

A New Visual Binary System in Cygnus

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Abstract: This paper documents the discovery of a new double star in Cygnus, currently not listed in the WDS catalog. On observed photometric and proper motion characteristics, calibration of distances, and other assumptions, it is concluded that the components comprise a wide gravitationally-bound visual binary system.

Introduction

I had first identified this new pair in December 2014, while studying the colourful binocular triple Omicron¹/Omicron²/30 Cygni. Much to my later excitement, I was delighted to note that the components squarely fit the binarity criteria I have systematized in earlier papers. The pair is positioned at ICRS 20 12 58.11 +46 08 43.5 (J2000.0). The primary has the designation HD192420 and the companion TYC 3559-2666-1 and they are of apparent visual magnitudes 9.78 and 11.37, respectively.

Lying in an impressive field of the summer Milky Way in Cygnus, this new double is to be found 36' south of α^1 Cygni (Figure 1).

Observations and Binarity Assessments

Having visually appreciated the components in my 120mm refractor on several nights, I eventually had the pleasure of imaging them to a much greater resolution using the 0.61-metre Cassegrain telescope of the Sierra Stars Observatory in California. A set of 30-sec exposure frames were taken in the R, G (visual), and B pass bands at 05:28 UTC on 2015 September 2. A photometric color composite image was then produced, as shown in Figure 2.

Astrometry performed on the source images yielded these measurements:

P.A.: 39.6°

Sep: 18.95" (Epoch 2015.6708)

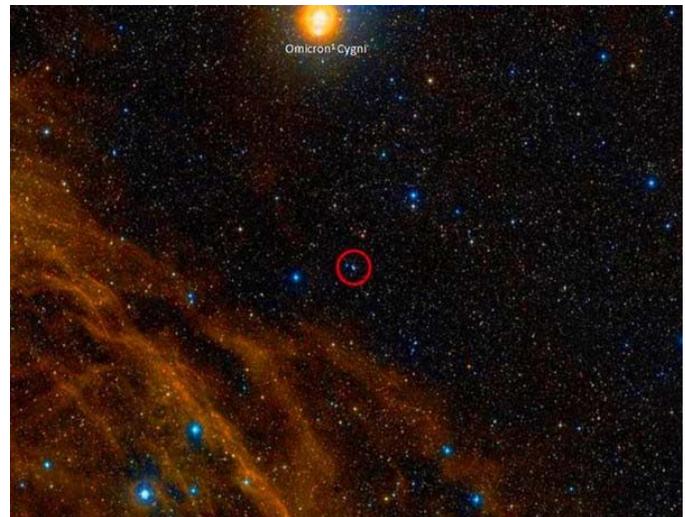


Figure 1. The new binary is circled (source: Wikisky).

The UCAC4 catalog [1] revealed the two stars to be sharing virtually identical proper motions, as shown in Table 1.

An average proper motion, μ , of components A and B was determined to be: $[(A\mu_\alpha^2 + A\mu_\delta^2)^{1/2} + (B\mu_\alpha^2 + B\mu_\delta^2)^{1/2}] / 2 = 45.24 \text{ mas yr}^{-1}$. Referring to the negative exponential I had previously determined in reference [2]:

$$y = 17941 x^{-1.11}$$

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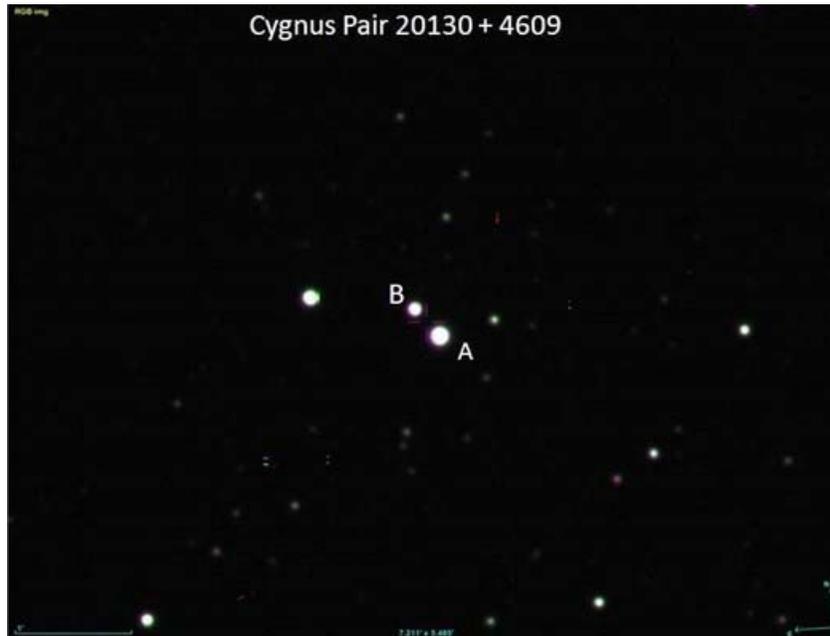


Figure 2. Discovery image obtained by the author using three-color photometry.

This proper motion of $45.24 \text{ mas yr}^{-1}$ indicates the binary is placed at a probable distance in the region of 220 ly (67 pc) from Earth.

From the 2MASS catalog [3] we find J and K magnitudes, color indices (J-K), and likely spectral types for the components, shown in Table 2.

The primary has a spectroscopically determined classification of G5V in SIMBAD, whereas the K6V classification for the companion has been inferred in this paper for the very first time from its 2MASS (J-K) color index of +0.47 [4].

This K6V classification for the secondary is consistent in relation to the primary’s already known G5V classification, considering that the two components have a Δm of 1.6 and share very similar PMs. Now G5V stars generally tend to be of absolute magnitudes of around 5.1, and K6V stars are generally of absolute magnitudes around 7.4 [5]. Projecting spectral distances of both components on these assumptions using the

distance modulus, we arrive at distances of 281 ly (86 pc) and 203 ly (62 pc) from Earth, respectively, for the A and B components. These values are sufficiently close to one another and fall on either side of the 220 ly (67 pc) distance projected earlier from proper motions, all of which in their totality suggest a true binary system.

At a distance of 220 ly, the angular separation of $18.95''$ would translate to a linear distance of: $\tan 18.95'' \times 63240 \times 220 \approx 1200 \text{ AU}$ between components A and B, which would be more than sufficiently close for them to be gravitationally bound as a binary pair.

Conclusions

On 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 gravitationally-connected binary system.

Table 1. Proper Motion of Components

| | μ_α mas yr ⁻¹ | Error mas yr ⁻¹ | μ_δ mas yr ⁻¹ | Error mas yr ⁻¹ |
|-----------|--------------------------------------|-------------------------------|--------------------------------------|-------------------------------|
| Primary | +38.3 | ±1.1 | +24.9 | ±0.9 |
| Companion | +38.5 | ±0.9 | +22.9 | ±2.5 |

Table 2. 2MASS Photometry, Color Indices and Spectral Types

| | J-mag | K-mag | Color Index (J-K) | Spec Type |
|-----------|-------|-------|----------------------|--------------|
| Primary | 8.525 | 8.160 | +0.37 | G5V |
| Companion | 9.952 | 9.481 | +0.47 | K6V |

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References

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