# Binary

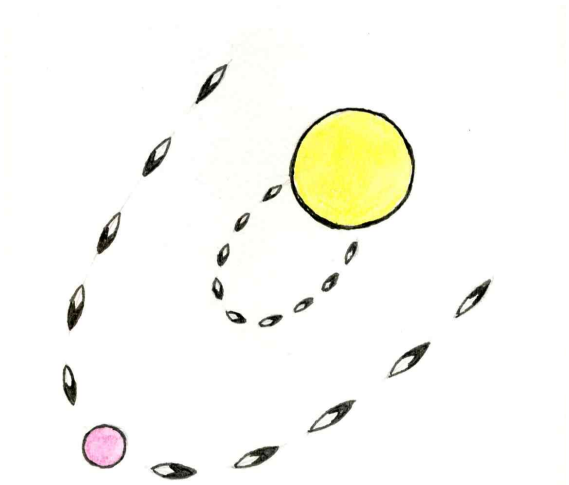
July, 2012

**Journal of the Double Star Group**

*Adviser and editor: Dr. John McCue, FRAS*

*A publication of the*
*Deep Sky Section,*
*Director: Callum Potter,*

*British Astronomical Association*



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## Double star catalogue

by John McCue

In the first issue of Binary, the Cambridge Atlas of Double Stars by Wil Tirion and James Mullaney was reviewed by Simon Johnson (CUP, ISBN 978-0-521-49343-7 in paperback). In the first part of that book, the authors present a list of showpiece doubles which everyone should see. This particular portfolio shows the wide variety and the spectacular sights that double stars bring to the observer at the telescope. Famous examples such as the Trapezium in the Orion Nebula, the Double-Double in Lyra, Regulus, Albireo, Sirius, Mizar and Alcor, Vega, Delta Cephei, Castor and Rigel are all there. Working through this list, I realised that many of them I hadn't seen before, and some of them, like Regulus and Rigel, were so familiar as naked-eye stars that I had never looked at them through a telescope for many years. I didn't even know that some of these well-known stars were duplicate in nature. This is definitely a collection of celestial wonders to see before you die, to coin a popular phrase.

I checked which ones were visible from the UK. That left 101 in the list, out of the original 133. This reminded me of the Messier and Caldwell catalogues so I made a separate inventory, adding the position angles and checking other details. Here are the 101 showpiece doubles from the original list by Tirion and Mullaney in the Cambridge Atlas.

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Cat003.jpg


Figure 1: Doubles 1 - 50

## Letters to Binary

from Roger Pickard, former President of the BAA.

I was interested in Peter Clark's observation reported in the recent Binary publication.

He says all 3 stars are listed as HD200253 in SkyMap but Guide has the brighter one only listed under this designation. It's also Tycho 2713 2875 at Johnson V magnitude: 6.0 and a Hipparcos star. The fainter one is Tycho 2713 1913 at Johnson V magnitude: 8.7 and the faintest one Tycho 2713 1326 at Johnson V magnitude: 9.3.

More info:

Tycho 2713 2875
Proper motion in RA: -3.47  0.24 milliarcseconds/year
Proper motion in dec: -6.42  0.24 milliarcseconds/year
Distance: 192  12 parsecs
Parallax: 5.21 +/- 0.33 milliarcseconds

Tycho 2713 1913
Proper motion in RA: 8  2 milliarcseconds/year
Proper motion in dec: 2  2 milliarcseconds/year
Distance: 77  65 parsecs
Parallax 13  11 milliarcseconds

Tycho 2713 1326
Proper motion in RA: -4  2 milliarcseconds/year
Proper motion in dec: -2  2 milliarcseconds/year
Distance: 63  55 parsecs
Parallax 16  14 milliarcseconds

So given the above (even bearing in mind the errors) it would seem to me they are all unrelated. What say you?

