

A New Common Proper Motion Pair in Sextans

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Abstract: This paper presents a new common proper motion double star that is not in the current edition of the Washington Double Star catalog. The result is a 13th magnitude companion that appears to share the same space motion with the 10th magnitude orange primary star, BD-09 3056, in Sextans.

Introduction

In the past few years, I have been seeking to identify new visual double stars that display a number of favorable attributes that make them attractive candidates for possible binary systems. This has meant conducting searches of the sky both visually, using my Skywatcher Explorer 8-inch EQ-5 F/5 Newtonian reflecting telescope, as well as photographically going down to as low as 13th magnitude pairs using the DSS / POSS survey images where possible.

Methods

The new pair reported in this paper first came to my attention as a pair of partially resolved stars of greatly unequal brightness in a STScI digitized sky survey image plate on January 21st 2012, while I was investigating another pair from the Washington Double Star (WDS) catalog. Later, I noticed the two stars were of similar orange colors, and were excluded from the WDS catalog and so I took an even greater interest. I was able to pinpoint them in the SIMBAD/Aladin previewer at ICRS coordinates 10 22 44.8972 -09 55 39.780 (J2000.0) which showed the primary star as BD-09 3056, of visual magnitude +10.20. A DSS image of the pair is shown in Figure 1.

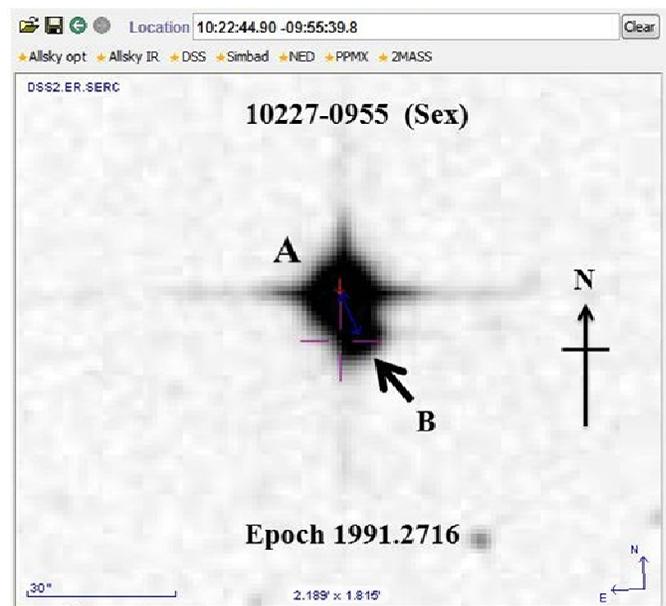


Figure 1: DSS image of the proposed new common proper motion pair.

Measurements

The Aladin applet facilitated taking a measurement of this pair on the above DSS image, yielding

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these results:

Position Angle (theta): 203.5°

Separation (rho): 8.804"

Via the 'prop' icon of Plane ID: DSS2.ER.SERC, the precise epoch of the above DSS image was found to be 1991-04-10 (J1991.2716). The stated measurements of theta and rho, therefore, are for this epoch.

Likelihood of Binarity

For two stars in a visual double star to have any kind of physical gravitational association between them, first and foremost they must both display very similar proper motions (PM) in RA and Dec, both in magnitude and in direction. The PPMXL catalog (Roeser+ 2010) shows this to be the case for this particular double star, giving the approximate results as shown in Table 1.

The pair, as a whole, thus has a total proper motion of: $([(-1.0)^2 + (-44.5)^2]^{1/2} + [(-2.2)^2 + (-41.5)^2]^{1/2}) / 2 = \sim 43.0$ milli-arcseconds per year.

Two further parameters are required to fully establish binarity in a visual double star system, i.e. the two stars must have similar radial velocities and also trigonometrical parallaxes. Neither of those was available for the two stars in this pair in the catalogs that I could access, so I resorted to other methods that I have used in the past to assess the situation.

In my report in the Webb Society DSSC 19¹ 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, a proper motion of ~ 43.0 mas/year for this Sextans double star suggests the pair is located somewhere around ~ 300 light-years distant from the Earth.

Considering the primary star in this pair is orange in color, for it to display a proper motion rate of 43 mas/year and shine with an apparent magnitude of 10.2, it is likely to be a K-type main sequence dwarf. If it were anything other than this, it would either shine with a different apparent brightness or display an altogether different rate of proper motion across the sky. Now the star 70 Ophiuchi A, in the 70 Ophiuchi binary system is a K0 V type main sequence dwarf

Table 1: Proper motion of components.

Sextans Double Star	Proper Motion in RA	Proper Motion in Dec
A-component	-1.0 mas/year	-44.5 mas/year
B-component	-2.2 mas/year	-41.5 mas/year

star, whose apparent magnitude is +4.0 and whose absolute magnitude is +5.5. If we apply the distance modulus formulae I had previously stated in my report in the Webb Society DSSC 18², we find that 70 Ophiuchi A would shine at an apparent magnitude of +10.3, virtually the same as the primary star's apparent magnitude of +10.2 in this double.

This is strongly indicative that the primary star in this Sextans double star (BD-09 3056) is of comparable mass and luminosity to 70 Ophiuchi A.

The secondary star in this Sextans pair is listed as magnitude 13.0 in the PPMXL catalog. By a similar set of comparative calculations as with the primary shown above, the 13th magnitude secondary star in this pair is found to be a low-mass red dwarf, perhaps of similar mass and luminosity as the star 61 Cygni B in that famous binary system. At a projected distance of circa 300 light-years from Earth, the linear distance separating the two stars in this Sextans pair is likely to be: $\tan(8.804'') \times 300 \times 63240 = 810$ Astronomical Units. Where 63240 is the number of Astronomical Units in one light-year.

Conclusions

In the absence of precise parallax and radial velocity measurements for both stars it is difficult to be one hundred percent certain, but otherwise all the parameters fittingly point to this being a good candidate for a slow binary system of long orbital period.

References

- Ahad, A. 2011 Webb Society Double Star Section Circular, **19**, 48
- Ahad, A. 2010 Webb Society Double Star Section Circular, **18**, 49