Measuring Double Stars with Position Circle and Filar Micrometer Screw: Report #2

Robert Korn

D-Gailenberg, robertjkorn@aol.com

Abstract: I present a list of 54 binaries observed in late 2012. Some remarks on changes against recently measured pairs are given. Also a short discussion about causes and consequences of diverging results obtained.

In *JDSO* Vol.10 n.3 [1] I presented the method and equipment which I have been using for more than 7 years to measure separation and position angle of binaries.

Here are a further 54 double stars, selected from Washington Double Star Catalog (WDS) and observed and measured in late 2012. The measurements are given in Table 1. The criteria for my choices, just like the equipment and the method, have not been changed and are subject to two factors. The first factor is the limits given by the equipment: pairs with a separation of more than 10" and a magnitude brighter than 9. Second, I was looking for objects that showed significant changes in rho and/or theta in the past.

The evaluation of the following list and comparison of the results obtained, against the published measures from other observers in the WDS, gave occasion to investigate whether the divergences found showed some systematic scheme. Therefore I have attempted a graphic evaluation (Figure 1) to show the portion of diverging results over the 13 observing sessions that contributed to the list reported.

Two facts are quite significant. First, most divergences concern the distances, while angle measures are less affected. Second, the later the time of year, the more the quota of divergences increases.

So, I investigated further in the rho-measures; Figure 2 shows the ratio between consistent and diverging rho-measures over the distances, these split in 5 categories of 50" steps.

Figure 2 shows very clearly that the portion of

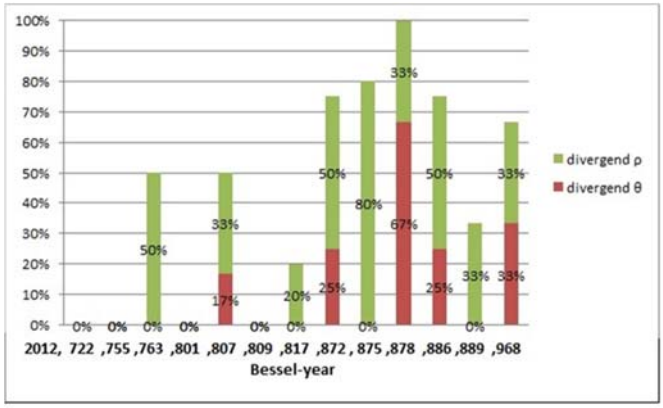

Figure 1: Quota of diverging measures in rho and theta over 13 sessions reported .

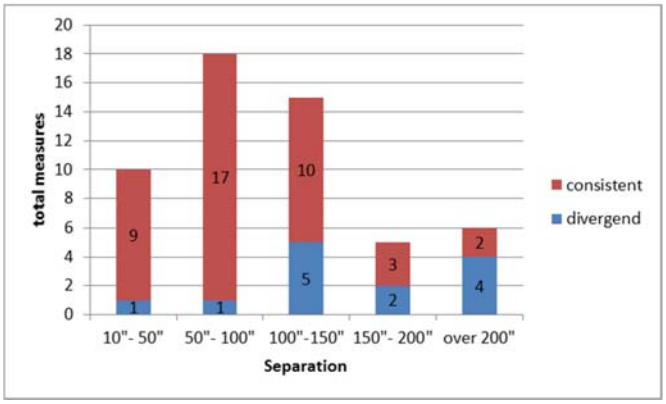

Figure 2: Ratio between consistent to deviating measures in rho over separation.

Measuring Double Stars with Position Circle and Filar Micrometer Screw: Report #2

Table 1. Measurements of Double Stars Measured in 2012.

