

A New Common Proper Motion Double Star in Corvus

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Abstract: In this paper, I report a new visual binary star in the Constellation of Corvus that is not in the current edition of the WDS catalog, the components of which share a common proper motion. On detailed binarity assessments, the two stars seem quite possibly a gravitationally connected pair.

Introduction

This pair first came to my attention in January 2012 in DSS images and I later obtained my own discovery image using the 0.61-meter Cassegrain telescope of the SSON [1] on the night of May 13th 2012 (at 05:28 UTC). The primary has the designation BD-13 3613 and is of visual magnitude +10.5, at ICRS coordinates: 12 53 38.5, -14 27 44 (Epoch 2000.0). I have estimated the brightness of the secondary to be at least 1.5 magnitudes fainter, at V mag. +12.0.

Latest Measurements

My discovery image of this pair is shown in Figure 1.

Proper Motion and Distance

The UCAC3 catalog [2] indicates that the two stars share similar proper motions (PM) in both RA and Dec, in both magnitude and in sign. These are given in Table 1.

The pair as a whole, has a total proper motion of $\{[(-31.5)^2 + (17.6)^2]^{1/2} + [(-27.0)^2 + (14.9)^2]^{1/2}\} / 2 \approx 33.5$ milliarcseconds per year. These values are similar to those stated in the PPMXL Catalog (Roeser+ 2010), which may be taken as an additional source of PM for independent verification. In that catalog, the secondary star has proper motions of (-27.7, +18.2) mas/

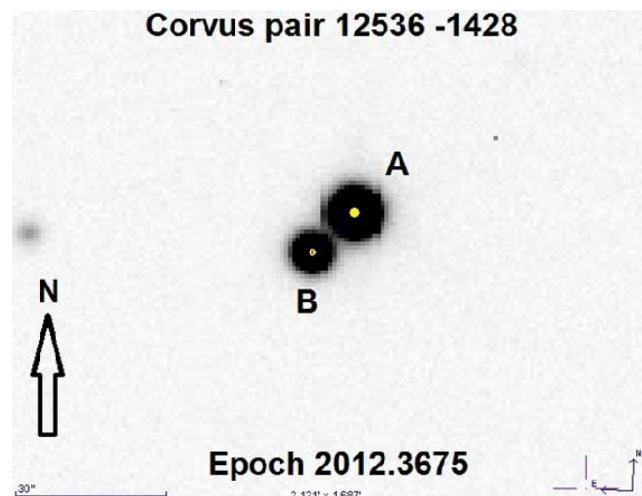


Figure 1: Image of the new cpm pair. Measurements from the above image yield position angle (theta) = 137.0° and separation (rho) = 11.59" (Epoch 2012.3675)

yr which are significantly more similar to the observed proper motions of the primary.

In my report in the Webb Society DSSC19 [4], I showed for purposes of illustration the distances and proper motions of a number of binary systems, and the basic correlation that exists between these two parameters. Referring to that scale, this figure of

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Table 1: Proper motion of the components.

Corvus Double Star	Proper Motion in RA	Proper Motion in Dec
A-component	-31.5 mas/year	+17.6 mas/year
B-component	-27.0 mas/year	+14.9 mas/year

33.5 mas/year suggests this Corvus double star is located in the region of somewhere around 400 light-years away from the Earth.

Photometry and Spectral Classification

The 2MASS catalog [3] which was the result of a survey of the sky conducted in the near-infrared, gives the J and K-band magnitudes for the two components in this Corvus double star shown in Table 2.

From these we deduce color indices of $(J - K) = +0.28$ for the primary and $(J - K) = +0.38$ for the secondary component.

In 2012, I devised a methodology for deciding the approximate horizontal position in the spectral classification of visual double stars on the Hertzsprung-Russell (H-R) diagram, by working out their 2MASS $(J - K)$ color indices [5]. From the above calculated color index values, and the methodology described in reference [5], we can infer spectral types of roughly $\sim G0$ for the primary star, and $\sim K0$ for the secondary star in this Corvus double. We can further state, with reasonable confidence, that both stars are likely to be of luminosity class “V” (main sequence dwarves on the H-R diagram) as follows.

Since we already have a basic assumption from the size of their PMs that this pair is located approximately around ~ 400 light-years away, we can show that the assumptions about their colors and spectral classifications fit the distance modulus. A G0V star placed at a distance of 400 light-years away from the observer will shine at an apparent visual magnitude of around +10.1. For example, the star Chi-1 Orionis is of spectral class G0V, situated at a distance of 28.3 light-years away, shining at apparent magnitude (m) +4.39, and it has an absolute magnitude (M) of +4.67. If Chi-1 Orionis were hypothetically placed 400 light-years away from Earth, it would shine with an apparent magnitude of +10.1. This is not far off from the primary star’s +10.5 magnitude brightness we observe in this Corvus double star.

Purely on the basis of the size of its observed proper motion, we can tentatively infer that the secondary star in this double star (B-component) has to be at a similar distance from the Earth as the primary. Its observed apparent brightness and color,

Table 2: J and K magnitudes of the components

	J-magnitude	K-magnitude
A-component	+9.575	+9.297
B-component	+10.744	+10.360

therefore, imply it too has to be of luminosity class “V”, as a K-type main sequence dwarf on the H-R diagram.

On the assumption that both stars in this pair are in fact at the same distance of 400 light-years away, if their orbit was projected in the plane of the sky, the two stars would be physically separated by:

$\tan(11.59^\circ) \times 400 \times 63240 = 1421$ Astronomical Units in three-dimensional space.

Conclusions

In the various methods of fitting the observed photometric values to physical properties, distances and proper motions of this pair discussed in this paper, it seems that this is quite possibly a binary star – as opposed to it being merely a line-of-sight optical double star.

References

1. Sierra Stars Observatory Network (SSON) <http://www.sierrastars.com>
2. UCAC3 Catalog (Zacharias+ 2009)
3. 2MASS All-Sky Catalog of Point Sources (Cutri+ 2003)
4. Ahad, A. 2011 Webb Society Double Star Section Circulars, **19**, 48
5. Ahad, A. 2012 Journal of Double Star Observations, Vol 8, No 4, October 1st 2012, page 333, Table 2.