Cheers,
Roger

## Editor's reply

Hi Roger,

Thanks very much for your message, and thanks for doing some checking. When Peter sent me the observation I checked with the Washington Double Star Catalogue and sure enough it wasn't there. That was the important thing for me. I didn't check with SkyMap Pro but you're right, only the bright star is HD200253.

After receiving your message, I checked the UCAC3, SIMBAD database and PPMXL against your Guide figures and they're broadly in agreement, though UCAC3 only agrees for the second brightest star. Yes, it's uppermost in my mind that to prove a binary/triple connection, the proper motions must all be similar, and they're certainly not here, and the distances back up the disconnection. Peter wasn't claiming a new binary/triple, just that they weren't in WDSC. I think he was most excited and amazed by that, and rightly so; there are still so many discoveries to be made. It's also true that the WDSC does not restrict its content to gravitationally bound binaries, even though these are much more interesting, in my view anyway, than line-of-sight doubles

Best wishes,
John

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from Peter Clarke

See what you think of using the natural filter of cloud passing over a system such as Castor. I find this to be the best split definition for bright close doubles. I tried this recently when Castor had become invisible to the naked eye. This is an interesting exercise when cloud arrives to shorten an observing session.

Best wishes,
Peter

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# Measuring double stars with a crosshair eyepiece and a stopwatch

by John McCue

Many amateur astronomers enjoy finding and observing double stars, and many like to take the observation one step further and measure the two important things about the two stars - how far apart they are (separation, s), and what angle they present to the observer (from north measured through east, $\theta$). Both of these measures can be then sent to the world repository of observations, the Washington Double Star Catalogue at the US naval observatory, and contribute towards the knowledge of that star, and maybe towards a calculation of its orbit. The only direct way of measuring the mass of a star is from a knowledge of its orbit around another.

The problem is that the two main methods are both quite expensive. A photographic CCD image of the double star can be taken and its sep. and p.a. measured afterwards using specialist software on your computer, or you can use an astrometric eyepiece which has an illuminated grid inside it to allow direct measurement of sep. and p.a. at the eyepiece.

Here's a method though, which is very cheap but untested, so I need your help to prove it works - you need a simple crosshair eyepiece and a stopwatch. When you have the double star in your crosshair eyepiece, turn off the telescope drive and turn the crosshairs until one arm is aligned with the way the stars are drifting; that's E-W direction, of course. Move the telescope (with the motor drive controls if available) until the double is 'upstream' of the wires, and time the difference between when the primary crosses the N-S wire and the secondary does so. In the diagram the primary is shown at the central wire crossing but that doesn't have to be the case; both stars just have to cross the N-S wire. Make a note of the the time on your stopwatch. This will be time B1B2.

Next, turn the crosshairs until one arm is aligned with the two stars themselves (the dotted lines in the diagram), then time the difference (again the drive should be off) between when the secondary crosses that arm (with the primary crossing the central wire crossing point) and when it crosses the other arm. Again, the primary doesn't have to go through the centre, but if not, time the difference between when the two stars cross the 'non-aligned' arm, no matter whether on the top side or lower side of the middle. This will be the time B1B3.

