Observation Report 2008, Humacao University Observatory

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Abstract: We report the measurement of position angle and separation of 141 binary pairs. The data was obtained using the 31 inch NURO Telescope at the Anderson Mesa location of Lowell Observatory near Flagstaff, Arizona, in May and September 2008. We gathered the data using the 2K x 2K CCD camera - NASACAM - at the prime focus of the telescope. The data was transferred and analyzed at the Humacao University Observatory by undergraduate students undertaking research projects.

Introduction

We present here the report of our observations on the year 2008. The 141 binaries observed where imaged at the prime focus of the 31 inch NURO telescope. The data was taken with the NASACAM CCD, a 2048 by 2048 pixel array with a field of view of 16 arc minutes X 16 arc minutes. The data was gathered on June 4 and September 24, 25, 26, 2008. In June, we gathered data to extract information only for 46 binary pairs since we were able to observe only one night. During our September visit, we obtained information about 95 pairs, or a total of 141 pairs for 2008.

Procedure

The CCD images were analyzed by students pursuing undergraduate research projects at the Humacao Campus Observatory. The students used the pixelization of the CCD images to obtain the separation and position angle. The CCD images where analyzed a second time using the software that is included in *The Handbook of Astronomical Image Processing for Windows*, 2nd Ed. by Richard Berry and James Burnell, Willman-Bell, Inc, Virginia (www.willbell.com) 2006. The Handbook includes the CD *AIP for Windows (II)*, which has a feature that, with some care, allows for measurement of separation directly from the CCD image. Since the software does not provide for introducing your telescope's plate scale in the computations you have to make your final number crunching with a hand calculator. Also, since there is a reducer on the optical path to the CCD, the images we acquire are mirror reversed with respect to the program's position angle routine, so one must have lots of care when one is measuring position angle with the program. There is a systematic error in position angle that occurs when the CCD camera is inserted into the telescope. This error can be corrected by using well known binary systems and binary systems that "don't move". Binary systems that "don't move" can be found in the neglected section of the Washington Double Star catalog, as binary stars that have been measured for the last 100 years and show no change in position

angle. By imaging a mix of well known binaries and fixed binaries (20 of them is enough) we can correct for this systematic error and the list of binaries presented here is corrected for this error.

The table we present here follows the standard JDSO ordering and includes 141 binaries.

Acknowledgements:

This research has made extensive use of the Washington Double Star Catalog, maintained at the U.S. Naval Observatory, and of the NURO telescope, property of the Lowell Observatory. We would like to acknowledge support from the Puerto Rico Space Grant Consortium and the L.S.AMP of the University of Puerto Rico. We also thank Ed Anderson of the NURO consortium and the University of Northern Arizona for his efforts on behalf of our students.

Table 1: Measurements made in June 2008.

Name	RA	DEC	MAGS	SEP	PA	DATE
HJ 514	12 02 49.71	+28 41 15.3	10.0 11.0	21.38	90.17	2008.426
GRV 849	12 02 53.16	+23 45 50.8	11.7 12.0	28.9	231.17	2008.426
STI 738	12 03 17.7	+59 24 05	12.24 13.1	6.3	37.17	2008.426
STF 594AC	12 03 28.5	+41 24 15	10.09 11.10	11.7	145.17	2008.426
POU3120	12 04 05.7	+23 11 41	11.09 13.1	13.9	195.17	2008.426
BU 458	12 04 17.11	-21 02 21.0	7.87 9.97	31.9	233.17	2008.426
KZA 26	12 05 07.7	+43 22 47.4	10.5 10.5	17.7	108.17	2008.426
HJ 4496	12 06 12.76	-18 53 27.9	10.05 10.98	12.5	28.17	2008.426
COU2707	12 30 04.9	+22 22 16	11.77 14.1	14.6	343.17	2008.426
HJ 519	12 30 26.33	+36 07 44.7	10.32 10.35	19	190.17	2008.426
STF1650	12 31 32.99	+24 37 13.1	9.54 10.47	16.9	178.17	2008.426
STF1649	12 31 36.46	-11 04 20.2	7.97 8.43	15.5	194.17	2008.426
LDS4224	12 32 13.2	+31 47 19	14.5 15.4	10.9	313.17	2008.426
HJ 211	12 32 21.1	-01 53 33	11.86 12.3	11.5	278.17	2008.426
LDS3049	12 32 26	+30 50 24	14.22 14.63	18.2	121.17	2008.426
HJ 542	14 12 18	+36 46	12.0 12.0	12.5	65.17	2008.426
POU3162	14 13 24	+24 24	12.02 13.8	7	351.17	2008.426
LDS 953	14 13 30	+21 38	13.7 15.2	10.4	172.17	2008.426
LDS4521	15 00 47.5	+23 06 26	16.3 17.3	27.1	340.17	2008.426
STF1901	15 0057.70	+312238.2	8.71 10.55	20.1	185.17	2008.426
HJ 1266	15 01 08.0	+04 15 17.	10.77 12.1	13.3	29.17	2008.426
KZA 80	15 20.7	+31 33	12.41 12.9	27	54.17	2008.426
KZA 87	15 24 48	+29 34	12.0 12.5	11.9	2.17	2008.426
KZA 90	15 27 24	+31 02	12.5 13.0	20.1	299.17	2008.426

