Lunar Occultation Observations of Known Double Stars – Report #1

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Abstract: Reports are presented of lunar occultations of close double stars observed using video including cases where a determination of the position angle and separation of the pair can be made and other cases where no duplicity has been observed.

This report is the first of a continuing series of double star measurements made during lunar occultations. The observations are contributed from observers around the world who observe lunar occultations. Unless noted otherwise, the observations were made using video at 30 fps (observers located in North America and Japan) or 25 fps (observers located in Europe and Australasia). Loader, in New Zealand, normally uses a 30 fps video.

In general, at the lunar occultation of a double star, the light from the star will disappear or reappear in stages, resulting in a stepped light curve of the event. We present the results obtained from the timing of such events of close double stars, in general limited to those with separations less than 2 arcseconds. When the occultation of a double star is timed from two or more well spread locations an accurate determination of the PA and separation of the pair can be made. Results for a few such events are presented in Table 1. When only one observation is made of a double star occultation a complete solution is not possible, but a vector (minimum) separation of the pair may be determined. Results of such events are presented in Table 2.

The method of analysis of such occultation observations is described by Herald (2009). The occultations are observed using unfiltered video cameras. As indicated by Herald, the unfiltered video cameras have a spectral response somewhere between the V and R magnitude bands.

Observations of occultations of reported double stars when no evidence of a double nature is observed are presented in Tables 3 and 4. The apparent lack of duplicity may be due to a number of factors as indicated in the headings of the tables. Instances are limited to those for which there are at least two observations with no duplicity observed.

In the tables observers are indicated by a two letter code corresponding to their initials codes. Names are listed at the head of this paper. WDS refers to the *Washington Double Star Catalog* and IF to the *Interferometric Catalog*, both published by United States Naval Observatory, Washington. XZ refers to the XZ80 catalog originally put out by the USNO. It includes all stars to magnitude 12.5 within 6°40' of the ecliptic, that is all stars which can be occulted by the moon.

Occultations of the double stars listed in Table 1 were observed at two or more position angles on the same night, allowing a determination of the separation and position angle.

The companion of the double stars listed in Table 2 was observed at a single position angle, allowing the determination of a vector separation and magnitude difference.

In Table 3, the companion of the stars listed in the WDS was not observed. Either the vector separation was too small, or the magnitude difference too large for the circumstances of the event.

Table 4 contains stars with an entry in the Interferometric Catalog but for which no companion was observed. Possible explanations are:

i. the vector separation was too small;
ii. the magnitude difference too large for the circumstances of the event;
iii. the purported companion does not exist.

References

Herald, D. " SAO97883 – a new double star", JDSO, Vol 5, No 4, 2009

Table 1: PA and separation measured

WDS name	XZ	RA Dec	PA	+/-	Sep	+/-	Mag. diff	Date	Observers
HO 345AB	10979	07227+2205	304	4	1.84	0.17	1.4	2009.851	HK, MI, MK
AG 140	101356	07260+2205	165	4	1.38	0.15	0.8	2009.851	HK, MK
A 2768	16040	10426+0335	241	4	0.41	0.08	1.3	2009.413	DB, EI, SM
CHR 78	25788	18448-2501	8	+21 -35	0.016	+0.006 -0.002	2.5	2009.214	DG, BL
FIN 327	26957	19253-2431	275	17	0.095	0.005	1.5	2008.693	DG,DH,GS,JB
CHR 184Aa,Ab	28441	20273-1813	50	7	0.071	0.015	2.6	2009.668	DH,BL
SHJ 323AB	28475	20289-1749	214.8	1.2	1.44	0.02	1.7	2009.668	DH,BL
HDS3054	29697	21274-1335	357	6	0.113	0.013	1.5	2009.747	EI,DB

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Table 2: Vector separation measured

WDS name	XZ	RA Dec	Vector Angle	Vector Sepn.	Mag. Diff	Date	Observer
CHR 127AB	6268	04536+2522	265.910	0.34″	1.75	2009.845	SM
CHR 203	7200	05365+2556	334.873	0.06″	0.98	2009.856	MK
COU 914	9119	06283+2441	280.129	0.20″	0.86	2009.700	SM
HDS 910	9439	06375+2435	273.696	0.45″	2.56	2009.867	SM
HO 247	11655	07461+2107	274.531	0.49″	0.51	2009.770	MI
COU 773	13520	08539+1958	79.721	0.135″	0.52	2008.134	DG
HDS1323	13821	09062+1552	323.032	0.17″	2.55	2009.407	DH
HO 253	14778	09478+1004	348.300	0.77″	2.3	2009.410	EI
BU 932AB	19503	13347-1313	133.397	0.11″	1.6	2007.179	BL
HDS2008	20149	14171-1835	359.764	0.014″	3.5	2009.199	BL
BU 125AB	23196	17122-2703	73.543	1.81″	1.7	2008.611	DH
I 1031	26024	18531-2745	25.709	0.24″	0.97	2005.774	DG

