A New Common Proper Motion Double Star in Sagittarius

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Abstract: In this paper I report a new visual binary star in the constellation Sagittarius that is not in the current edition of the WDS catalog, the components of which share a common proper motion. On observed photometric characteristics, estimation of distance, and other assumptions, it has not been possible to rule out a possible physical association between the two stars.

Introduction

I had first noticed this pair as a CPM double star back in May 2012, while imaging 'fast-moving' double stars from the WDS catalog in the general vicinity in the neighboring constellation of Capricornus. The primary has the designation HD 186751, is of V mag +9.7 and resides at ICRS: 19 46 50.7 -15 55 41 (2000.0). The secondary is of V mag +10.4, 25.2 arcseconds away from the primary.

Offering a spectacular sight in small telescopes, this pair is located in an exciting region of the sky not far from the summer Milky Way in northeastern Sagittarius (Figure 1).

A close-up FITS image was obtained in the J-band (taken at a wavelength of 1.24 μm) from the Two Micron All-Sky Survey [1] for epoch 1999-06-07, as shown in Figure 2. From this image (which is of an adequately high resolution of 0.9 arcseconds per pixel) the following positional measures were found:

Position Angle (θ): 352.0° (Epoch 1999.4326)

Separation (ρ): 25.24" (Epoch 1999.4326)

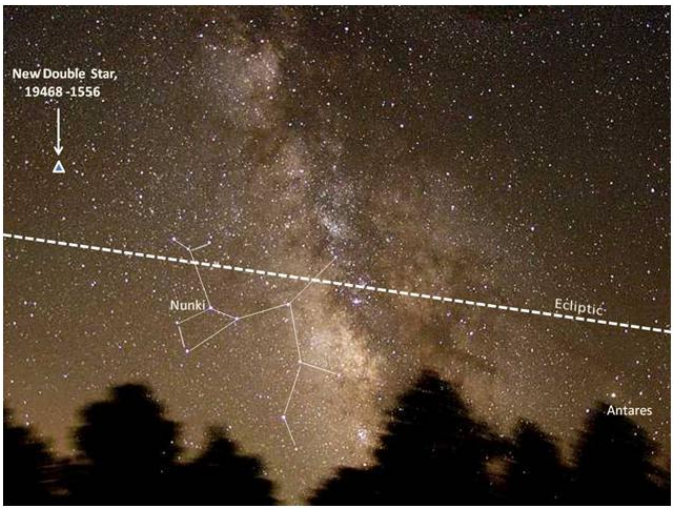

Figure 1: Location of the proposed new double star

Proper Motion and Distance Calibration

From the UCAC3 Catalog [2], we find the two stars share similar proper motions in both RA and Dec, in both magnitude and in sign, Table 1. The pair as a whole has a total proper motion of:

$$\frac{\sqrt{25.5^2 + 2.0^2} + \sqrt{25.5^2 + 4.0^2}}{2} = 25.7 \text{ mas/yr.}$$

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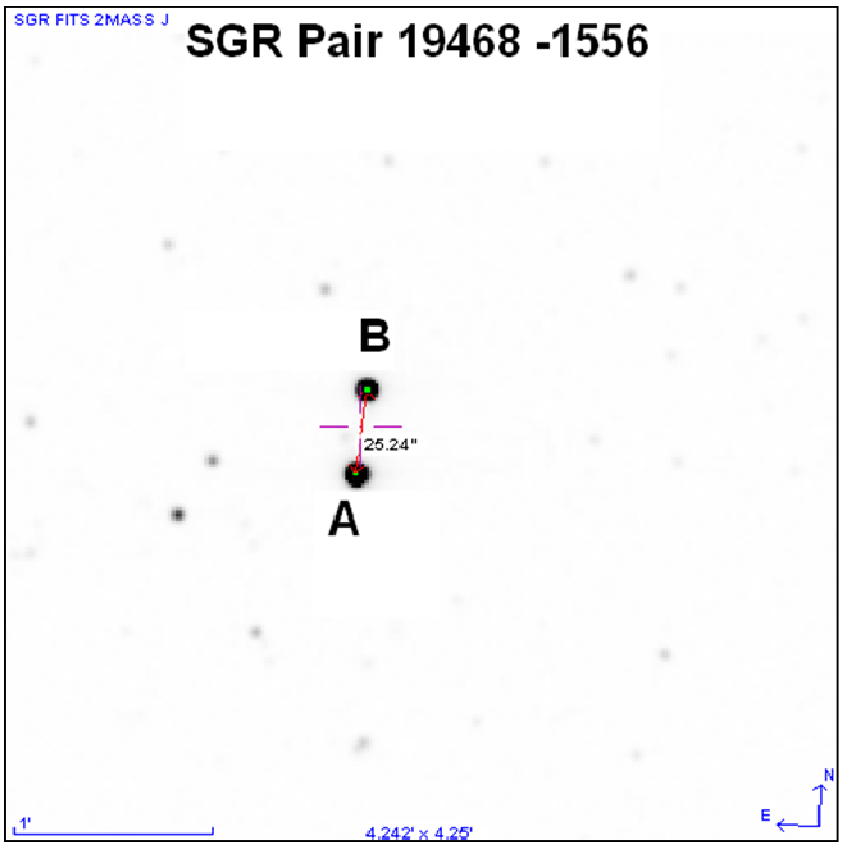

