, and the manner in which they all fit together, we conclude that this is a physical system with gravitationally-connected components.

Acknowledgments

This research has made use of the Washington Visual Double Star catalog maintained at the United States Naval Observatory and the SIMBAD and VizieR databases maintained at the Centre de Données astronomiques, Strasbourg, France.

References

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