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NEW ELEMENTS FOR 54 ECLIPSING BINARIES

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Abstract:
This research presents new elements for 54 eclipsing binaries found using data from the ASAS-3, Hipparcos and NSVS databases. Some of the systems studied are new and others are confirmed or had wrong elements in the literature. The discovery of apsidal motion in TZ Pyx is presented and an identification problem with CPD-41 7746 in NGC 6231 is addressed. Conspicuous BE-variability superposed to eclipsing variations is discovered in HD 61407.

Methodology

Following an extensive research of new and unsolved eclipsing binaries that started in 2003 (see **Otero, 2003**, for the first paper of the series), the ASAS-3 **(Pojmanski, 2005)**, NSVS **(Wozniak et al., 2004)** and Hipparcos **(Perryman et al., 1997)** databases have been used to find new elements for 54 systems. All observations available from those databases have been combined to improve the period determinations. Unfiltered NSVS ROTSE1 magnitudes were shifted to match the V magnitude of the stars. When neither ASAS nor Hipparcos observations exist, the original ROTSE1 magnitudes have been given. Hipparcos observations have been transformed to V using a table by the author published electronically in IBVS No. 5482 **(Otero, 2003b)**. Saturated data in ASAS-3 and flagged observations in the Hipparcos Epoch Photometry and the NSVS dataset were discarded.
The candidate stars were selected from the NSV catalogue **(Kukarkin and Kholopov, 1982)** and its supplement **(Kazarovets et al., 1998)** and the GCVS (General Catalogue of Variable Stars, **Kholopov et al., 2006**). Stars in the GCVS and NSV catalogues that had no given classification or were classified as eclipsing binaries, S, L, I, CST or VAR with no spectral type published or spectral type earlier than K were checked. This list also include new eclipsing binaries randomly found by visual inspection of ASAS-3 light curves of relatively bright stars (V= 7.5 to 9.5) with B-V smaller than 0.6 in random sky areas. Elements were found with AVE **(Barberá, 1999)** and a Microsoft Excel period search utility kindly provided by Patrick Wils **(Wils, 2003)**. Periods and epochs were then improved by light curve fitting of all the datasets available. The uncertainties are those for when the folded light curve began to show systematic differences. The time span of the observations determines the accuracy of the periods and ranges from 1 (when only data from the NSVS database are available) to 17 years (when there are observations at least from the Hipparcos and ASAS-3 databases).

Results

Table 1 gives positions and cross-identifications for all of the eclipsing binaries studied. The first column gives the star's number in this paper. The following columns give the ASAS or NSVS identifier; the GSC number; other known identification; a GCVS name if the star was already known to be variable and the star's position according to the NOMAD catalogue **(Zacharias et al., 2005)**.

Table 1 – Positions and cross-identifications for the fifty four eclipsing binaries studied.

Star Name					NOMAD position (J2000.0)
#	ASAS/NSVS ID	GSC ID	Other ID	GCVS ID	
1	NSVS 1606999	GSC 4018-1972	ALS 13385	V0362 Cas	00 02 21.45 +63 28 07.7
2	ASAS 000702+2250.7	GSC 1729-0206	HIP 578	New	00 07 02.00 +22 50 40.0
3	ASAS 011601-2542.6	GSC 6425-1835	NSVS 17508482	NSV 15265	01 16 00.60 -25 42 33.0
4	---	GSC 7547-1134	HIP 6867	gam Phe	01 28 21.93 -43 19 05.6
5	---	GSC 4031-2047	HIP 7939	V0772 Cas	01 42 02.91 +61 02 17.7
6	ASAS 025810-0611.8	GSC 4706-0963	NSVS 12100696	NSV 00998	02 58 10.41 -06 11 50.1
7	ASAS 035307+2532.1	GSC 1804-0883	HD 24323	New	03 53 07.42 +25 32 07.3

8	ASAS 053224+2141.2	GSC 1309-2875	NSVS 9577341	NSV 02086	05 32 23.97 +21 41 10.6
9	ASAS 053547-0222.4	GSC 4770-1145	HD 37090	New	05 35 46.53 -02 22 26.6
10	NSVS 6933763	GSC 2404-1097	HIP 26658	NSV 16617	05 39 56.62 +30 05 11.2
11	ASAS 063641-2236.9	GSC 6508-0771	HIP 31593	NSV 16934	06 36 41.06 -22 36 53.0
12	ASAS 064517-4642.1	GSC 8117-0053	HD 49283	New	06 45 17.30 -46 42 06.5
13	ASAS 070721-0935.0	GSC 5385-0099	HIP 34355	NSV 17346	07 07 20.69 -09 34 59.6
14	ASAS 070808-1036.3	GSC 5385-0784	BD-10 1883	NSV 17356	07 08 07.72 -10 36 17.3
15	ASAS 071822-2451.2	GSC 6541-3890	HIP 35370	New	07 18 21.94 -24 51 11.9
16	---	GSC 7655-2687	HIP 36377	sig Pup	07 29 13.83 -43 18 05.2
17	ASAS 073321-1148.8	GSC 5405-3700	NSVS 15352307	New	07 33 21.51 -11 48 39.9
18	ASAS 073822-2214.3	GSC 5992-3237	HD 61407	New	07 38 21.47 -22 14 16.4
19	ASAS 074754+0933.6	---	NSVS 10030395	UY CMi	07 47 54.10 +09 33 32.0
20	ASAS 075047-3022.2	GSC 7119-0429	CPD-30 2066	NSV 03763	07 50 46.91 -30 22 12.1
21	ASAS 081022-3546.3	GSC 7133-2398	HD 68297	New	08 10 22.28 -35 46 22.5
22	---	GSC 4129-2554	HIP 40772	NSV 17814	08 19 17.16 +62 30 25.8
23	ASAS 083809-4004.9	GSC 7666-2100	HD 73699	New	08 38 08.98 -40 04 51.9
24	ASAS 084108-3212.1	GSC 7140-2924	HIP 42619	TZ Pyx	08 41 08.26 -32 12 03.0
25	ASAS 090047-1820.8	GSC 6018-0701	HIP 44258	New	09 00 47.05 -18 20 46.7
26	---	GSC 2997-0034	HIP 46642	NSV 18216	09 30 38.31 +44 46 09.9
27	---	GSC 9418-2651	HIP 52340	DR Cha	10 41 51.52 -79 46 59.8
28	ASAS 104847-6035.7	GSC 8957-2013	HD 93858	New	10 48 46.52 -60 35 39.9
29	ASAS 105042-5912.7	GSC 8626-0675	HD 94129	New	10 50 41.36 -59 12 45.8
30	ASAS 110949-6028.2	GSC 8959-0199	HD 306059	New	11 09 49.37 -60 28 10.1
31	ASAS 111514-6009.9	GSC 8959-1742	HD 97969	New	11 15 14.49 -60 09 52.7
32	ASAS 113821-6322.3	GSC 8976-4901	HIP 56769	V0871 Cen	11 38 20.36 -63 22 21.9
33	---	GSC 2531-0414	HIP 61902	NSV 19457	12 41 07.76 +30 26 13.6
34	ASAS 130236-5956.0	GSC 8660-0921	HD 113151	New	13 02 36.10 -59 56 00.8
35	ASAS 130632-6504.8	GSC 8997-2247	HD 113659	New	13 06 32.35 -65 04 49.5
36	---	GSC 4183-1726	HIP 74037	NSV 20256	15 07 50.16 +63 07 01.6
37	ASAS 153351-5831.3	GSC 8708-0518	HD 138274	New	15 33 51.00 -58 31 16.8
38	ASAS 155727-5920.3	GSC 8709-0934	HD 142389	New	15 57 27.42 -59 20 15.4
39	ASAS 160240-6353.4	GSC 9044-0004	HD 143156	New	16 02 40.26 -63 53 24.4
40	NSVS 5280826	GSC 3500-2316	SVS 2064	V712 Her	16 49 56.90 +46 14 20.9
41	ASAS 165430-4139.2	GSC 7876-2235	SAO 227397	New	16 54 29.49 -41 39 15.0
42	ASAS 175015-4126.5	GSC 7894-0260	HIP 087298	V1090 Sco	17 50 15.19 -41 26 30.0
43	ASAS 180605-2411.7	GSC 6842-1179	HD 165246	New	18 06 04.68 -24 11 43.9
44	ASAS 182106-5407.8	GSC 8744-2529	HV 9868	NSV 10625	18 21 05.05 -54 07 45.3
45	---	GSC 3548-2346	HIP 92204	NSV 24598	18 47 29.58 +49 25 55.3
46	NSVS 1207116	GSC 4443-1813	BV 354	NSV 11763	19 05 22.98 +73 46 26.3
47	NSVS 3164029	GSC 4231-1158	SON 7840	BN Dra	19 47 08.04 +61 22 12.7
48	---	GSC 3558-0479	HIP 98028	V2094 Cyg	19 55 12.05 +46 39 56.0
49	ASAS 195905-3750.5	GSC 7934-3946	HD 188942	New	19 59 04.73 --37 50 28.2
50	ASAS 204128+1854.8	GSC 1642-0650	NSVS 11474594	BP Del	20 41 28.40 +18 54 51.0
51	ASAS 205836-1322.1	GSC 5782-1414	HD 199587	New	20 58 35.61 -13 22 06.6
52	NSVS 8689339	GSC 2702-0226	SVS 503	V1901 Cyg	21 12 05.73 +31 23 07.9
53	NSVS 5907113	GSC 3182-1005	SVS 2365	V1905 Cyg	21 25 49.70 +39 04 19.7
54	ASAS 225629-4721.8	GSC 8447-1207	CD-48 14362	AF Gru	22 56 29.17 -47 21 46.9

Table 2 lists the elements and data for the stars. The first column gives the star's number in this paper. The other columns give the brightness range of the variable (magnitudes at maximum and at minimum I and II respectively); the passband of the observations (V for ASAS-V or Hp converted to V magnitudes and R1 for ROTSE1 magnitudes); the variability type; the period; the epoch of maximum light derived from the complete dataset; the spectral type and its source.

Table 2 – Elements and data for the fifty four eclipsing binaries studied.

