

A New Visual Binary System in Aquarius

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Abstract: In this paper, a new common proper motion pair is reported in Aquarius, currently not listed in the WDS catalog. From a combination of B, V, J, and K-band photometry, proper motion, and radial velocity observations, the components are shown to be part of a gravitationally connected binary system.

Introduction

A DSS image of this pair, located at ICRS: 20 59 15.95, -08 11 57.6 (J2000.0), is shown in Figure 1.

The primary bears the designations HD199726 and BD-08 5534, and is of V-mag 9.78. The secondary is of an estimated V-mag of ~ 11.8 . The pair was visually sighted and sketched with a Skywatcher Evostar 120mm refractor at 00:25 UT on August 1, 2014 as



Figure 1: Digitized sky survey image of the new binary in Aquarius

shown in Figure 2.

It must be stressed, however, the faint companion was only just barely glimpsed through dark adapted

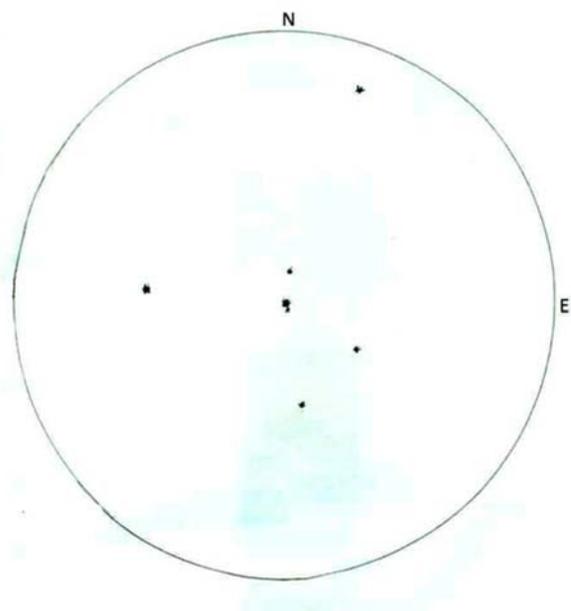


Figure 2: The new binary visually sketched at a magnification of $\times 159$.

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Table 1: Proper Motions and Radial Velocities of the Components

	μ_{α} mas yr ⁻¹	Error mas yr ⁻¹	μ_{δ} mas yr ⁻¹	Error mas yr ⁻¹	Radial Velocity km sec ⁻¹	Error km sec ⁻¹
Primary	+15.7	±1.6	+2.5	±3.4	+7.98	±1.8
Companion	+16.7	±1.6	+0.0	±1.9	+6.66	±1.9

eyes and using averted vision. The system was later imaged to a greater resolution using the 0.61-meter Cassegrain telescope of the Sierra Stars Observatory Network[1] on 2014 September 4th, which enabled approximate measurements to be taken:

Position Angle: 161.1°

Separation: 10.58"

Proper Motions and Radial Velocities

As mentioned in earlier papers[2], the components of a dynamically associated binary system would, in addition to displaying common proper motions, be expected to have very similar radial velocities. The primary in this Aquarius pair has a measured radial velocity of +7.98 km/sec. Radial velocities of stars as faint as this are generally not so abundantly available, however. In recent years, efforts have been initiated to extend radial velocity measurements across broader regions of the sky and going down to fainter limiting magnitudes.

The Radial Velocity Experiment (RAVE)[3], in particular, is a multi-fiber spectroscopic astronomical survey of stars in the Milky Way using the 1.2-meter UK Schmidt Telescope of the Anglo-Australian Observatory (AAO). From this survey, it has been possible to obtain a radial velocity measurement of the faint companion in this new Aquarius pair. This, along with UCAC4 [4] proper motions for both stars are summarized in Table 1.

We note that the PM vectors and radial velocities of both components are closely aligned, considering the small error margins in each. This is strongly indicative of a binary association between the two stars.

From Table 1, a total proper motion, μ , of 16.3 mas yr⁻¹ was computed for the pair, suggesting a distance in the region of about 400 to 700 ly from Earth [5].

Photometry and Distance Calibration

A summary of photometric data, taken from the UCAC4 and 2MASS[6] catalogs, along with spectral classifications are shown in Table 2.

We note that the primary component already has a spectroscopically determined classification of F8V in the catalogs. The K0V classification for the secondary has been determined in this paper as follows: the “K0” part is derived from its 2MASS (J-K) color index of +0.39[7] and the “V” part (main-sequence dwarf) from its apparent visual brightness and estimated distance in the region of 400 to 700 ly, inferred from proper motions⁵. This K0V classification for the secondary is consistent in relation to the primary’s already known F8V classification, considering that the two stars have a Δm of 2.0 and share very similar PMs. Now F8V stars generally tend to be of absolute magnitudes of around 4.0 and K0V stars are generally of absolute magnitudes around 5.9[8]. Projecting spectral distances of both components on these assumptions using the distance modulus, we arrive at distances of 467 ly and 494 ly from Earth, respectively, for the A and B components.

These distances are close enough to one another and fit comfortably within the 400 to 700 ly distance range projected earlier from proper motions, again suggesting a true binary system.

Conclusions

On consideration of the astrophysical parameters of this pair discussed in this paper, and the manner in which they all fit together, we conclude that this is a proven gravitationally-connected binary system.

References

1. Sierra Stars Observatory Network (SSON), website: <http://www.sierrastars.com>

Table 2: B, V, J, and K-band Photometry and Spectral Types

	B	V	J	K	Color Index (B-V)	Color Index (J-K)	Spec Type
Primary	10.202	9.778	9.046	8.824	+0.42	+0.22	F8V
Companion	...	~11.8	10.643	10.250	...	+0.39	K0V

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5. Ahad, A., Webb Society Double Star Section Circular, **19**, 48, 2011.
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8. *Allen's Astrophysical Quantities*, 4th edition, Cox, Arthur N. (editor), Springer, New York, 2000.