Name	RA	Dec	mag 1/2	rho	theta	Date	N	Remarks
S 838 AD	00h 04.2	62° 17	5.9/8.2	244"	197°	2012,807	2	No change against v.r.
STTA256 AB	00h 08.0	31° 23	7.1/7.3	110"	113.5°	2012,755	2	Measures consistent, θ↓ with trend
BU 483 AC	00h 09.1	40° 51	7.0/7.7	158.2"	269°	2012.755	2	Measures consistent, θ↑with trend
BU 484 AC	00h 09.7	52° 02	7.6/8.5	81.8"	51°	2012.801	2	No change
ARY 7 AB	00h 10.4	58° 31	7.8/8.3	122.7"	1°	2012.801	2	No change
ARY 9	00h 11.6	58° 13	7.1/8.6	135.1"	81.5°	2012.801	2	θ no change; ρ↓. Consistent
HJ 1944	00h 13.2	-17° 11	7.7/9.0	65.3"	335°	2012.801	2	ρ↑, θ↓ consistent
STF 30 AB	00h 27.2	49° 59	7.0/8.9	14.2"	313°	2012.807	2	ρ matches v.r. Θ 2° under v.r.
STT 10 AC	00h 27.5	16° 02	6.5/9.5	272.5"	156°	2012.968	2	Θ No change ρ 2″ under v.r., but with the trend
HJ 1968 AB	00h 27.7	-16° 25	7.3/10.0	36.92"	232.5°	2012.807	2	ρ 1″ over, θ 1.5° under v.r. Both with trend
HJ 1981 A-BC	00h 31.0	-10° 05	6.9/8.4	78.7"	90°	2012.968	2	P no change, θ 2° over v.r. But matches trend
HJ 323	00h 40.7	-04° 21	6.0/8.5	62.2"	285.5°	2012.801	2	No change
H 5 82 AB	00h 47.4	51° 06	8.0/8.4	56"	75.5°	2012.809	2	No change
STTA 9AB	00h 49.9	30° 27	7.8/8.8	120.9"	243.5°	2012.763	2	Θ No change. ρ 4‟ (!) over v.r. Measurements show no error; =0″.
HJ 629 AC	00h 55.6	34° 33	9.3/8.9	65.8"	257.5°	2012.968	2	Consistent with trend: θ↑, ρ↓
STTA 11 AB, C	01h 07.2	38° 39	7.6/8.8	60.5"	163.3°	2012.763	2	No change
S 397	01h 21.1	64° 39	6.3/8.6	56.5"	339.5°	2012.878	2	P no change; θ 2° under v.r., but matches ↓ trend
STTA 17 AC	01h 24.5	39° 02	8.0/8.5	134.7"	345°	2012.878	2	P 2″ under 2007 measure, confirming ↓ trend. Θ slightly under v.r.
HJ 2052	01h 31.6	-19° 01	6.9/7.5	80.5"	114°	2012.807	2	no change
STF 142 AB	01h 39.9	13° 15	8.9/9.2	21.3"	65°	2012.807	2	P slightly under v.r., confirming ↓ trend; θ 2° under v.r., but with↓ trend
KPR 1 AC	01h 44.3	09° 29	7.9/8.4	189.8"	285°	2012.807	2	no change
STFA 4 AB	01h 56.2	37° 15	5.8/6.1	207.1"	298°	2012.809	2	no change
ARN 90 AB	01h 56.8	38° 02	9.0/9.2	36.9"	194.5°	2012.809	2	no change
H 6 69 AC	02h 09.4	25° 56	5.0/8.0	104"	277°	2012.878	2	P no change; θ 2° under v.r.
BUP 30 AC	02h 22.8	41° 24	5.8/7.4	302.2"	9.5°	2012,817	2	No change
WAL 20 AC	03h 02.3	41° 24	8.0/8.9	96.5"	211°	2012,817	2	No change
ENG 11	03h 07.7	36° 37	7.5/9.2	132.5"	260°	2012,817	2	See text
STFA 6	03h 09.2	07° 28	7.7/7.8	80.9"	164°	2012,817	2	No change

Table 1 concludes on next page.

Measuring Double Stars with Position Circle and Filar Micrometer Screw: Report #2

Table 1 (conclusion). Measurements of Double Stars Measured in 2012.

Name	RA	Dec	mag 1/2	rho	theta	Date	N	Remarks
ENG 12AB	03h 10.9	-11° 08	7.3/8.6	143.1"	50.5°	2012.875	2	**P~1" under v.r. θ↓confirming trend**
ENG 13AB-C	03h 15.1	16° 18	8.9/8.5	172.2"	185°	2012.875	2	P 1.5" under v.r. matches ↓ trend. Θ 1° under v.r. against trend.
STT 557AB	03h 19.4	03° 22	4.9/8.9	263.6"	164.5°	2012.875	2	Θ consistent; ρ3" under v.r., but matches ↓ trend
STT 54AB	03h 32.0	67° 35	7.7/9.0	20.9"	1°	2012.872	2	Θ no change; ρ 1" under v.r., matches ↓trend
BU 1231AC	03h 43.7	65° 59	7.9/8.8	87.6"	260.5°	2012.872	2	P no change;θ increased 1.5° against 2003 measure, confirming trend
STTA 38AB	03h 44.6	27° 54	6.8/6.9	134.7"	52°	2012.875	2	Θ no change; ρ 1.5" under v.r.
S 437AB-C	03h 46.3	24° 11	8.1/7.7	38.2"	308°	2012.875	2	Quite consistent
BUP 45AC	03h 55.6	42° 53	7.5/8.0	176.7"	90°	2012.872	2	Θ no change; ρ 2" under v.r., but consistent with ↓trend
BUP 49	04h 00.8	18° 12	5.9/9.1	174.7"	275.5°	2012.872	2	Θ 1.5° under v.r; ρ no change
S 738AB	20h 10.6	33° 38	7.8/8.4	41.8"	104°	2012.886	2	P no change; θ 2° under v.r.
ENG 72AB	20h 14.5	36° 48	5.0/6.7	213.4"	155°	2012.886	2	Θ no change; ρ 2" under v.r., against ↑trend
STF2708AB	20h 38.7	38° 38	6.8/8.7	56.5"	323°	2012.886	2	No change
ENG 77AC	20h 56.8	42° 54	7.3/9.1	125.8"	17°	2012.889	2	P increased 2.2" against 2003 measure, θ increased 2°. Both with ↑trends.
STF2758AB	21h 06.9	38° 45	5.4/6.1	31.6"	151°	2012.889	2	Quite no change
ARN 78	21h 31.4	48° 29	7.6/8.8	51.6"	99°	2012.889	2	Θ no change; ρ ~2" over v.r., but matches ↑trend
S 799AB	21h 43.4	38° 17	5.7/7.0	147.9"	60°	2012.886	2	Θ no change; ρ 2" under v.r., matches ↓trend
ARN 24AC	22h 25.8	-20° 14	6.7/8.0	127.7"	89.5°	2012.801	2	No change
WEB 10AB	23h 38.6	44° 41	8.3/8.8	128"	304°	2012.722	2	No change
STF3041AC	23h 47.9	17° 03	8.4/9.2	60.7"	358.5°	2012.722	2	No change
STF3041AB	23h 47.9	17° 03	8.4/9.1	57"	358.5°	2012.722	2	No change
STF3044	23h 53.0	11° 55	7.3/7.9	20"	283.2°	2012.722	2	No change
STTA251AB	23h 53.6	51° 31	6.9/9.1	48"	209.5°	2012.722	2	P no change; θ 1.5° over v.r,, matches ↑trend
HO 205AD	23h 54.1	39° 17	6.7/9.4	122.7"	215.5°	2012.722	2	No change
ARY 33	23h 59.2	50° 32	7.3/8.1	99.6"	140°	2012.722	2	No change