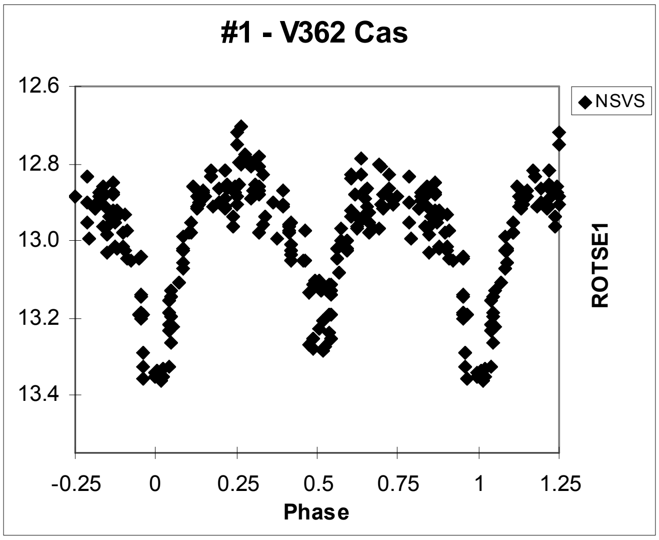
#	Magnitude range			Filt	Type	Period (days)	Epoch (HJD)	Spectral type	Source
	Max	Min I	Min II						
1	12.8	13.35	13.2	V	EB	1.04496(1)	2451402.678(5)	B	14
2	8.28	8.8:	---	V	EA	1.5437775(8)	2448254.130(5)	F2III/IV	4
3	11.91	12.12	12.08	V	EW/KE	0.406798(1)	2452235.550(5)	A7	14
4	3.39	3.49	3.48	V	EB/GS+LB	194.1(3)	2449063.5(8)	M0III	12
5	6.68	6.76:	6.74:	V	EA	10.7269(2)	2448219.46(3)	B8IIIpSi	15
6	12.75	14.0:	13.5	V	EB	64.38(3)	2451504.8(5)	---	---
7	8.53	<8.87	<8.69	V	EA	13.0620(3)	2453354.715(5)	A0	15
8	12.35	12.75	12.43	V	EA	1.35567(1)	2451536.885(5)	---	---
9	7.80	<8.26	<8.20	V	EA	13.5496(2)	2452912.913(3)	F3V	10
10	8.03	<8.21	<8.12	V	EB	66.76(1)	2448013.1(3)	F5II+Be	14
11	6.34	6.48	6.40	V	EA	1.98571(1)	2448401.484(4)	B5V	13
12	9.17	9.36	---	V	EA	38.501(1)	2452690.72(2)	B9V	7
13	8.32	8.41	8.40	V	EB	2.35510(1)	2451889.743(5)	B3II-III	11
14	10.06	10.18	---	V	EA	1.90150(2)	2453780.725(5)	B9	1
15	8.91	9.07	8.95	V	EA	4.19184(2)	2451993.495(5)	B2IV/V	9
16	3.23	3.27	3.26	V	EB/GS+LB	258(2)	2448553(1)	K5III SB	11
17	12.75	13.5	13.3	V	EA+BE	26.98(1)	2452626.0(1)	Be	17
18	8.83	9.00	9.00	V	EA+BE	4.45037(4)	2451903.75(2)	B5(IV)	9
19	13.15	14.0	13.20	V	EA	4.4499(1)	2453046.64(1)	---	---
20	10.79	12.15	10.9	V	EA	3.70821(3)	2453798.630(3)	---	---
21	8.92	9.01	8.96	V	EA	4.89927(6)	2453856.64(1)	B9IV	8
22	5.73	5.79	---	V	EA/RS:	89.06(6)	2448022.9(1)	G8III+F0:	2
23	7.55	7.66	7.66	V	EA	1.13492(1)	2452717.769(4)	B3V	5
24	10.67	11.44	11.38	V	EA	2.318546(4)	2452226.773(2)	---	---
25	8.99	9.06	9.05	V	EA	2.03915(1)	2448568.32(1)	A1V	9
26	7.35	7.45	7.36	V	EA	1.7854(1)	2448147.080(5)	A5	15
27	5.97	<6.06	<6.00	V	EA	19.4436(6)	2448774.21(1)	B5IV	11
28	9.08	9.17	9.14	V	EA:	4.778(1)	2453015.80(1)	B1IIIn	13
29	8.43	8.55	8.49	V	EB	1.51416(4)	2451936.715(5)	B9IV	6
30	9.42	9.58	9.51	V	EA	0.96280(1)	2453470.672(4)	B3.5V	18
31	7.70	7.80	7.78	V	EA	14.758(4)	2451908.74(9)	B1:Vn	11
32	6.45	6.53	6.53	V	EA	2.090704(4)	2453041.76(1)	O7IIIn((f))	18
33	6.94	7.02	---	V	EA	2.7044(2)	2448052.22(2)	A5mF0	18
34	9.46	9.55	9.50	V	EA	3.56278(7)	2451888.826(9)	A0IV	6
35	8.02	8.10	8.06	V	EA	3.4273(2)	2453521.605(5)	O9IV	3
36	6.82	6.95:	<6.88	V	EA	2.44405(6)	2448832.12(1)	F4III SB	15
37	8.81	9.15	9.08:	V	EA	15.0615(5)	2453175.80(1)	A0IV	16
38	9.38	9.58	9.58	V	EA	3.4590(1)	2453063.815(5)	B8IV/V	6
39	8.13	8.6	---	V	EA	49.005(6)	2453560.57(2)	B4III	15
40	13.7	15.3	14.1:	R1	EA	5.0312(4)	2451321.70(1)	---	---
41	9.23	<9.43	9.28	V	EA	6.3495(5)	2453033.926(7)	B0.5V	18
42	8.31	8.49	8.48	V	EA	1.707481(4)	2448502.767(4)	B9III	7
43	7.7	<7.81	7.73	V	EA	4.5928(1)	2452383.888(8)	O8V(n)	18
44	13.7	14.4	13.8:	V	EA	0.65186(1)	2452876.625(9)	---	---
45	7.19	7.27	<7.22	V	EA	4.243(1)	2448261.16(1)	F0mF5nSr+A	18
46	11.97	<12.5	<12.35	R1	EA	7.35025(5)	2452862.675(5)	---	---
47	13.9	<15.0	14.2	R1	EA	5.884(1)	2451287.70(2)	---	---

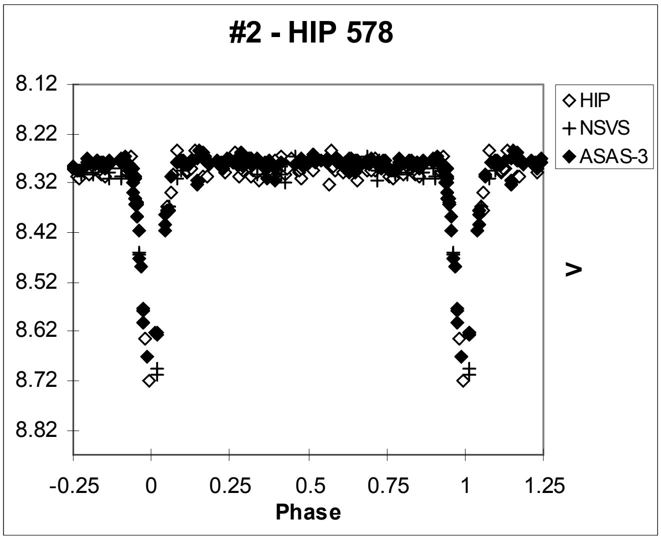
48	7.63	7.74	---	V	EA	8.4803(3)	2448803.68(1)	A7p or A5m	18
49	8.32	8.50	8.50	V	EA	1.76937(1)	2453820.883(6)	F3V	8
50	13.0:	13.3:	13.15:	R1	EA	5.350(1)	2451378.62(2)	---	---
51	7.46	8.05	7.71	V	EA	5.78261(4)	2452445.749(2)	G0V	15
52	13.10	13.75	13.53	R1	EB	0.80890(1)	2451474.586(3)	---	---
53	12.55	13.25	12.7	R1	EA	0.72335(1)	2451474.600(3)	---	---
54	11.53	<12.02	---	V	EA	1.578063(8)	2452839.824(6)	---	---

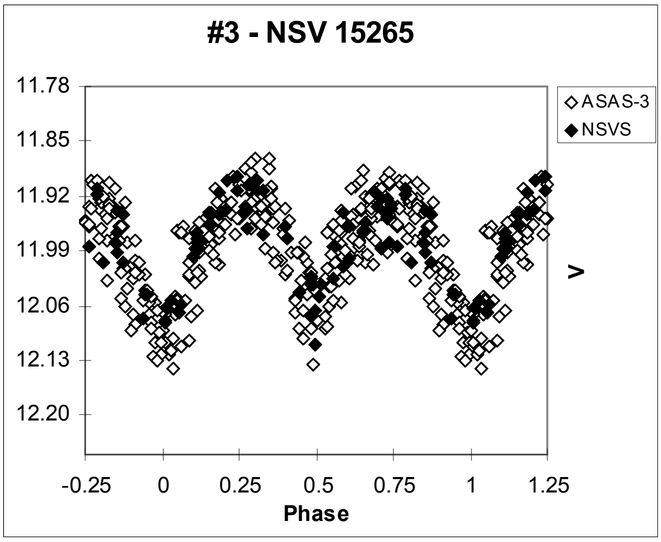
Sources for spectral types in Table 2:

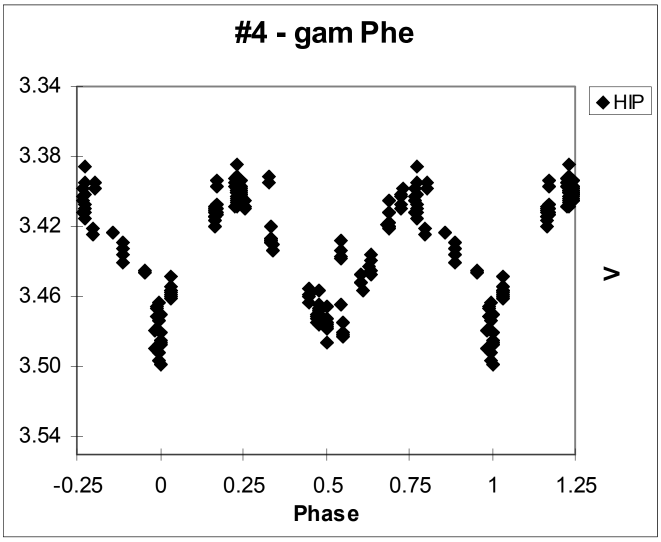
1) **Bagnulo et al., 2006**; 2) **Barbier-Brossat et al., 1994**; 3) **Buscombe, 1998**; 4) **Grenier et al., 1999**; 5) **Guarinos, 1992**; 6) **Houk and Cowley, 1975**; 7) **Houk, 1978**; 8) **Houk, 1982**; 9) **Houk and Smith-Moore**, **1988**; 10) **Houk and Swift, 1999**; 11) **Jaschek, 1978**; 12) **Keenan and Barnbaum, 1999**; 13) **Kennedy, 1983**; 14) **Kholopov et al., 2006**; 15) **Ochsenbein, 1980**; 16) **Paunzen et al., 2001**; 17) **Pereira, 2003**; 18) **Skiff, 2005**.

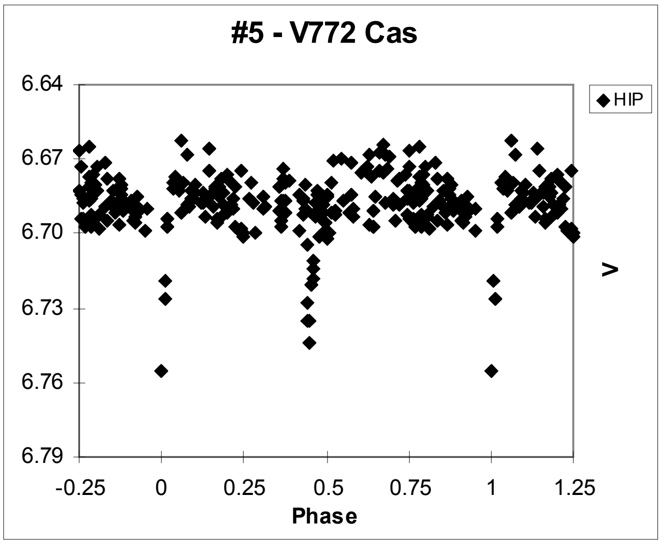
Figures 1 to 54 show the collection of light curves showing the eclipses of all the systems studied in this paper. Light curves for special cases can be seen in the individual notes section.