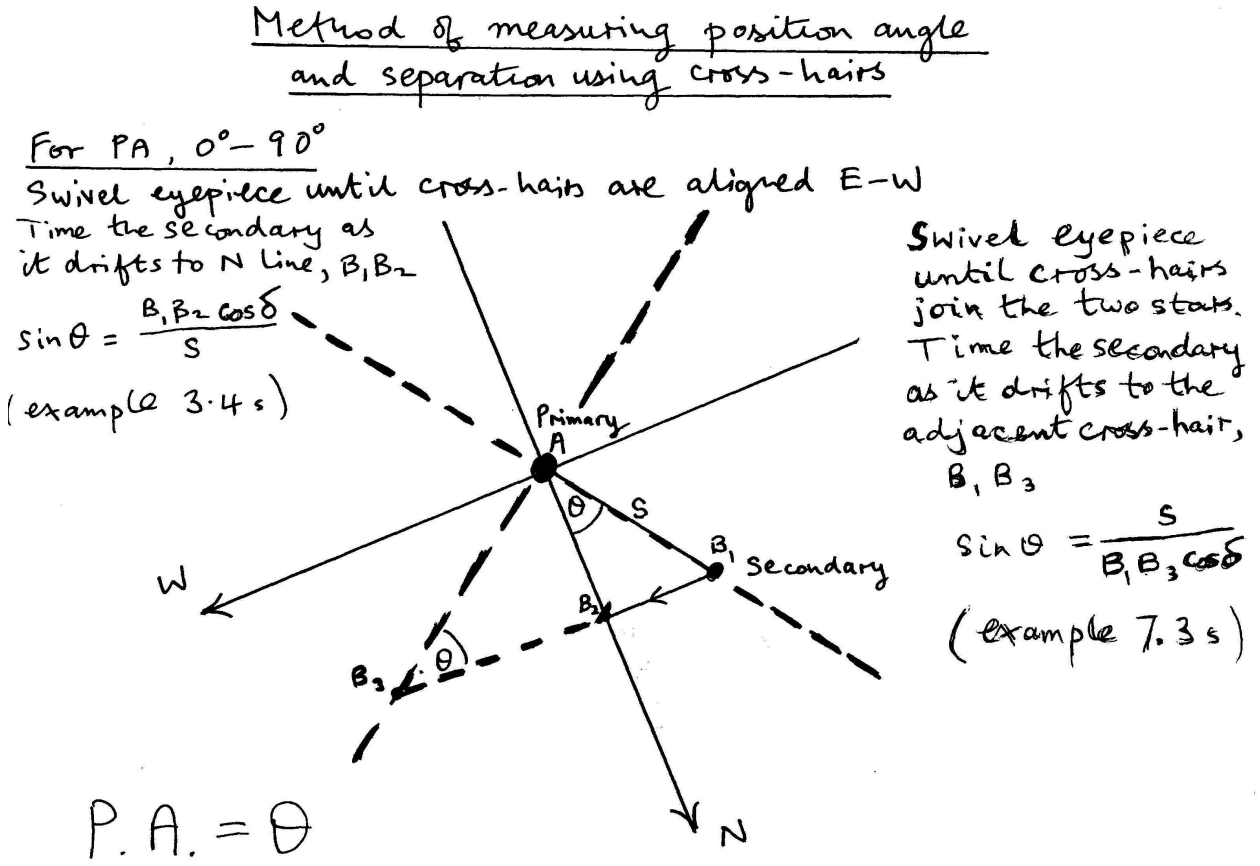


Figure 2: Diagram for stopwatch and crosshair method

The diagram in Fig. 2 shows the two formulae which can be solved to give the values of s (separation) and $\theta$ (position angle). Note also that you will substitute for the value of $\delta$, the declination of the double star. When you've calculated s, don't forget to turn the seconds of time into seconds of angle by multiplyiing by 15. The diagram also gives two example times, B1B2 = 3.4 seconds, and B1B3 = 7.3 seconds. Try the formula - these two times should give separation, s = 37.4" and position angle, $\theta$ = 43.0 deg., if the declination, $\delta$ is 60 deg.

Notice that if the position angle is more than 90 deg. but less than 180, the primary will still be leading the way across the wires, and the same formula holds good, but the calculated p.a. will be 180 deg - $\theta$.

If the p.a. is between the 180 and 270, the secondary will now lead the way, again the same method and formula can be used, and the calculated p.a. will be 180 + $\theta$.

Finally, if the p.a. is between the 270 and 360, the secondary will still lead the way, the same method and formula can yet again be used, but the calculated p.a. will be 360 - $\theta$.

If the p.a. is close to 0 or 180 deg., then the timing becomes very difficult. I'm working on this!

I would be really glad to hear from anyone who would like to have a go at this method, and especially if you find any mistakes, which are entirely my own. Try this with any double

stars that you enjoy observing.

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## Two possible new doubles

by Abdul Ahad

Following a visual survey over the past five years using my Skywatcher 8-inch Newtonian reflector, Im pleased to announce that I have identified two more new double stars (further to those published in Binary no.1) that have not hitherto appeared in any double star lists, and that werent included in the Washington Double Stars (WDS) catalogue.

My aim was to seek out only those pairs that displayed the correct attributes to be eligible for regarding them as potential binary systems or those belonging to commonly moving stellar streams.

I made all my discoveries using an equatorially mounted and clock-driven Sky Watcher Explorer 8-inch, EQ5 f/5 Newtonian reflector. I did not have possession of a digital SLR camera until December 2009, so recorded all my observations by visually sketching the star fields containing the candidate systems, then checking them against the Palomar Observatory Sky Survey (POSS) plates, taken between the 1950s and 1990s.

The two double stars I have identified have catalogue designations in the SIMBAD astronomical database, where their components all appear as single stars, however. None have previously appeared in any double star catalogues, and all are genuinely new discoveries. In order to decide if a particular pair was a common proper motion (CPM) double, with a strong possibility of them being a genuine binary pair, connected together by gravity as they drift through space, I made use of the astrometry data listed in SIMBAD. This entailed scrutinizing the proper motions of each star in both RA and Declination. If both stars in the pair had closely correlated proper motion directions in both RA and Declination, then that pair was said to have satisfied my tight CPM criterion. the two pairs are:

(1) HD 162792 / BD+08 3520s, a triple star in constellation Ophiuchus, J2000.0 ICRS coords of primary: 17 52 24.3813 +08 34 16.933, V mags 9.54 (A), 9.96 (B) and 12.0 ( C), spectral classes: F5 V, K0 V. The third star has been identified in the POSS plates, but has no identification in any catalogues.

(2) HIP 104969 / BD+67 1298 in constellation Cepheus, J2000.0 ICRS coords of primary: 21 15 42.6 +68 21 07.7 / 21 15 39.2 +68 21 23.7, V mags 7.91, 9.35, spectral class F0 and G5 V.

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# Appeal for observations

**by John McCue**

In the previous article, Abdul Ahad announced the possible discovery of new binaries. Observational measures of these pairs would be much appreciated.

Abdul commented that if the Washington Double Star Catalogue is the repository of all double star observations made worldwide, then it is reasonable to assume that if you observe a double star that is not listed then it has not been seen by any other observer, or at least not recognised as a double.

BAA observers are urged to observe these stars, and particularly to measure the separation and position angle of these pairs.

**What to record**

The details needed for an observation are to be seen in tables 1, 2 and 3 of this issue. The magnitudes may be quoted from catalogues or estimated from your personal observation, and N is the number of nights over which the double was observed, or the number of times the PA and Sep, were measured on one night, which led to the average PA and Sep. being quoted.

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# Observations for submission to the Washington Double Star Catalogue

**From the WDSC Established Doubles list**

There are literally thousands of double stars for the observer to choose from, and plenty of books and atlases to help observers. The following observations will add to the store of scientific knowledge of double stars by submission to the Washington Double Star Catalogue. Established doubles are those that have been observed many times, and recently. Neglected doubles are exactly that, and are further described below.

**From the WDSC Neglected Doubles list**

These doubles have not been observed for 20 years or have been observed only once. The compilers of the WDSC would like confirmation of their existence, and do not necessarily require position angle and separation measurements.

The following is a fascinating account by Peter Clark of a hunt for one of these neglected doubles:

"I chose HJ943 at the end of August 2010 from the list provided by the new Double Star Section of the BAA because it hadn't been observed since 1909, by Col. John Herschel. In 1820, Sir William Herschel recorded its position angle and separation as 330° and 4" apart. Then in 1909 his grandson submitted 150° and 5.6", at 21h 47.2m, + 26° 48' according to the WDS catalogue and both recorded the magnitudes as 10. But on the night of Aug 31, 2010, the position was filled with emptiness, and this is no less important than a positive observation. Drawing my attention were two mag.10.3 stars 500" to the east forming a triangle with the position. On the way there you will be rewarded with the trio of stars at $\kappa$ Peg., a white star and one a strong blue young star, the other orange. Then there are three

Table 1: WDSC submissions of established doubles

| Star | RA(2000) | Dec(2000) | Mags | PA | Sep | N | Epoch | Name |
|---|---|---|---|---|---|---|---|---|
| | hhmm.m | ±ddmm | | ddd | ss.s | no.obs | yyyy.yy | |
| ABH164AQ | | | | 078 | 100.5 | 3 | 2010.61 | MN |
| ABH164AP | | | | 050 | 85.4 | 3 | 2010.61 | MN |
| ABH164AN | | | | 052 | 62.2 | 3 | 2010.61 | MN |
| ABH164AM | | | | 053 | 54.2 | 3 | 2010.61 | MN |
| ABH164AK | | | | 343 | 52.0 | 3 | 2010.61 | MN |
| ABH164AL | | | | 353 | 63.0 | 3 | 2010.61 | MN |
| ABH164AD | | | | 076 | 24.7 | 3 | 2010.61 | MN |
| ABH164AE | | | | 027 | 25.6 | 3 | 2010.61 | MN |
| ABH164AC | | | | 115 | 10.9 | 3 | 2010.61 | MN |
| ABH164AU | | | | 074 | 102.3 | 3 | 2010.61 | MN |

Table 2: WDSC submissions of neglected doubles

| Star | RA(2000) | Dec(2000) | Mags | PA | Sep | N | Epoch | Name |
|---|---|---|---|---|---|---|---|---|
| | hhmm.m | ±ddmm | | ddd | ss.s | no.obs | yyyy.yy | |
| HJ943 | 2147.2 | +2648 | 10,10 | No | stars | seen | 2010.67 | PRC |

9th magnitude celestial street lights in a line to the HJ 943 position. Is the true HJ 943 pair there?"

**Doubles not listed in the WDSC**

Table 3: WDSC submissions of previously unreported doubles

| Star | RA(2000) | Dec(2000) | Mags | PA | Sep | N | Epoch | Name |
|---|---|---|---|---|---|---|---|---|
| | hhmm.m | ±ddmm | | ddd | ss.s | no.obs | yyyy.yy | |
| MN15 | 2045.8 | +7146 | 8.6,10.3 | 283 | 39.5 | 3 | 2009.89 | JM |
| MN27 | 2156.9 | +6532 | 8.7,10.4 | 353 | 20.5 | 3 | 2010.13 | JM |
| MN24 | 0815.4 | +6618 | 10.1,11.4 | 264 | 57.3 | 3 | 2010.17 | JM |
| MN37 | 0355.2 | +6157 | 11.3,11.5 | 286 | 26.4 | 3 | 2010.17 | JM |

The Cleveland and Darlington Astronomical Society held a campaign called Expedition to the North Pole, in which members were encouraged to make observations on any class of objects with declinations above 60° so that they are approximately circumpolar from Britain. As mentioned in the appendix to Martn Nicholson's article in this issue, those unreported

doubles from the new UCAC3 catalogue with such a declination are under scrutiny by the aforementioned society and shown in Fig. 1, but it should be noted that Martin Nicholson has recently examined the WDSC and found that some in this list are now observed and reported to the Washington Double Star Catalogue. They are MN 1, 13, 25, 33, 25 and 39.

The four stars in Table 3 have been identified, and measured by the software Aladin applied to CCD images taken by the observer.

**Observer abbreviations**
JM: John McCue
MN: Martin Nicholson
PC: Peter Clarke