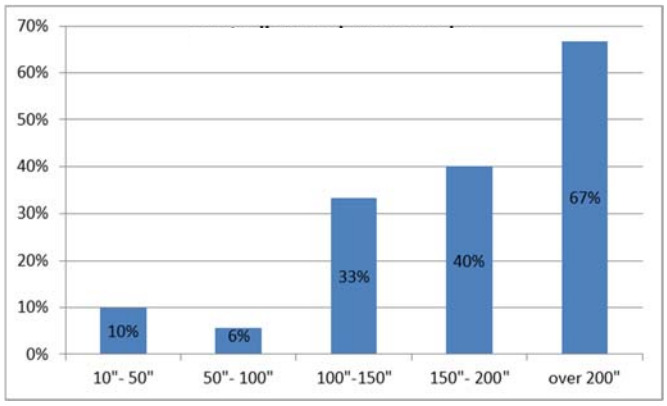

Figure 3. Dependence between separation and quota diverging measures of rho.

diverging results increases as distance grows. Figure 3 shows the percent of "divergers" and more clearly shows the connection.

Taking into account all these considerations, I came to the conclusion that the reason for the discrepancies in separation measurements is not a subjective one, but has its cause in the action of the micrometer screw. With typical low harvest and winter-season temperatures here on the mountain-sides, the mechanics become slow reacting, almost as if they have to "go a longer way". In my opinion, decreasing viscosity of lubrication plays a major role in this. This corresponds also with the fact that the deviations manifest in most cases in lower results than to be expected. I will keep an eye on this in the future.

As concerns the qualitative aspect of the issue discussed, I must say that the typical difference between my results and the presumably correct values ranges in general around 2". With respect to the fact that the deviations are to be found mostly in the measures of distances >150", one must consider that these discrepancies give an erroneous ratio of almost 2%. This makes the results obtained usable, but one should consider the fact. Furthermore, it seems remarkable that the relative results in most cases are reported if they adhere to the reported trend; results that go against the reported trend are hard to find.

Some words on ENG11 at 03h07.7+36°37: I observed this pair October 25, 2012 and found it with a separation of 132.5" (σ = 0.9") and position angle 260°. The latter diverged from the WDS value by more than 9°! I tended to believe this to be an erroneous measure on my part, because the sigma was negligibly small, and because the other measures that night were quite in the range of given values to be expected. Then, I found in the JDSO an article by R. Nugent and E. Iverson[2] in which their result on ENG11 - obtained with better and more sophisticated methods than my own - was consistent with my PA measure from 2012 and suggests that the entry in the WDS is erroneous.

Acknowledgements:

Gianluca Sordiglioni maintains a useful tool with his website: http://stelledoppie.goaction.it, that gives fast and complex information on double stars. Thanks for that!

This project has made use of the Washington Double Star Catalog maintained at the U.S. Naval Observatory.

References

[1] Korn, Robert, "Measuring Binaries with Position-Circle and Filar Micrometer-Screw", *JDSO,* **10**, 174, 2014.

[2] Nugent, Richard and Ernest Iverson, "Double Star Measures Using the Video Drift Method", *JDSO,* **11**, 21, 2015.