Table 3: Companion not observed (definite double star)

WDS name	XZ	RA Dec	Vector angle	Resolution limit	Limiting Mag. diff	Date	Observer
CHR 124Aa,Ab	4889	03470+2431	222° 118°	0.034″ 0.022″	--- ---	2007.672 2009.095	SM SM
SMK 1Aa,Ab	8068	06010+2734	35° 51°	0.015″ 0.022″	2 3	2009.174 2009.174	DG DH
CHR 170Aa,Ab	10181	06588+2605	57° 52°	0.023″ 0.020″	3 3	2009.177 2009.177	DH DG
MCA 28	10203	06595+2555	89° 88°	0.031″ 0.030″	3 3	2009.177 2009.177	DH DG
TDS9739	40376	16026-2452	86° 82° 135°	0.031″ 0.031″ 0.027″	2.5 2.7 0.7	2009.654 2009.654 2009.654	DH SR JT
FOX 256 See note	29337	21084-1454	113° 114°	0.016″ 0.015″	2.7 3	2009.895 2009.895	KM MI
CHR 116	31135	22583-0224	194° 207° 352°	0.023″ 0.025″ 0.012″	3 2.7 2.5	2009.602 2009.602 2009.826	DG DB YA

[The 'Resolution limit' is set at no less than two frame intervals [0.080s (PAL) or 0.067s (NTSC)] times the vector rate of motion.]

Table note: The WDS shows FOX 256 as a pair with a separation 10.4" measured in 1908. The IF has a single entry for FOX256 from 1991 showing any separation as < 0.1. The light curves from occultation observations show no second star with a vector separation less than ca 1.3".

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Table 4: Companion not observed (possible double star)

Star name	XZ	RA Dec	Vector angle	Resolution limit	Limiting Mag. diff	Date	Observer
BD+06 43	482	00257+0741	265° 95°	0.029″ 0.022″	2.5 2.5	2008.709 2008.860	DH BL
Iot Ari	2721	01574+1749	165° 185°	0.008″ 0.020″	1.8 2.8	2008.789 2009.461	DH DG
BD+21 416	4151	03107+2154	290° 73° 200°	0.017″ 0.029″ 0.018″	2.5 4 2.7	2005.648 2006.921 2009.840	BL TO HK
Mel 22 541	4829	03452+2450	309° 237° 88° 101°	0.012″ 0.030″ 0.025″ 0.014″	--- 2 3 3	2005.725 2009.692 2009.917 2010.066	BL DG DH DH
Pleia H256	4831	03453+2428	220° 245°	0.022″ 0.037″	--- 3.5	2005.725 2007.672	BL SM
Mel 22 697	4840	03456+2428	211° 238°	0.035″ 0.026″	--- 3	2005.725 2007.672	BL DG
OCC 193	4863	03459+2433	217° 105°	0.026″ 0.021″	--- ---	2005.725 2009.095	BL SM
Eta Tau	4911	03475+2406	227° 41°	0.026″ 0.021″	3 3	2009.618 2009.917	SM YA
BD+25 678	5382	04087+2553	127° 67° 201°	0.015″ 0.026″ 0.020″	3 3 3	2006.026 2007.075 2009.618	DG SM DG
OCC 115	6938	05263+2836	142° 320°	0.017″ 0.017″	2.7 2.5	2008.200 2008.723	DG BL
BD+15 1977	13824	09064+1516	68° 306° 312°	0.018″ 0.033″ 0.033″	3.5 2.5 2.7	2009.330 2009.930 2009.930	SM DH DG
CP-25 6547	25420	18317-2541	118° 7°	0.028″ 0.012″	2.5 2	2008.915 2009.662	DG DB
HR 7039	25814	18457-2659	324° 271°	0.021″ 0.031″	--- ---	2004.350 2007.420	BL BL

[The 'Resolution limit' is set at no less than two frame intervals [0.080s (PAL) or 0.067s (NTSC)] times the vector rate of motion.]