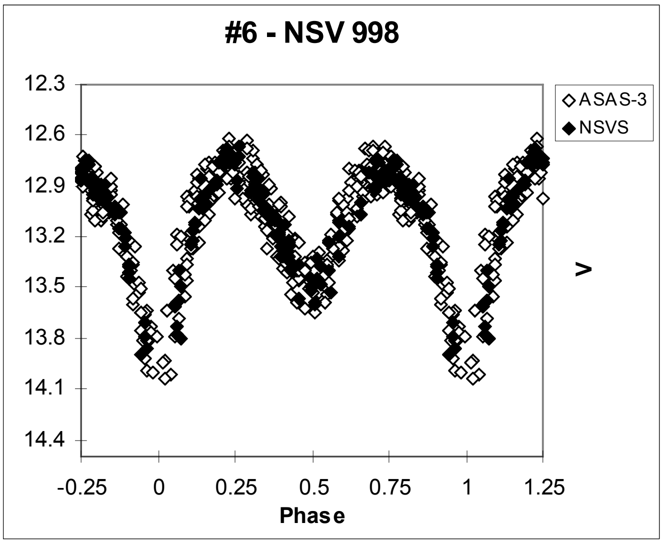


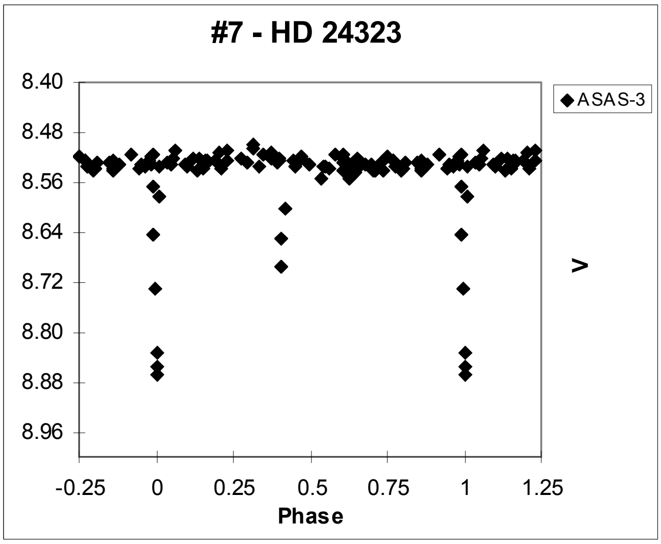


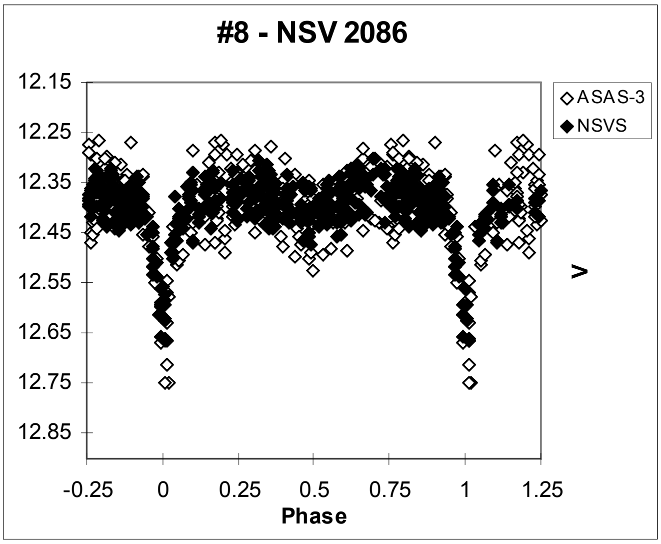


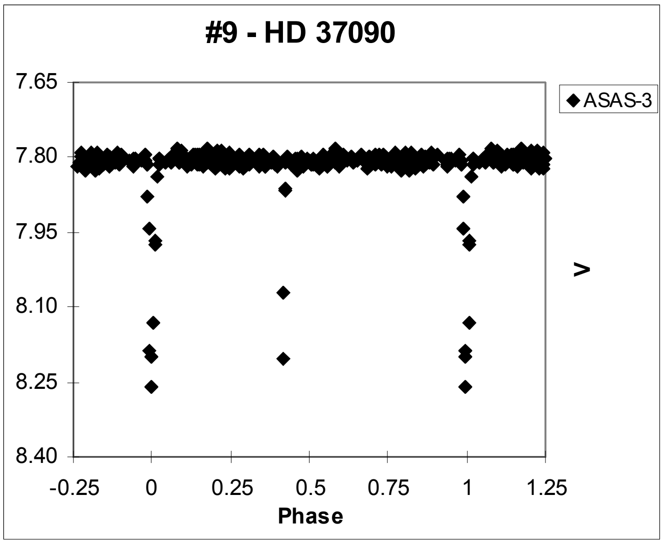


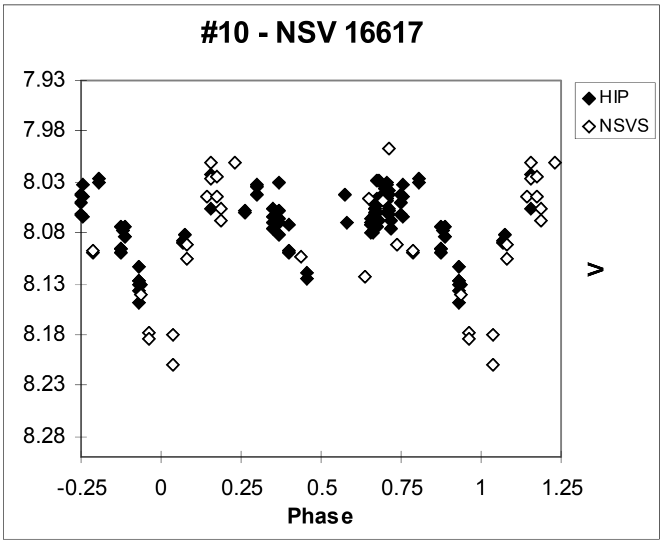

#5 - V772 Cas
HIP
6.64 6.67 6.70 6.73 6.76 6.79
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase


#6 - NSV 998
ASAS-3
NSVS
12.3 12.6 12.9 13.2 13.5 13.8 14.1 14.4
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase


#7 - HD 24323
ASAS-3
8.40 8.48 8.56 8.64 8.72 8.80 8.88 8.96
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase


#8 - NSV 2086
ASAS-3
NSVS
12.15 12.25 12.35 12.45 12.55 12.65 12.75 12.85
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase


#9 - HD 37090
ASAS-3
7.65 7.80 7.95 8.10 8.25 8.40
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase


#10 - NSV 16617
HIP
NSVS
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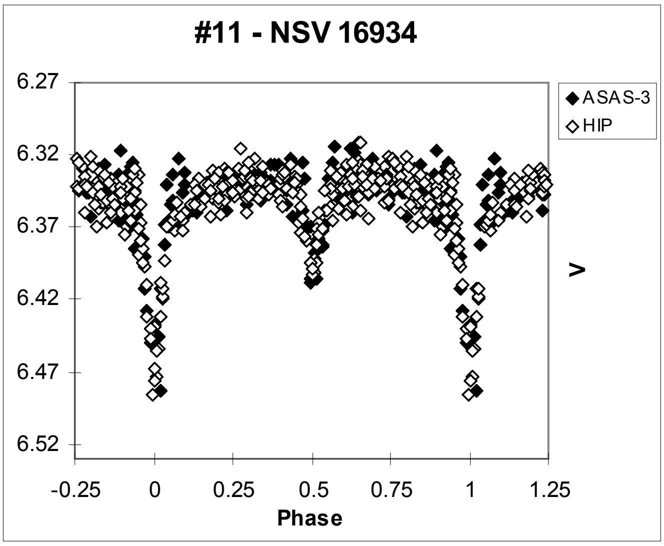
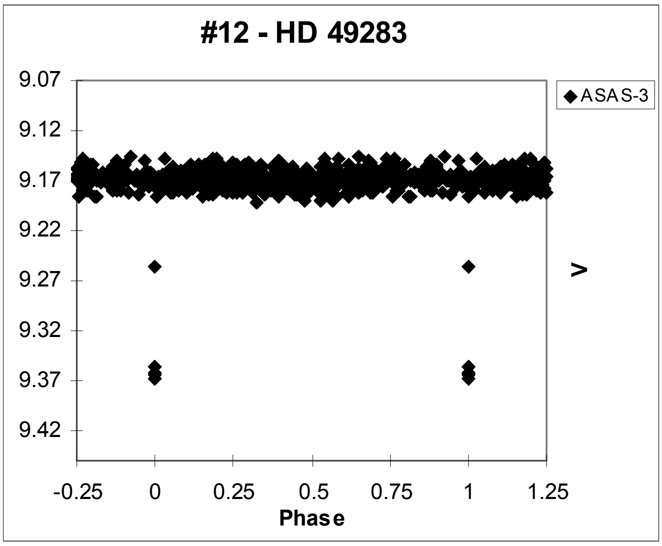
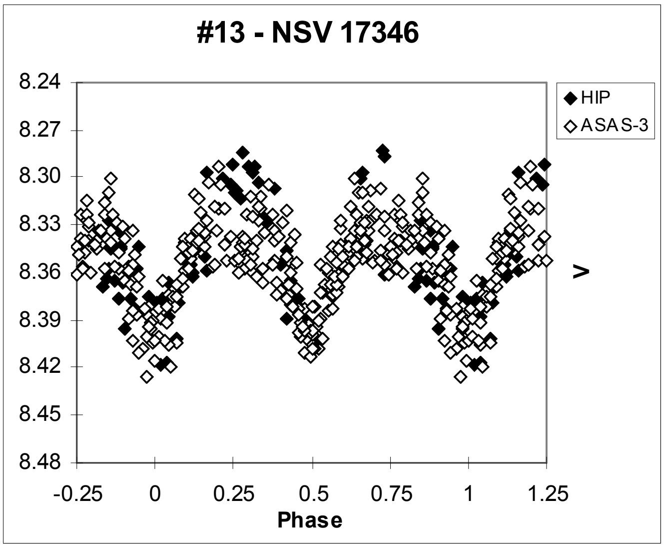
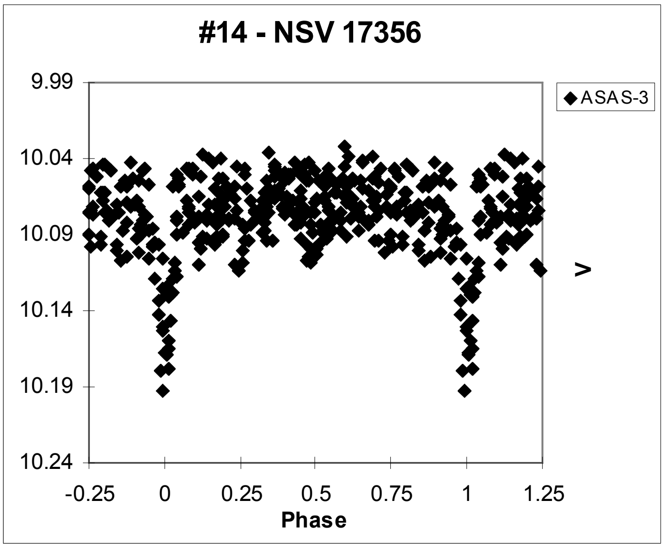
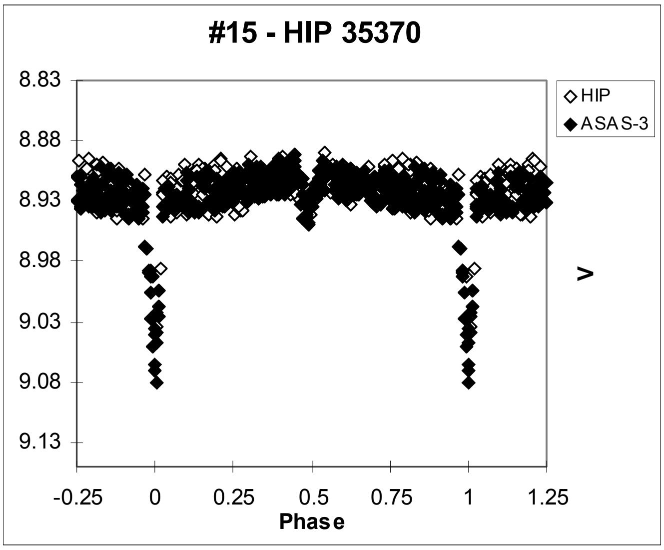
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