Table 1 continues on next page.

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Table 1 (conclusion): Measurements made in June 2008.

Name	RA	DEC	MAGS		SEP	PA	DATE
POU3193	15 35 18	+24 08	13.2	13.7	7.8	295.17	2008.426
HJ 580	16 02 48	+37 05	9.20	12.2	41.4	9.17	2008.426
HJ 582	16 07 06	+35 07	11.11	13.61	23	233.17	2008.426
ALI 370	16 07 24	+35 48	12.06	12.5	13.5	145.17	2008.426
POU3214	16 07 48	+23 06	11.1	13.3	13.5	80.17	2008.426
BAL2429	16 54 51.2	+03 18 41	11.77	12.8	11.6	51.17	2008.426
STF2010AB	16 08 04.5	+17 02 49	5.10	6.21	26.5	17.17	2008.426
ES 627	16 18 36	+51 20	9.88	10.98	12.2	287.17	2008.426
WFC 186	17 06 06	+43 29	10.81	12.11	18.5	16.17	2008.426
STF2127	17 07 04.42	+31 05 35.1	8.70	12.30	14.6	284.17	2008.426
SLE 9	17 07 06.29	+20 29 21.7	10.49	11.94	19.51	172.17	2008.426
SLE 85	18 07 33.1	+03 13 53	11.2	12.5	11.9	180.17	2008.426
BAL1952	18 07 34.4	+02 24 08	11.52	12.8	14.6	156.17	2008.426
BAL2474	18 08 03.4	+03 43 12	10.0	11.0	15.9	282.17	2008.426
POU3351	18 08 08.8	+23 27 12	12.05	13.9	10.6	155.17	2008.426
STF2293	18 09 54	+48 24	8.08	10.34	13.6	82.17	2008.426
BAL2483	18 14 41.6	+03 42 05	12.00	12.7	13	193.17	2008.426
SLE 145	18 14 58.3	+03 03 43	11.2	11.9	11.7	29.17	2008.426
HJ 1349	18 48 48	+33 19	8.29	10.7	29.8	92.17	2008.426
BEM 37	19 01 24	+53 28	11.87	11.90	11.5	309.17	2008.426
STF2459	19 07 22.01	+25 58 23.9	9.12	10.07	14	232.17	2008.426
AG 375	19 14 12	+26 26	9.89	10.92	18.5	297.17	2008.426

Table 2: Measurements made in September 2008

Name	RA	DEC	MAGS		SEP	PA	DATE
HJ 582	16 07 06	+35 07 00	11.11	13.61	23.2	232.75	2008.732
ALI 370	16 07 26.8	+35 48 29	12.06	12.5	14	150.25	2008.732
HJ 259	16 07 35.37	+35 47 27.4	14.3	14.7	36.2	154.25	2008.732
POU3214	16 07 48.8	+23 05 29	11.1	13.3	13.05	82.25	2008.732
STF2010AB	16 08 04.5	+17 02 49	5.10	6.21	27.1	10.25	2008.732
ES 627	16 18 35.71	+51 19 51.5	9.88	10.98	12.0	288.25	2008.732
GRV 940	16 51 36.98	+00 28 41.9	9.29	10.69	46.4	343.25	2008.732
BAL2429	16 54 51.2	+03 18 41	11.77	12.8	11.7	52.25	2008.732

Table 2 continues on next page.

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Table 2 (continued): Measurements made in September 2008.