Figure 2: Image from 2MASS, taken in the J-band.

From the 2MASS catalog, we find the J and K-band magnitudes for the two components in this Sagittarius double star given in Table 2. From these we compute color indices of (J – K) = +0.32 for the primary and (J – K) = +0.40 for the secondary component.

A 2MASS color index (J – K) for the primary star of +0.32 suggests it to be a 'Sun-like' star with a spectral class near a G2.

The absolute magnitude of the Sun, for example, has been calibrated in various photometric bands where its (J – K) color index is approximately equated to +0.36, and we know the Sun is classified as a G2V star on the H-R diagram. We also know that a G2V star typically shines at an absolute magnitude of +4.8, and applying the distance modulus formula to the primary's apparent visual magnitude of 9.7, yields a distance to the primary of about 300 light-years. This distance is consistent with the total proper motion of 25.7 mas/year for the pair, from the broad relationships between the observed proper motion and likely distance I have referenced in previous papers. This is then sufficient evidence to suppose the primary is likely to be similar to a G2V star, much like our own Sun.

Table 1: Proper motion of the components

	Proper Motion in RA	Proper Motion in Dec
A-component	+25.5 mas/yr	+2.0 mas/yr
B-component	+25.5 mas/yr	+4.0 mas/yr

Table 2: J and K magnitudes of the components

	J-magnitude	K-magnitude
A-component	+8.376	+8.058
B-component	+9.010	+8.608

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The secondary's color index of +0.40 suggests it to be a much cooler and comparatively less luminous star compared to the primary, and of spectral class K on the H-R diagram.

Differencing the apparent magnitudes of the two stars, we find a Δm of 0.68 that is consistent with the observed color difference between the two component stars and with their respective spectral classifications. This further suggests they are both shining from a similar (if not the same) distance, estimated to be 300 light-years away.

Lunar Occultations

Positioned less than 6° north of the ecliptic line in the sky means this pair can get occulted by the Moon in its monthly circuits of the sky, and such occultations would be repeated over a cycle of about 19 years. Visibility will be restricted to observers located in the southern hemisphere of Earth, however, due to the specific position of this pair and orientation of the lunar orbit relative to the Earth's equatorial plane. According to simulations carried out using the Stellarium planetarium software, in the present cycle, the Moon will pass in front of the two stars in succession as seen from Cape Town, South Africa on the night of 24th-25th June 2013 and again on 18th August 2013. Similar occultations may be observed from Sydney, Australia on 28th-29th May 2013 and again on 22nd July 2013.

Conclusions

Given their virtually identical common proper motions, the two stars are most likely drifting in the same direction in 3D space in their travels relative to the center of the Milky Way galaxy. The observed photometric properties of each star and a calibrated distance of circa 300 light-years for the pair give a strong indication that they might be gravitationally linked. Considering also the visual spectacle that would be afforded to telescopic observers in potential occultations by the Moon, it is recommended that this pair be included in the WDS catalog as an exciting new visual double star.

References

1. The Two Micron All-Sky Catalog of Point Sources (Cutri, et al., 2003)

2. UCAC3 Catalog (Zacharias, et al., 2009)