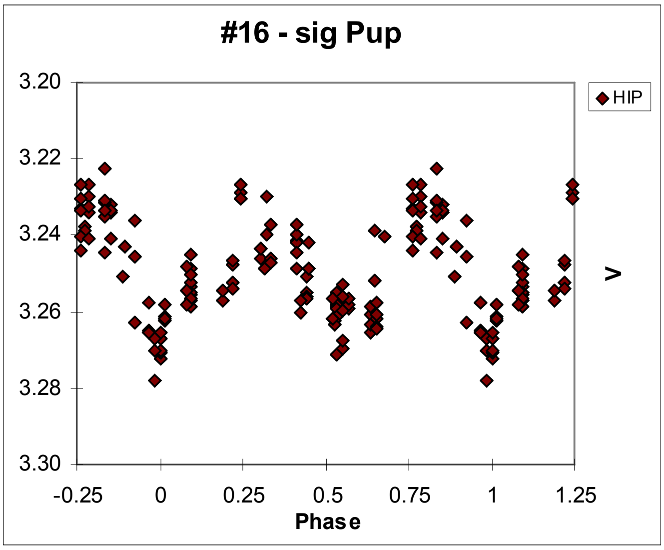

#11 - NSV 16934
ASAS-3
HIP
V
6.27
6.32
6.37
6.42
6.47
6.52
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

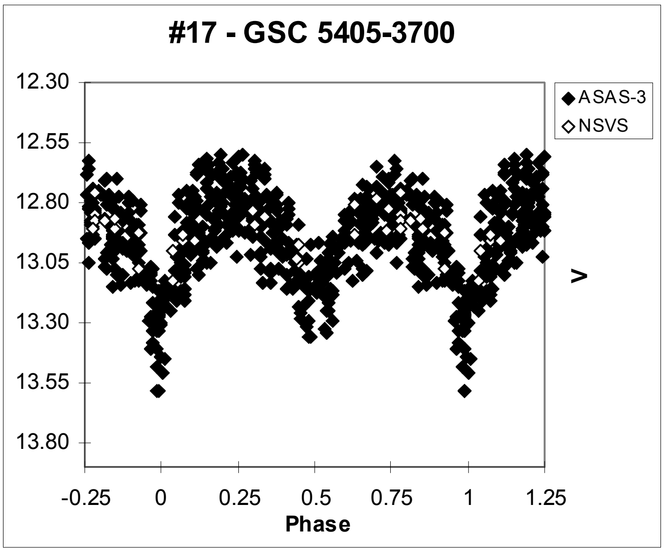

#12 - HD 49283
ASAS-3
V
9.07
9.12
9.17
9.22
9.27
9.32
9.37
9.42
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

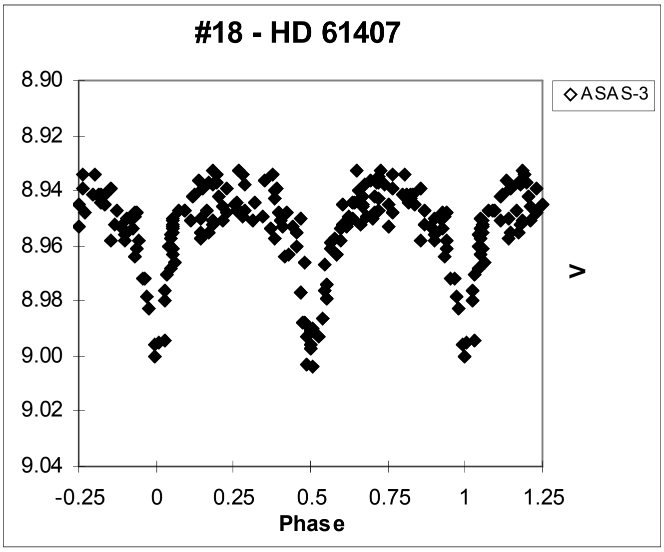

#13 - NSV 17346
HIP
ASAS-3
V
8.24
8.27
8.30
8.33
8.36
8.39
8.42
8.45
8.48
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

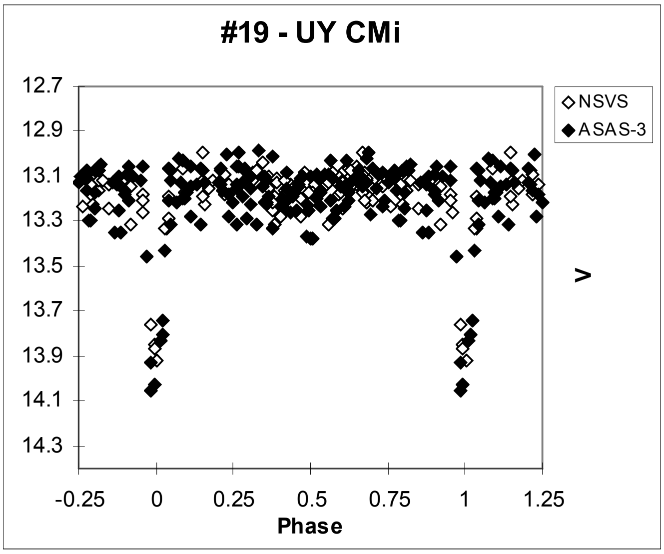

#14 - NSV 17356
ASAS-3
V
9.99
10.04
10.09
10.14
10.19
10.24
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

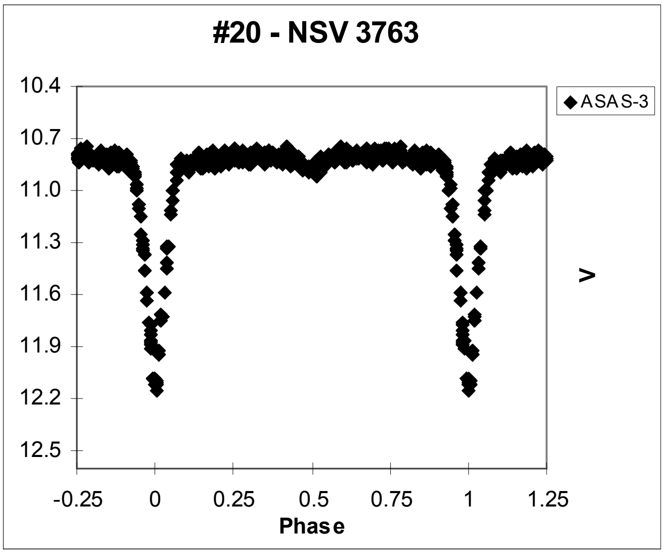

#15 - HIP 35370
HIP
ASAS-3
V
8.83
8.88
8.93
8.98
9.03
9.08
9.13
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

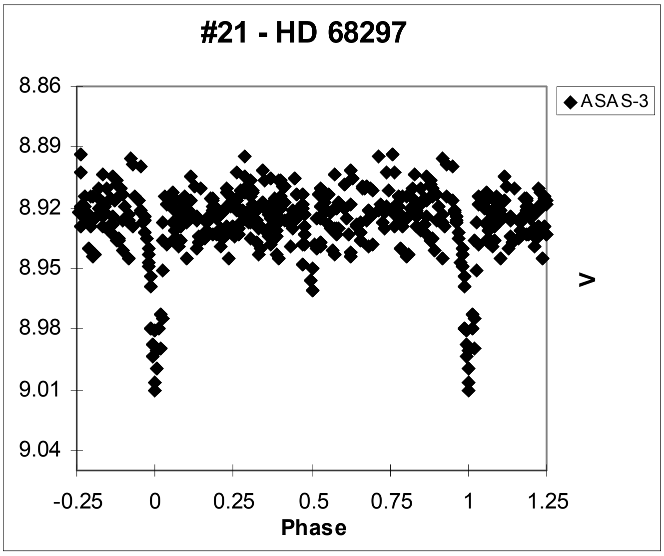

#16 - sig Pup
HIP
V
3.20
3.22
3.24
3.26
3.28
3.30
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

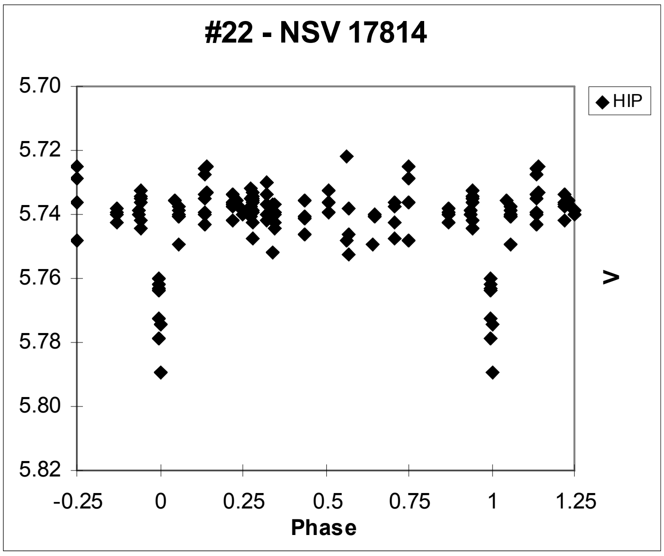

#17 - GSC 5405-3700
ASAS-3
NSVS
12.30
12.55
12.80
13.05
13.30
13.55
13.80
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

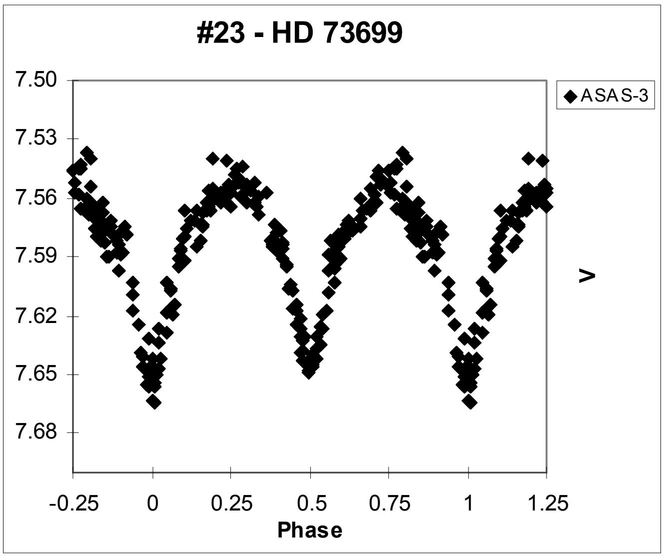

#18 - HD 61407
ASAS-3
8.90
8.92
8.94
8.96
8.98
9.00
9.02
9.04
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

