Measuring Double Stars in Ursa Minor with a Micrometer and an Eyepiece Reticle

Papadimitriou Athanassios
Astronomical Society of Corfu, Greece

Abstract: Twenty-two binary stars were measured in Ursa Minor by using a micrometer for the measuring of the angular distance. An eyepiece reticle was also used for the more accurate measuring of angle position .

Introduction

First of all I used the excellent search engine for double stars "Stelle Doppie" and I selected double stars appropriate for my equipment for instance double stars with separation greater than 6 arcsec , D mag bigger than 1 mag and stars not fainter than 12 mag. Also stars which were measured very recently were excluded.

Equipment

My equipment included a Celestron's equatorial mounts CG5 , a newtonian telescope Konus 200 /1000 , a Meade 12mm wireless astrometric eyepiece, a barlow Tele Vue 2x and Meade 9mm wireless Illuminated reticle eyepiece with micrometric x-y positioning controls. For the measuring of separation the astrometric eyepiece with barlow in which the linear scale was calibrated by known method, was used and it was found that the micrometer scale has divisions that are equal to 11.09 arcsec. An outer protractor 360° was constructed that was attached to the barlow and a pointer that was attached to the eyepiece. (Ronald Tanguay 1998) A lever was also placed on the barlow so as to have a better and without any vibrations, tightening of the eyepiece .For the measuring of the position angle an eyepiece with adjustable reticle was used which was aligned with an outer protractor**,** Figure 1.

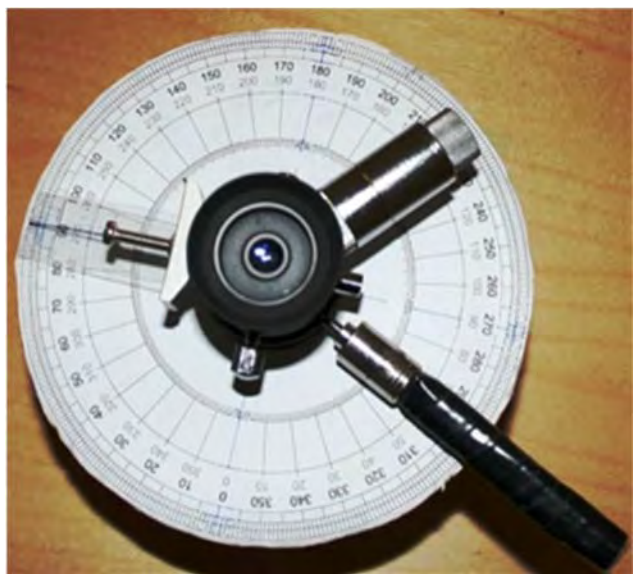

Figure 1. The reticle eyepiece with the outer protractor.

This eyepiece was selected because:

1) When we measure the position angle we should calibrate the protractor with the motion of the star in the R.A therefore when the drive motor is turned off the primary star has to run parallel to the linear scale. If we use micrometer for this reason, the numbers on the linear scale will prevent from a proper evaluation.
2) After this alignment with the method described above, we must rotate the eyepiece in order to have the primary and secondary star in the same direction. Without doubt the measurement is better when both stars are situated between the lanes of the reticle, Figure 2.
3) When using the crosshairs of regulators we do not have to use the controller to bring the stars near the crosshair. Certainly the movement of the reticle

Measuring Double Stars in Ursa Minor with a Micrometer and an Eyepiece Reticle

Figure 2. The stars are situated between the lanes of the reticle

does not affect the correct alignment with the outer protractor.

Comments

All observations took part in the summer of 2014 on Corfu Island. Primarily a few test measurements were performed in recently measured stars in order to ascertain if the equipment has significant deviations from the recent measurements. For example the test that was done in STF 1972 AB in U.Mi has very few deviations from the last measurement in 2011(table 1). Apparently the equipment was proved to be well alighted and calibrated. There were 3 observations performed on each star and the final value was defined as the average of measurements . For both measurements barlow 2x was used. The technique of measuring the position angle with reticle eyepiece was considered particularly accurate and relaxing. Table 2 gives a list of 22 observation results obtained in the summer of 2014.

Acknowledgments

I would like to thank the members of the Astronomical Society of Corfu for the concession of the telescope .

I would also like to thank Gianluca Sordiglioni for providing a useful tool with lots of information about binaries on his website: http://stelledoppie.goaction.it

References

Argyle, Robert, 2004,, Observing and Measuring Visual Double Stars, London: Springer.

Tanguay, Ronald, *The Double Star Observer's Handbook,* Saugus, MA: Double Star Observer, 1998.

Table 1. Test with STF 1972AB

NAME	R.A	DEC	MAG1	MAG2	LAST SEP	OBS SEP	LAST P.A	OBS P.A
STF 1972 AB	15 29 11	(+) 80 26 55	6.60	7.30	31.40	31.50	79.00	79.00

Measuring Double Stars in Ursa Minor with a Micrometer and an Eyepiece Reticle

Table 2. Measures of 22 Double Stars in Ursa Minor

NAME	R.A	DEC	MAG 1	MAG 2	SEP (ρ)	P.A (θ)	N	DATE	NOTES
STF1761	13 32 01	71 43 01	9.30	10.10	20.4	69.8	3	2014.431	1
STF1798	13 55 02	78 23 59	7.60	9.60	8.3	11.0	3	2014.431	2
STF1822	14 09 37	72 50 04	9.00	10.80	14.3	50.0	3	2014.491	3
STF1840AB	14 19 54	67 46 56	7.00	10.00	30.3	222.0	3	2014.431	4
STF1841AB	14 21 07	67 48 10	7.30	11.00	35.2	264.3	3	2014.431	5
STF1859	14 28 31	73 03 18	8.60	10.10	20.5	234.5	3	2014.431	6
STTA130	14 32 17	80 20 27	9.00	9.40	52.3	298.0	3	2014.494	7
STF1897	14 53 35	69 45 46	7.60	11.00	34.2	319.5	3	2014.491	8
S 666	14 56 48	74 54 03	7.00	9.00	167.8	32.5	3	2014.494	9
HJL1089	14 59 24	83 19 39	9.60	10.70	58.9	333.0	3	2014.491	10
H 5 86AB	15 17 16	71 12 40	7.30	11.00	51.7	130.5	3	2014.491	11
H 5 86AC	15 17 16	71 12 40	7.30	11.40	94.6	115.0	3	2014.491	12
HAU 23	15 28 50	80 36 50	9.50	11.50	35.8	63.0	3	2014.491	13
STF1972AC	15 29 37	80 25 37	6.60	11.40	187.0	101.0	3	2014.431	14
STF1971	15 35 12	75 20 16	9.60	12.00	14.3	315.0	3	2014.494	15
A 856AC	15 43 22	81 19 09	8.30	11.10	62.7	343.0	3	2014.494	16
UC 3072	15 51 48	73 19 02	8.70	11.30	43.5	37.8	3	2014.491	17
STF2125	16 40 57	82 21 53	9.00	10.50	11.6	180.3	3	2014.491	18
KU 1	16 43 06	77 30 48	6.00	11.50	104.5	13.0	3	2014.494	19
HDO 143	16 45 58	82 02 14	4.20	11.20	77.0	2.0	3	2014.494	20
WAL 75AC	16 57 18	86 50 40	8.40	10.70	78.1	92.0	3	2014.494	21
WFC 190	17 20 04	75 22 33	9.80	10.50	8.3	39.0	3	2014.491	22

Table Notes:

1. Rho increased 0.1", theta decreased 1.2°
2. Rho increased 0.8", theta consistent with trend reported
3. Rho decreased 0.6", theta decreased 2°
4. Rho increased 3", theta consistent with trend reported
5. Rho increased 0.3", theta decreased 0.7°
6. Rho increased 0.6", theta increased 0.5°
7. Rho increased 1.2", theta decreased 1°
8. Rho decreased 0.4", theta increased 0.5°
9. Rho increased 3.2", theta increased 0.5°
10. Rho decreased 1.2", theta consistent with trend reported
11. Rho increased 0.7", theta increased 0.5°
12. Rho increased 0.1", theta increased 1°
13. Rho increased 0.8", theta decreased 1°
14. Rho increased 34.7", theta decreased 4° (measures reported from 1994)
15. Rho decreased 0.9", theta decreased 3°
16. Rho decreased 3.2", theta increased 3° (measures reported from 1999)
17. Rho increased 2.6", theta decreased 1.2°
18. Rho decreased 0.3", theta decreased 0.7°
19. Rho decreased 1.8", theta consistent with trend reported
20. Rho decreased 0.4", theta increased 1°
21. Rho decreased 1.2", theta increased 3°
22. Rho increased 0.3", theta decreased 1°