Name	RA	DEC	MAGS		SEP	PA	DATE
LDS4721	17 05 52.	+26 05 30	13.5	17.0	39	2.25	2008.732
BAL1486	17 05 55.9	+00 55 57	10.86	12.4	8.05	11.25	2008.732
WFC 186	17 06 05.5	+43 28 56	10.81	12.11	18.4	14.25	2008.732
BAL1931	17 06 09.8	+02 06 05	11.4	11.5	17.9	187.75	2008.732
COU 109	17 06 27.9	+22 07 57	10.01	13.1	8.3	137.25	2008.732
SLE 77	17 06 38.8	+32 14 56	10.4	13.2	20.2	268.75	2008.732
SLE 78BC	17 06 49.8	+33 56 00	11.27	12.15	14.8	202.25	2008.732
STF2122	17 06 53.0	-01 39 22	6.38	9.73	21.4	279.25	2008.732
AG 353	17 07 01.4	+12 13 22	9.83	11.7	9.8	248.75	2008.732
STF2123	17 06 57.50	+06 48 03	9.82	9.98	19.2	217.25	2008.732
STF2127	17 07 04.42	+31 05 35.1	8.70	12.30	15.9	281.25	2008.732
SLE 9	17 07 06.29	+20 29 21.7	10.49	11.94	20.2	172.75	2008.732
GRV 946	17 07 14.12	+25 44 34.5	10.54	11.71	20.8	41.75	2008.732
LDS 988	17 06 56.77	+06 47 48.2	12.2	12.4	18.7	37.25	2008.732
SLE 85	18 07 33.1	+03 13 53	11.2	12.5	11.5	180.25	2008.732
BAL1952	18 07 34.4	+02 24 08	11.52	12.8	13.9	154.25	2008.732
POU3350	18 07 59.9	+24 06 00	11.8	12.0	9.35	64.25	2008.732
BAL2474	18 08 03.4	+03 43 12	10.0	11.0	16.0	278.25	2008.732
POU3351	18 08 08.8	+23 27 12	12.05	13.9	10.6	155.25	2008.732
SLE 111	18 08 53.9	+27 24 56	10.8	12.5	14.6	313.25	2008.732
BAL2478	18 09 42.9	+03 54 26	10.34	11.3	12.2	108.75	2008.732
STF2293	18 09 53.83	+48 24 05.7	8.08	10.34	13.4	82.95	2008.732
HJ1 315	18 09 53.5	+29 41 16	11.85	13.1	9.4	129.25	2008.732
SEI 559	18 10 27.8	+33 55 55	11.0	11.0	12.1	170.75	2008.732
AG 217	18 11 05.89	+53 29 37.8	10.77	11.85	15	238.45	2008.732
ALI 140	18 11 25.14	+35 06 45.5	10.97	11.79	14.6	250.45	2008.732
BAL2483	18 14 41.6	+03 42 05	12.00	12.7	13.5	196.75	2008.732
SLE 145	18 14 58.3	+03 03 43	11.2	11.9	11.8	27.25	2008.732
ES 646	18 15 09.4	+52 09 25	8.3	14.1	10.2	196.25	2008.732
STF2459	19 07 22.01	+25 58 23.9	9.12	10.07	13.7	234.25	2008.732
POU3718	19 08 00.6	+24 58 09	10.69	13.7	14.2	272.95	2008.732
HJ 877	19 10 04.2	+19 33 15	10.8	11.1	12.5	293.75	2008.732
SLE 931	19 10 20.34	+02 49 58.7	9.9	12.0	12	80.75	2008.732
ALI 617	19 11 47.9	+37 21 23	11.59	12.6	14.3	80.25	2008.732
POU3745	19 12 00.7	+23 46 18	12.47	13.7	11.6	22.75	2008.732

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Table 2 (continues): Measurements made in September 2008.

Name	RA	DEC	MAGS		SEP	PA	DATE
HJ 1375	19 12 29.96	+28 14 26.7	11.02	13.64	12.8	85.45	2008.732
HLM 18	19 13 15.0	+39 08 57	10.94	11.33	13.06	332.75	2008.732
SLE 935	19 14 26.74	+02 12 06.2	11.0	11.0	7	215.25	2008.732
SEI 585	19 14 48.6	+38 20 01	8.91	11.7	14.4	121.75	2008.732
ARA1175	19 15 30.0	-19 55 19	11.60	12.5	12.9	14.25	2008.732
HJ 2861	19 16 30.4	+07 12 10	10.84	13.8	12.7	54.25	2008.732
BAL1516	19 17 00.2	+01 45 03	11.03	11.1	11.3	272.75	2008.732
HJ 2868	19 17 56.9	+58 07 58	11.9	11.9	11.8	99.25	2008.732
ALI 620	19 19 03.7	+37 45 01	11.56	12.0	13.9	4.25	2008.732
POU3769	19 20 22.	+25 11 42	12.82	12.70	12.5	262.25	2008.732
POU4247	20 10 48.	+23 19 12	12.7	12.7	10.8	94.75	2008.732
ALI 657	20 11 17.70	+37 30 50	11.21	11.34	10.9	277.25	2008.732
SLE 959AB	20 11 50.08	+37 26 06.8	11.8	12.6	12.04	177.25	2008.732
STI 953	20 12 39.1	+59 23 39	11.4	12.4	19.9	14.25	2008.732
SEI1012	20 13 02.3	+34 50 28	11.0	11.0	14.8	49.25	2008.732
CHE 235	20 14 36.16	+14 52 35.2	10.00	11.5	14.1	28.75	2008.732
STI2586	21 42 40.45	+56 14 56.9	10.71	11.72	12.5	2.75	2008.732
POU5478	21 44 59.1	+24 30 56	11.8	13.1	16.1	328.75	2008.732
AG 420	21 47 24.4	+28 54 55	11.1	11.9	7.5	147.25	2008.732
HJ 1726	22 06 51.5	+15 05 01.	11.0	11.5	18.9	24.39	2008.735
STI 2706	22 19 58.4	+56 03 39.	12.50	13.1	14	83.25	2008.735
STI 2720	22 21 30.0	+58 36 48.	12.1	12.1	14.9	162.25	2008.735
STI 2722	22 21 59.1	+56 19 52.	10.67	13.1	14.5	71.75	2008.735
STI 2728	22 22 22.96	+55 16 41.9	12.5	13.1	15.5	36.25	2008.735
8 Lacertae (STF2922AB)	22 35 52.2	+39 38 03.	5.66	6.29	22.8	187.25	2008.735
AG 423	22 36 15.6	+29 44 43.	8.32	9.7	23.5	154.25	2008.735
STT 475 AB	22 39 04.5	+37 22 31.	6.84	10.8	16.1	72.75	2008.735
STI 2866	22 49 42.30	58 04 13.4	10.58	11.28	15.1	182.25	2008.735
STI 2872	22 50 16.7	+57 36 20	11.85	11.9	11.1	56.75	2008.735
STI 2876	22 51 26.3	+56 19 32	11.20	11.2	12.7	58.25	2008.735
HJ 1839	23 00 23.9	+41 07 29	8.78	10.5	14.7	294.25	2008.735
STI 2957	23 13 39.4	+56 47 48	12.1	12.4	13.3	156.25	2008.735
STF 2999 AB	23 18 46.44	+05 11 18.7	8.90	9.17	77.6	167.85	2008.735
STF 2999 BC	23 18 47.55	+05 10 03.7	9.17	10.86	10.5	172.55	2008.735
STF 2999 AD	23 18 46.4	+05 11 18	8.90	11.9	27.7	19.75	2008.735

Table 2 continues on next page.

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Table 2 (conclusion): Measurements made in September 2008.

Name	RA	DEC	MAGS		SEP	PA	DATE
HJ 307	23 19 20.7	+13 26 48	10.22	12.00	25.3	313.25	2008.735
HJ 987	23 29 40.5	+32 12 40	9.22	12.1	13.2	280.25	2008.735
STI3007	23 36 42.8	+58 19 49	13.2	13.2	8.8	122.25	2008.735
STI3012	23 38 24.5	+58 00 27	12.6	12.6	7.9	99.75	2008.735
HJ 1899	23 40 35.4	+55 12 40	8.68	10.5	12.9	247.25	2008.735
BAL1249	23 41 02.7	+00 43 07	10.36	12.4	14.1	336.25	2008.735
HJ 5435AC	23 57 23.1	-16 05 44	9.52	12.5	25.2	56.25	2008.735
ES 1051AC	23 57 42.35	+53 45 27.5	10.4	12.7	9.6	186.05	2008.735
Es 1051AB	23 57 42.35	+53 45 27.5	10.4	11.7	6.4	50.08	2008.735
STI3089	00 03 52.3	+55 17 57.	12.6	13.2	17	125.25	2008.735
BU 9001 AC	00 05 09.7	+45 13 44	6.69	10.58	21.7	235.75	2008.735
STF3064	00 07 37.92	+40 08 52.6	6.84	10.50	27.2	10.25	2008.735
BU 1339AC	00 08 01.7	+31 23 28	7.13	13.6	16.1	272.25	2008.735
HJ 1947AB	00 16 21.5	+43 35 42	6.16	9.83	9.7	77.65	2008.735
STF 36AB	00 32 23.7	+06 57 19	5.68	9.52	28.4	83.25	2008.735
STF 40AB	00 35 09.6	+36 49 56	6.72	8.48	11.8	312.25	2008.735
55 Piscium (STF 46)	00 39 55.57	+21 26 18.6	5.56	8.49	5.02	191.85	2008.735