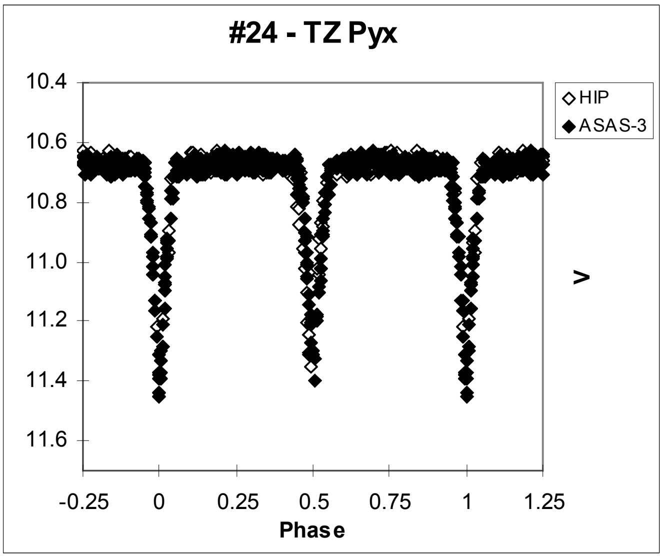

#19 - UY CMi
NSVS
ASAS-3
12.7
12.9
13.1
13.3
13.5
13.7
13.9
14.1
14.3
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

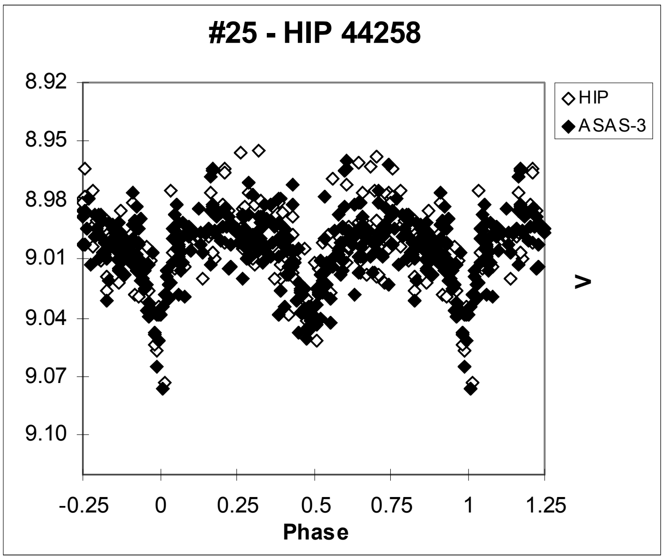

#20 - NSV 3763
ASAS-3
10.4
10.7
11.0
11.3
11.6
11.9
12.2
12.5
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

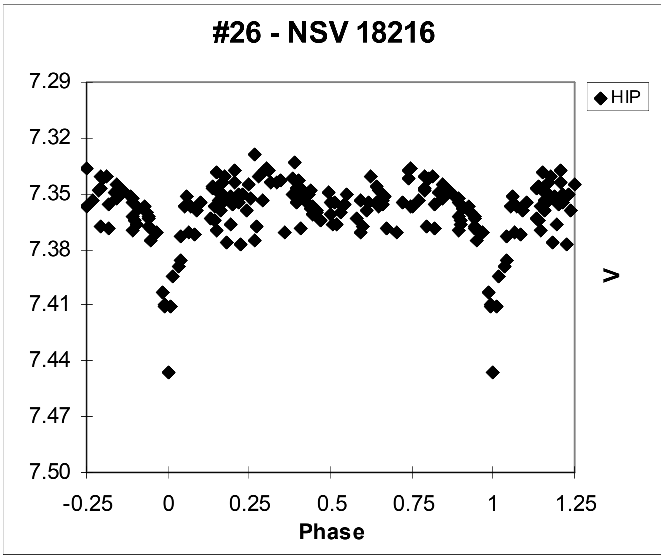

#21 - HD 68297
ASAS-3
8.86
8.89
8.92
8.95
8.98
9.01
9.04
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

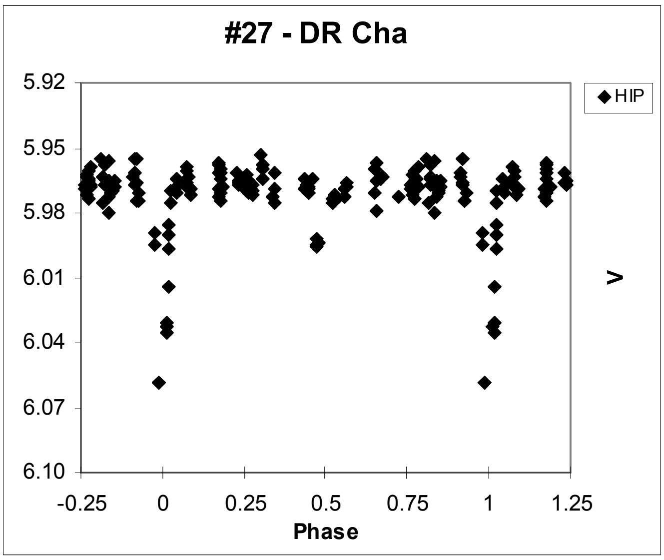

#22 - NSV 17814
HIP
5.70
5.72
5.74
5.76
5.78
5.80
5.82
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

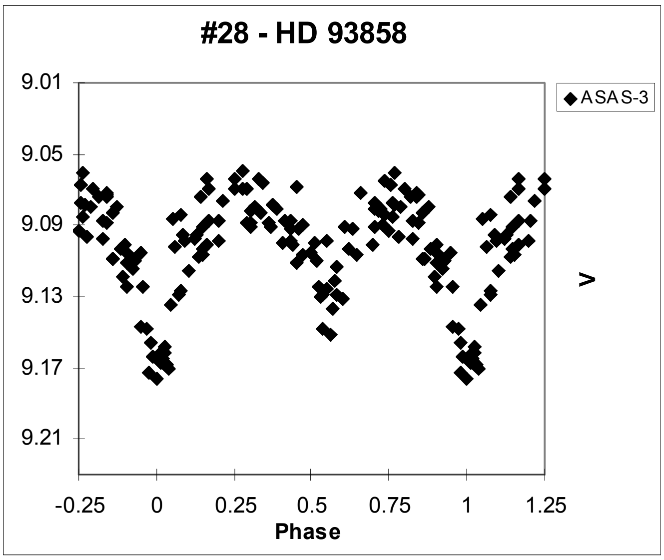

#23 - HD 73699
ASAS-3
V
Phase

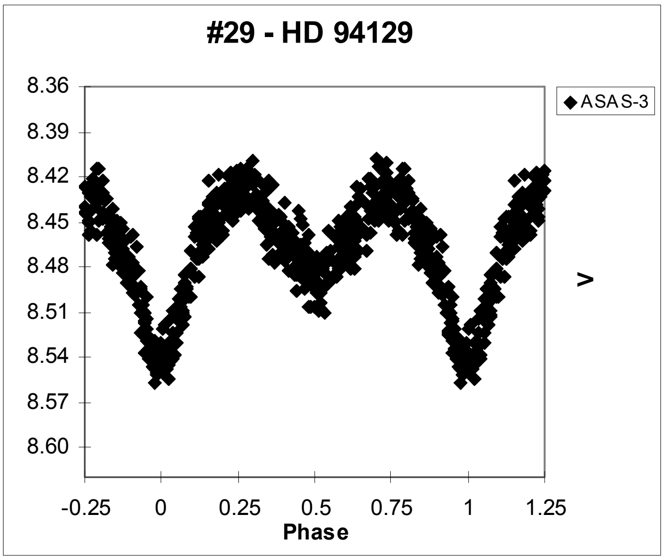

#24 - TZ Pyx
HIP
ASAS-3
V
Phase

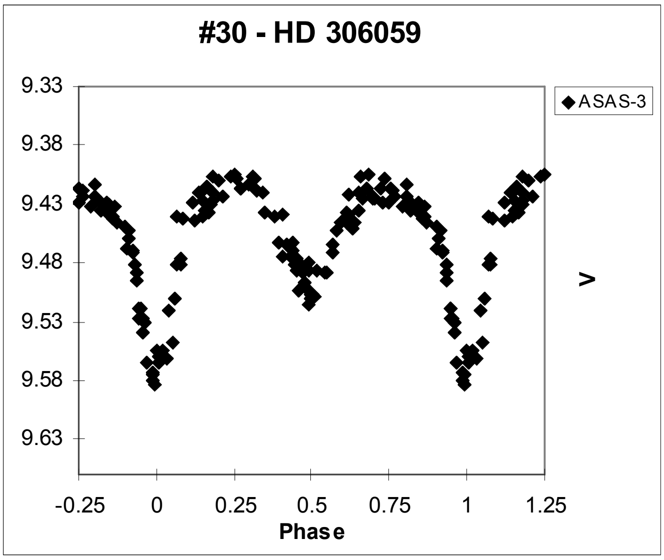

#25 - HIP 44258
HIP
ASAS-3
V
Phase

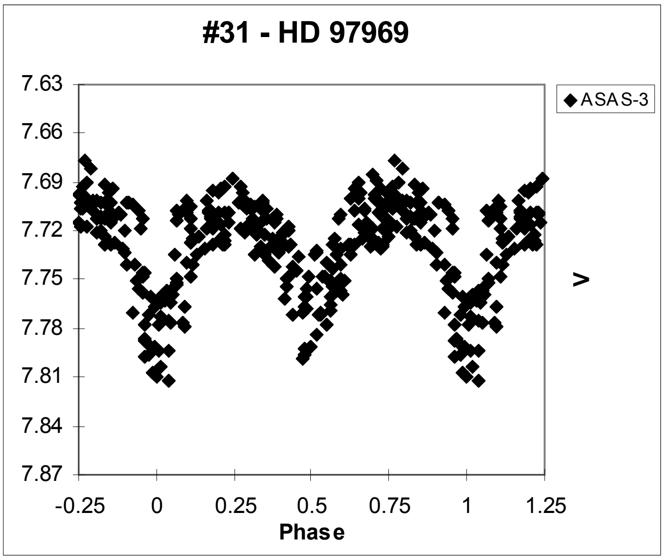

#26 - NSV 18216
HIP
V
Phase

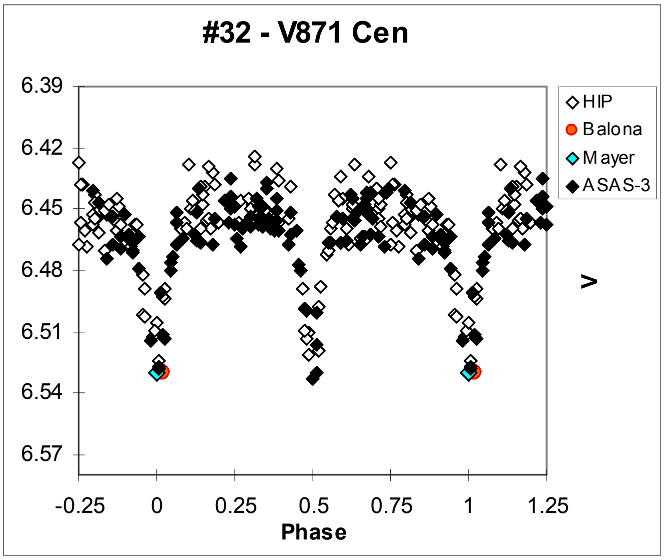

#27 - DR Cha
HIP
V
Phase

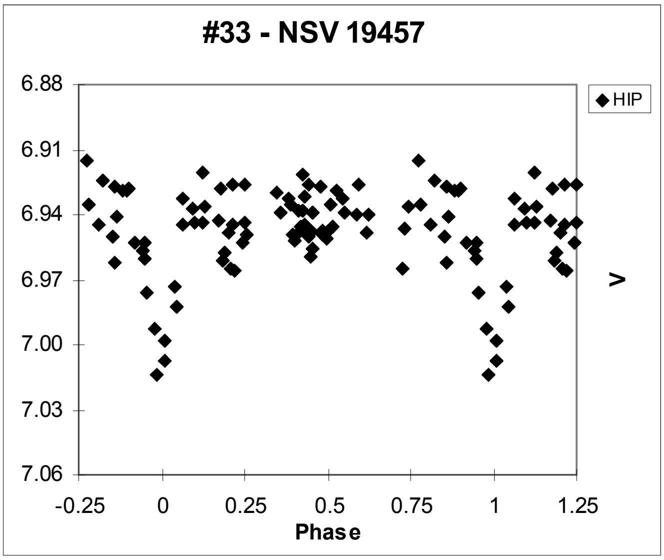

#28 - HD 93858
ASAS-3
V
Phase

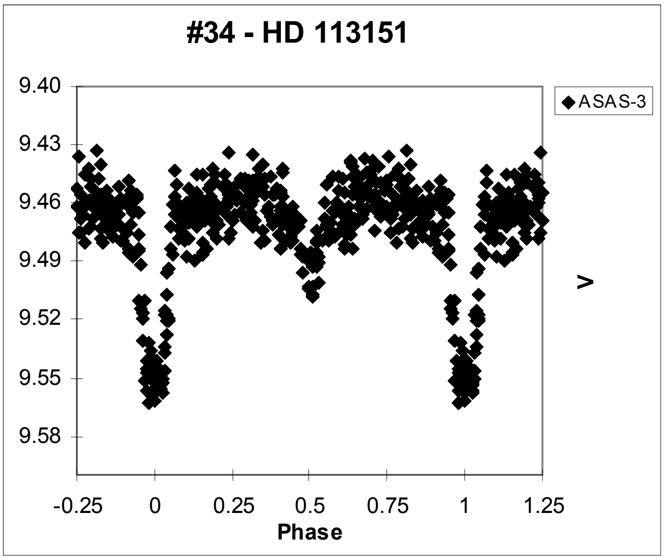

#29 - HD 94129
ASAS-3
8.36
8.39
8.42
8.45
8.48
8.51
8.54
8.57
8.60
V
-0.25
0
0.25
0.5
0.75
1
1.25
Phase

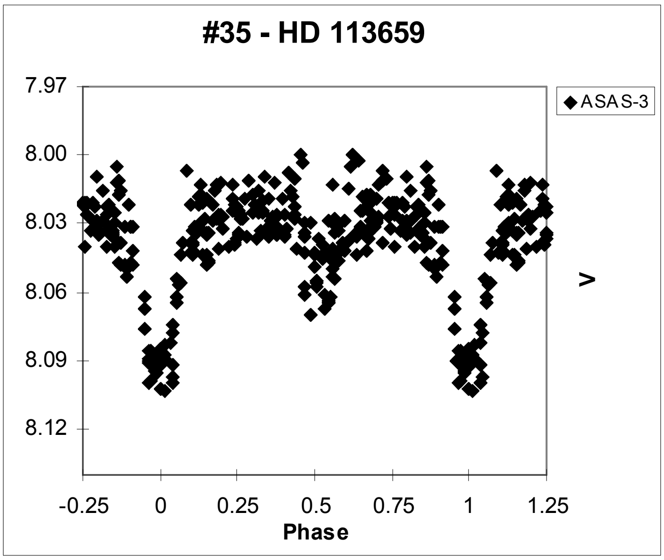

#30 - HD 306059
ASAS-3
9.33
9.38
9.43
9.48
9.53
9.58
9.63
V
-0.25
0
0.25
0.5
0.75
1
1.25
Phase

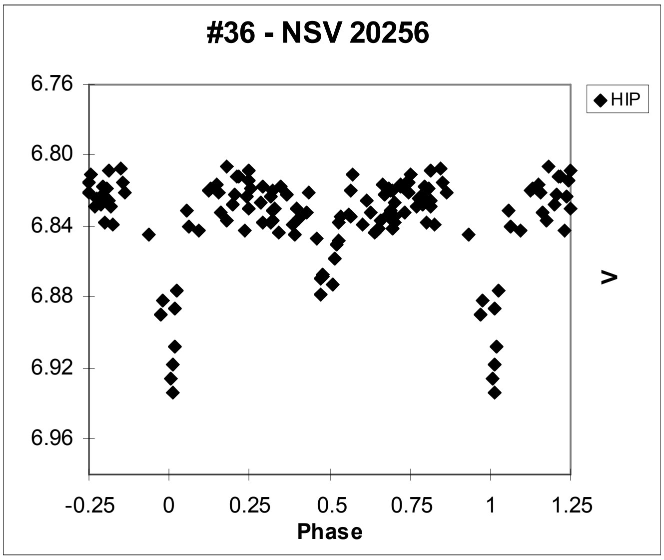

#31 - HD 97969
ASAS-3
7.63
7.66
7.69
7.72
7.75
7.78
7.81
7.84
7.87
V
-0.25
0
0.25
0.5
0.75
1
1.25
Phase

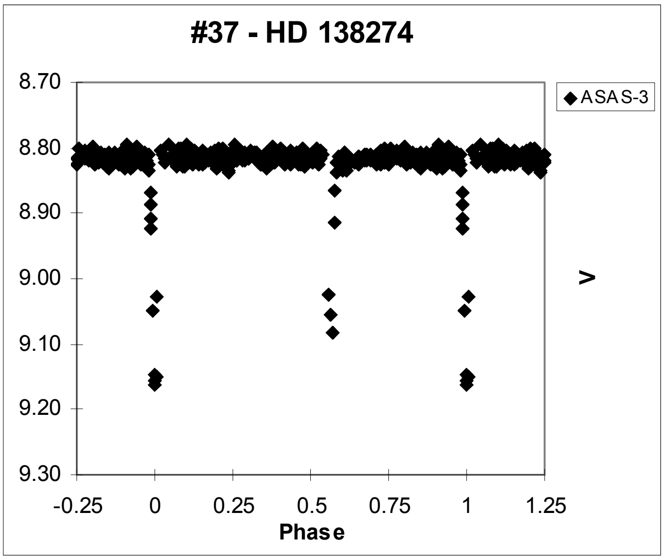

#32 - V871 Cen
HIP
Balona
Mayer
ASAS-3
6.39
6.42
6.45
6.48
6.51
6.54
6.57
V
-0.25
0
0.25
0.5
0.75
1
1.25
Phase

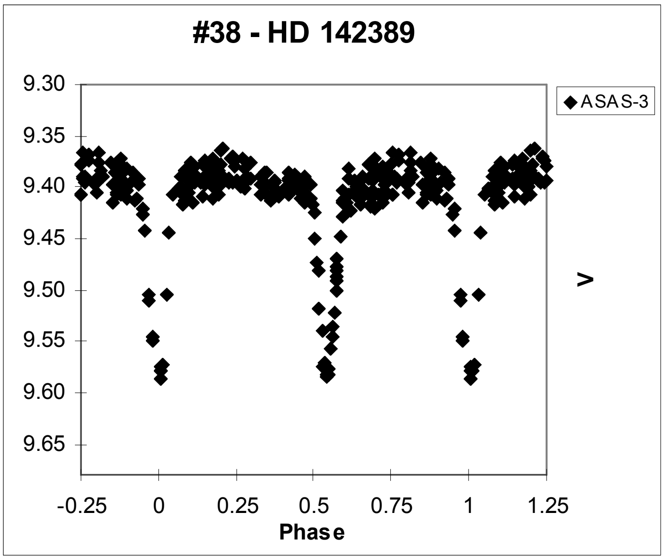

#33 - NSV 19457
HIP
6.88
6.91
6.94
6.97
7.00
7.03
7.06
V
-0.25
0
0.25
0.5
0.75
1
1.25
Phase

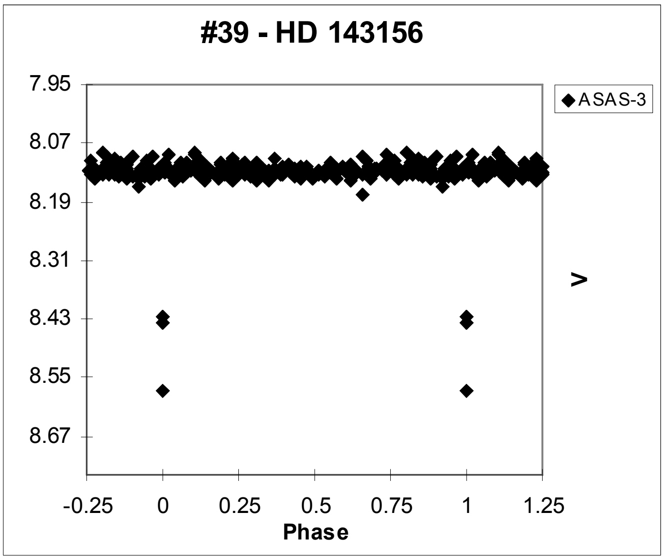

#34 - HD 113151
ASAS-3
9.40
9.43
9.46
9.49
9.52
9.55
9.58
V
-0.25
0
0.25
0.5
0.75
1
1.25
Phase

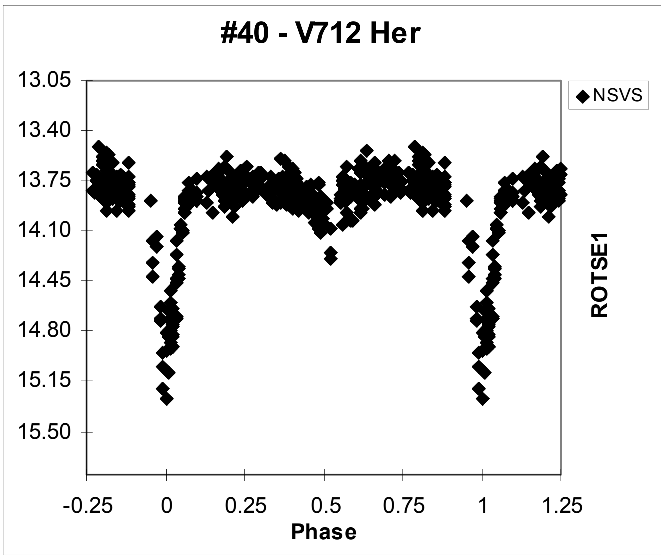

#35 - HD 113659
ASAS-3
7.97
8.00
8.03
8.06
8.09
8.12
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

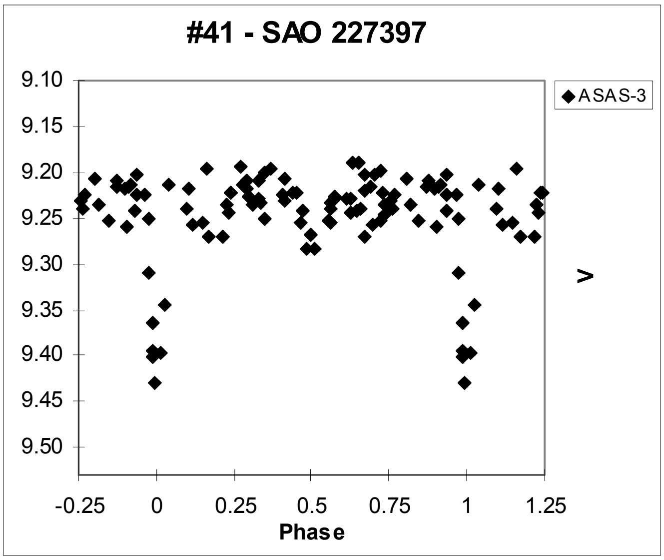

#36 - NSV 20256
HIP
6.76
6.80
6.84
6.88
6.92
6.96
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

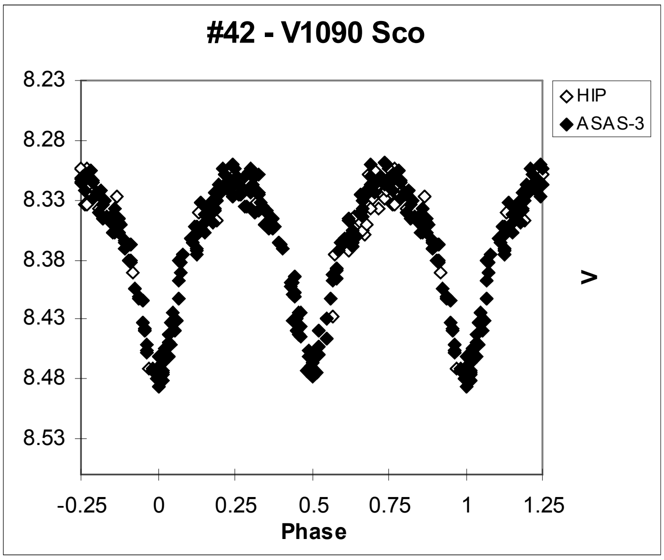

#37 - HD 138274
ASAS-3
8.70
8.80
8.90
9.00
9.10
9.20
9.30
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

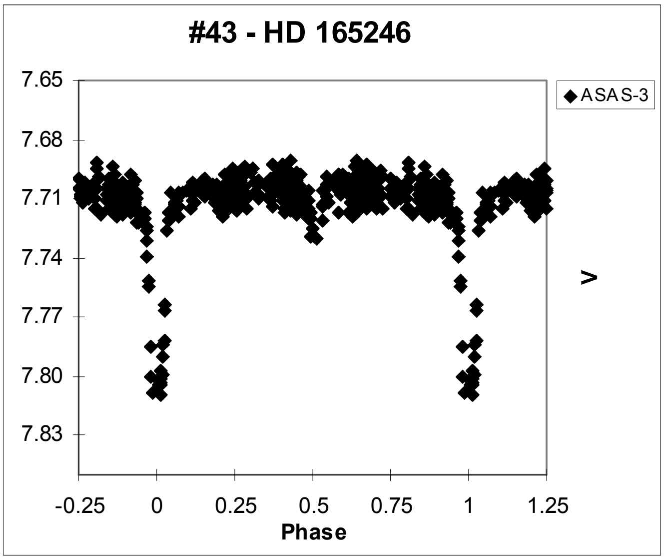

#38 - HD 142389
ASAS-3
9.30
9.35
9.40
9.45
9.50
9.55
9.60
9.65
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

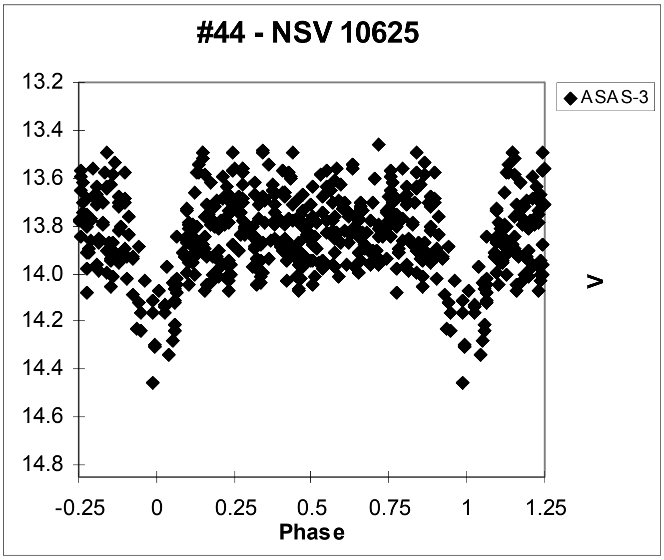

#39 - HD 143156
ASAS-3
7.95
8.07
8.19
8.31
8.43
8.55
8.67
V
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

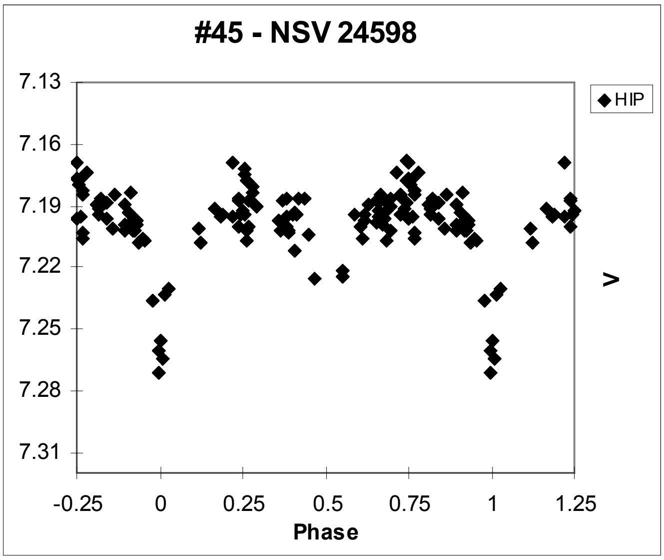

#40 - V712 Her
NSVS
13.05
13.40
13.75
14.10
14.45
14.80
15.15
15.50
ROTSE1
-0.25 0 0.25 0.5 0.75 1 1.25
Phase

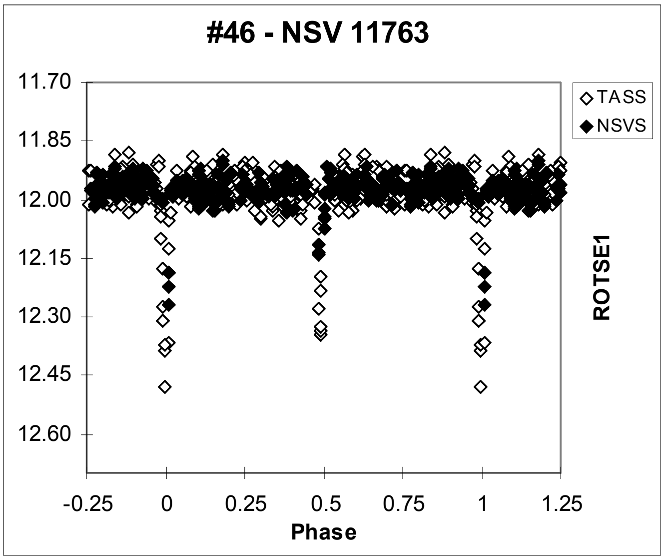

#41 - SAO 227397
ASAS-3
9.10
9.15
9.20
9.25
9.30
9.35
9.40
9.45
9.50
-0.25
0
0.25
0.5
0.75
1
1.25
Phase
V

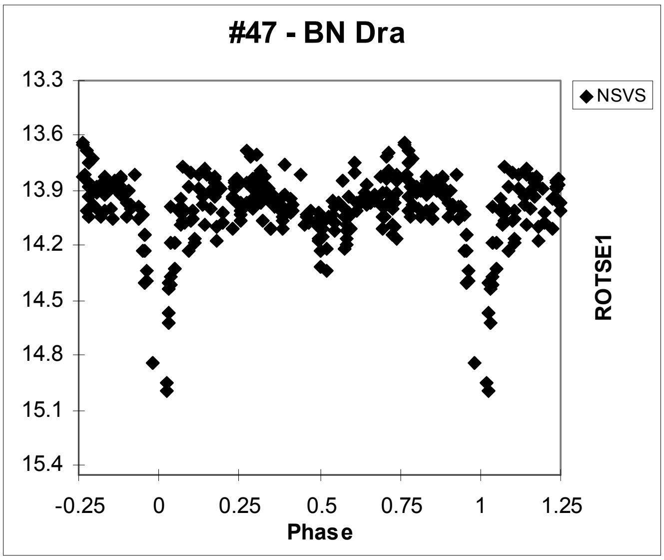

#42 - V1090 Sco
HIP
ASAS-3
8.23
8.28
8.33
8.38
8.43
8.48
8.53
-0.25
0
0.25
0.5
0.75
1
1.25
Phase
V

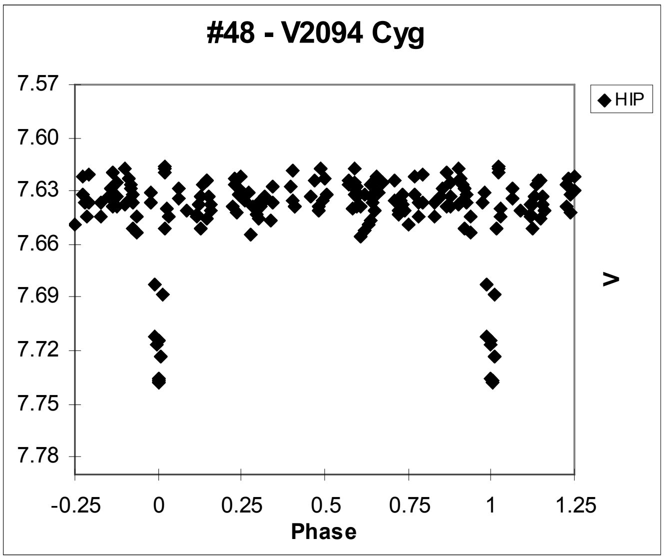

#43 - HD 165246
ASAS-3
7.65
7.68
7.71
7.74
7.77
7.80
7.83
-0.25
0
0.25
0.5
0.75
1
1.25
Phase
V

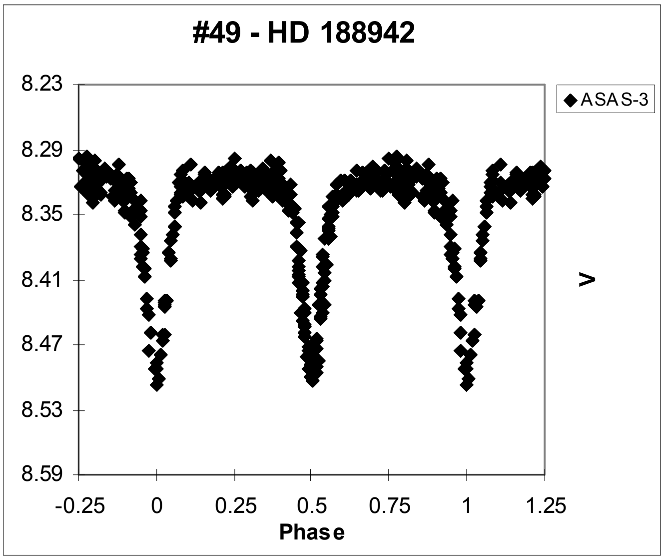

#44 - NSV 10625
ASAS-3
13.2
13.4
13.6
13.8
14.0
14.2
14.4
14.6
14.8
-0.25
0
0.25
0.5
0.75
1
1.25
Phase
V

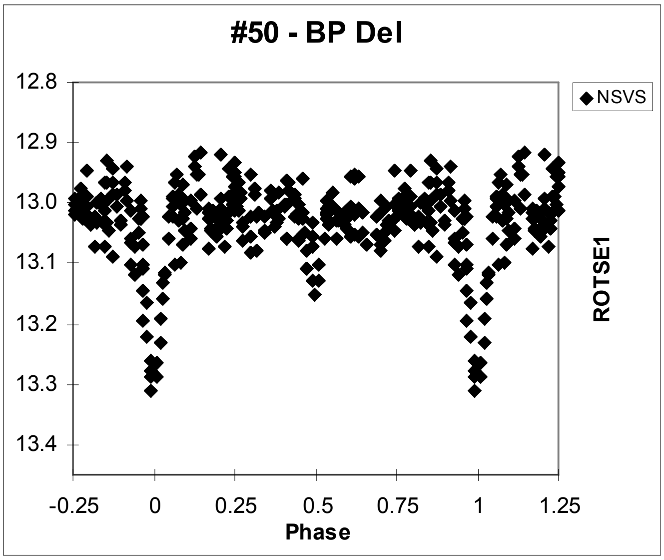

#45 - NSV 24598
HIP
7.13
7.16
7.19
7.22
7.25
7.28
7.31
-0.25
0
0.25
0.5
0.75
1
1.25
Phase
V

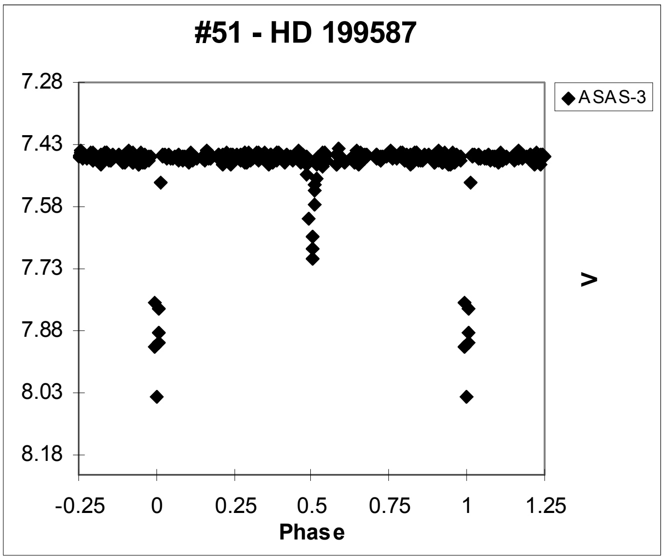

#46 - NSV 11763
TASS
NSVS
11.70
11.85
12.00
12.15
12.30
12.45
12.60
-0.25
0
0.25
0.5
0.75
1
1.25
Phase
ROTSE1

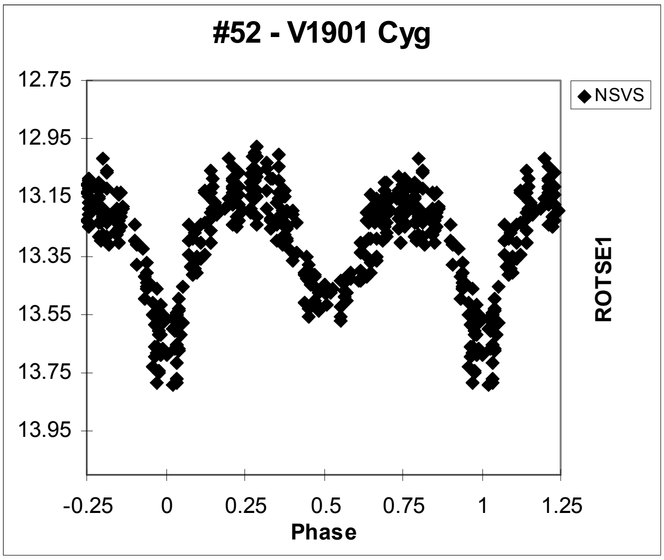

#47 - BN Dra
NSVS
ROTSE1
Phase
13.3
13.6
13.9
14.2
14.5
14.8
15.1
15.4
-0.25
0
0.25
0.5
0.75
1
1.25

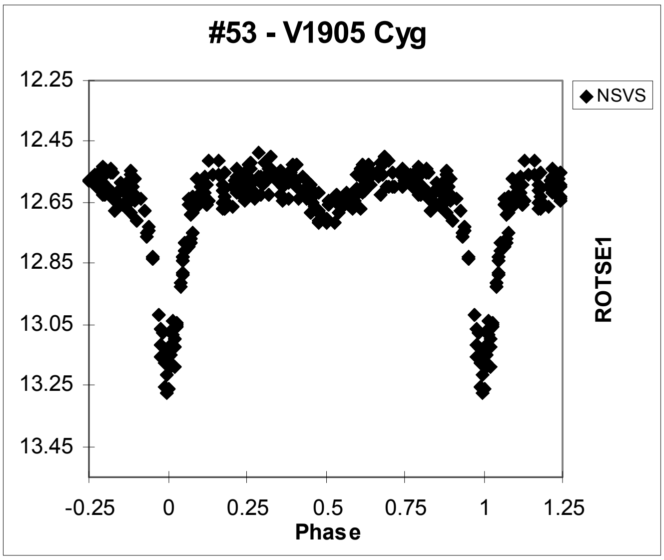

#48 - V2094 Cyg
HIP
V
Phase
7.57
7.60
7.63
7.66
7.69
7.72
7.75
7.78
-0.25
0
0.25
0.5
0.75
1
1.25

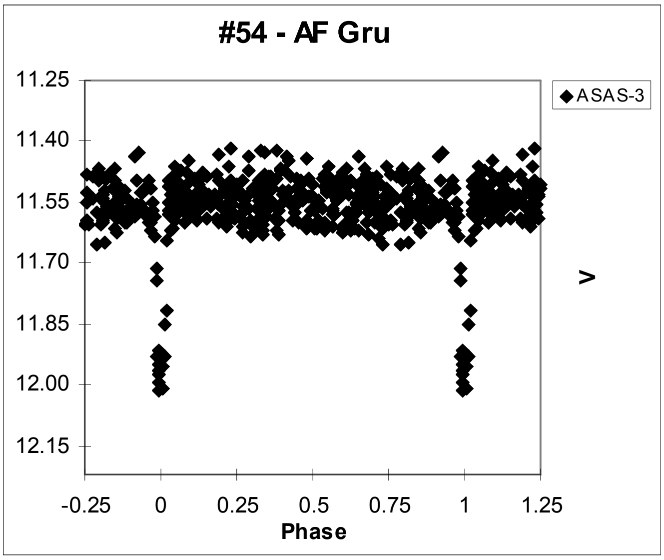

#49 - HD 188942
ASAS-3
V
Phase
8.23
8.29
8.35
8.41
8.47
8.53
8.59
-0.25
0
0.25
0.5
0.75
1
1.25


#50 - BP Del
NSVS
ROTSE1
Phase
12.8
12.9
13.0
13.1
13.2
13.3
13.4
-0.25
0
0.25
0.5
0.75
1
1.25


#51 - HD 199587
ASAS-3
V
Phase
7.28
7.43
7.58
7.73
7.88
8.03
8.18
-0.25
0
0.25
0.5
0.75
1
1.25


#52 - V1901 Cyg
NSVS
ROTSE1
Phase
12.75
12.95
13.15
13.35
13.55
13.75
13.95
-0.25
0
0.25
0.5
0.75
1
1.25





Notes for individual stars:

#1 – Classified as ISA in the GCVS with a range 12.0 - 13.6 p.
#2 – Period might be twice the value given with similar minima.
#4 – It might be ELL-type. Also small amplitude intrinsic variable. Known spectroscopic binary with a period of 193.79 d. **(Luyten, 1936)**. Classified as a variable with a period of 97.5 d. in the Hipparcos Catalogue **(Perryman et al., 1997)**. Classified as LB: in the GCVS.
#5 – Eccentric system. It might be a small amplitude (V= 6.68 - 6.69) ACV star with a possible period of 3.5473 d. More accurate observations are needed.
#7 – In M45 field. Non-member according to **Pearce and Hill (1975)**. Eccentric system. Lack of observations at mid-eclipses. Primary eclipse might be the secondary.
#9 – Eccentric system. No observations at mid-eclipse.
#10 – Classified as EB: in the GCVS that quotes a spectroscopic period of 66.75 days and a V range from 8.06 to 8.12. Visual companion, mag. 11.4 Hp, sep. 1".2 **(Perryman et al., 1997)**.
#11 – Wrong period of 2.09516 days in **Koen and Eyer (2002)**.
#12 – Period might be twice or half the value given.
#13 – Wrong period of 1.67062 days in **Koen and Eyer (2002)**.
#14 – NGC 2343 cluster non-member **(Claria, 1972)**. Visual companion at 2".6 **(Worley et al., 1997)**.
#15 – 0.02 mag. reflection effect. In open cluster NGC 2362.
#16 – Known spectroscopic binary with a period of 257.8 d. **(Wilson, 1918)**. Also a small amplitude intrinsic variable. Classified as a variable with a period of 130.5 d. in the Hipparcos Catalogue **(Perryman et al., 1997)**. Classified as ELL: in the GCVS.
#18 – Eclipses at quiescence have an amplitude of 0.06 mag. (V= 8.94 - 9.00) Mean magnitude variations due to the BE-type variability have been subtracted for the eclipsing plot. See Fig. 55 for the long-term variations. V= 8.83 is the Be outburst maximum. Primary eclipse might be the secondary.

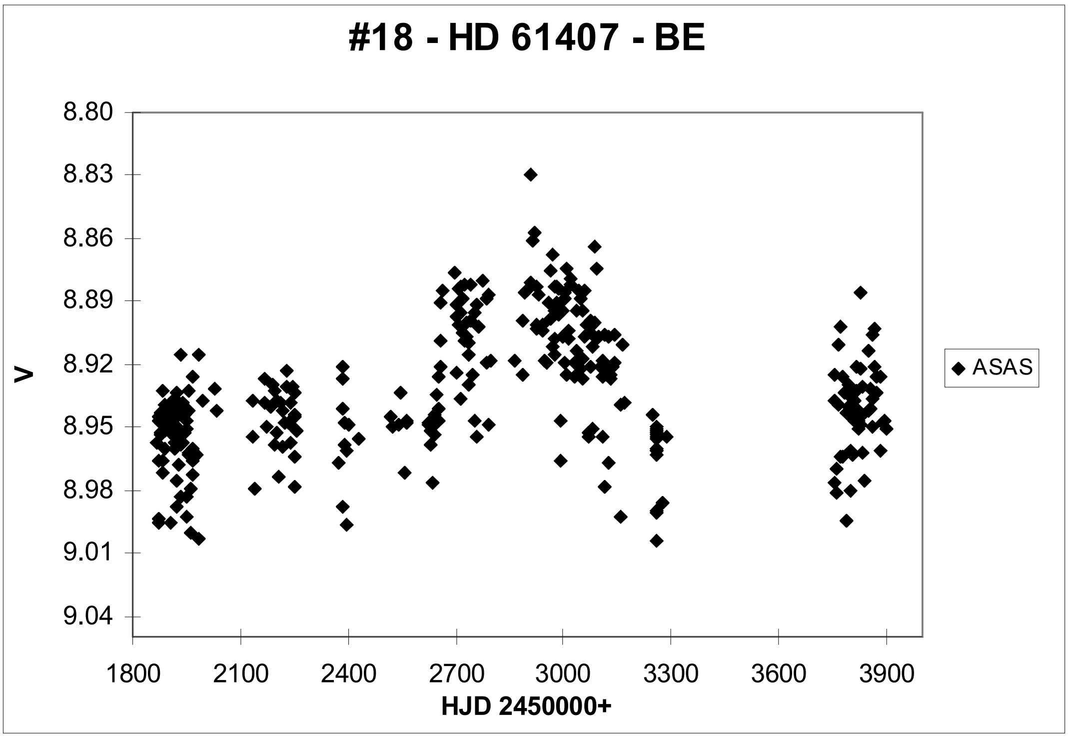


Figure 55: Light curve of HD 61407 showing its BE variability. