A New Double Star in Cepheus

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Abstract: A new double star has been found in Cepheus, at 21:55:22.8 +65:01:40.8, J2000. A measurement made with the Aladin tool[1] of the new double gives 15.6 arc seconds of separation and a position angle of 27°. The APASS[2] visual magnitudes, as reported by the UCAC4[3] are 11.1 and 11.35. Historical data from the stars are listed, as are distance estimates to the pair.

A new double star has been found in Cepheus at R.A. = 21:55:22.8, dec. = +65:01:40.8, J2000.The pair was found while observing STT 457, WDS ID: 21555+6519. Using the Aladin tool, UCAC4 listed the proper motions (in milliarcseconds per year) of the pair as:

Primary pmRA: -0.5, pmDec: -5.8.
Secondary pmRa: -0.8, pmDec: -8.2.

This was reported to William Hartkopf[4] of the USNO[5], who has included it in the WDS[6] as TVB 7.

The primary's UCAC4 id is 569-000097, and the secondary's UCAC4 id is 569-000094.

Dr. Hartkopf researched the new pair and emailed me his results:

"I extracted Tycho[7], UCAC4, and 2MASS[9] measures, as well as two photographic measures from 1895 and 1903 - so 5 astrometry measures spanning over a century, plus 5 additional photometry measures."

These results are shown in Table 1. Column headings in the table are defined as follows:

- Date is the date of the observation.
- Rho is the separation angle, in arc seconds.
- Errors in rho are also in arc seconds.
- Theta is the position angle, in degrees.
- Errors in theta are also in degrees.
- A mag is the magnitude of the primary.
- B mag is the magnitude of the secondary.
- FEW: Filter effective wavelength, in nanometers.
- FWHM: Full width at half maximum, in nanometers.
    - Note: A "B" designates a blue magnitude, where the filter information was not accurately known.
- Aperture: Telescope aperture, in meters.
- Obs ct: Number of observations used to generate the data.
- Sources (With publication year appended):
    - WFC: From the Washington Fundamental Catalog[10]
    - TYC: From the Tycho catalog.
    - TMA: From the 2MASS catalog.
- Type: The observation's data type.
    - Pa: Photographic technique with an astrograph.
    - Ht: Tycho data from the Hipparcos satellite.
    - E2: 2MASS data.
    - Eu: UCAC data.

Based on the Wikipedia H-R diagram[9] and UCAC4 blue and visual magnitudes, the primary appears to have a spectral class of A8, and the secondary F9. Assuming these stars to be main sequence dwarves, this gives them approximate absolute magnitudes of +4 and +6. Using the well known distance modulus equation:

$$M - m = 5(\log_{10}(d)) - 5$$

where M is the absolute magnitude, m the apparent magnitude, and d is the distance in parsecs. Solving for d gives:

$$d = 10^{((m - M + 5) / 5)}.$$

Distances of 250 and 120 parsecs result from the abso-

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Table 1. Historic Measurements of the New Double Star Extracted by W. Hartkopf

Date	Rho	Error in rho	Theta	Error in theta	A mag	Error in A mag	B mag	Error in B mag	FEW	FWHM	Aperture	Obs ct	Source	Type
1895.88	23.9	_	15.857	_	-	-	-	-	-	B	0.3	1	WFC1998	Pa
1903.73	26.7	_	15.780	_	-	-	-	-	-	B	0.3	1	WFC1998	Pa
1991.66	26.8	_	15.908	_	11.096	0.077	11.353	0.093	530	100	1.4	1	TY-C2000b	Ht
1991.66	_	-	-	-	11.526	0.072	12.130	0.136	430	90	1.4	1	TY-C2000b	Ht
1999.74	27.1	_	15.71	_	10.062	0.026	10.413	0.026	1256	245	1.3	1	TMA2003	E2
1999.74	_	-	-	-	9.822	0.030	0.174	0.028	1633	160	1.3	1	TMA2003	E2
1999.74	_	-	-	-	9.795	0.021	0.157	0.019	2210	300	1.3	1	TMA2003	E2
2003.702	27.0	0.1	15.746	0.029	10.95	0.03	11.33	0.05	609	70	0.2	4	UC_2013a	Eu

lute magnitudes of +4 and +6, respectively. If they are both subgiants, however, the absolute magnitudes are both close to +3, giving a distance of about 400 parsecs.

Figure 1 is a photo of the new binary from the DSS as rendered by the Aladin Sky Atlas tool.

Note that the proper motions associated with these stars are fairly small, although rho and theta have shown little change from when the pair was first measured. It is hoped that observations from the recent Gaia mission and other subsequent measurements will establish that this pair, and many like it, are physical.

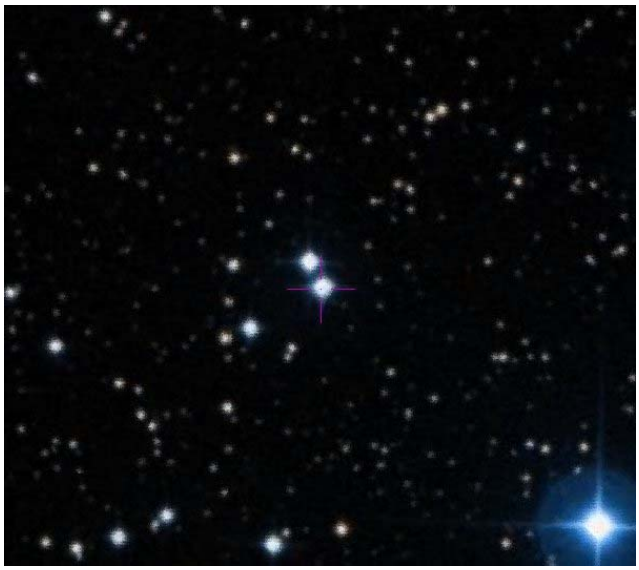

Figure 1. DSS image of the new double star.

Acknowledgements

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References

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2) AAVSO APASS web site, http://www.aavso.org/apass

3) The Fourth *US Naval Observatory CCD Astrograph Catalog (UCAC4)*, Zacharias, et al, 2012, http://www.usno.navy.mil/USNO/astrometry/optical-IR-prod/ucac

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5) USNO web site, http://www.usno.navy.mil/USNO/

6) Brian D. Mason, Gary L. Wycoff, William I. Hartkopf, Geoffrey G. Douglass, and Charles E. Worley, 2001. *The Washington Double Star Catalog*, http://ad.usno.navy.mil/wds/

7) Tycho-2 web site, http://www.astro.ku.dk/~erik/Tycho-2/

8) 2MASS web site, http://ww.ipac.caltech.edu/2mass/

9) Wikipedia H-R diagram, http://upload.wikimedia.org/wikipedia/commons/6/6b/HRDiagram.png

10) USNO catalog listing for the Washington Fundamental Catalog, http://www.usno.navy.mil/USNO/astrometry/information/catalog-info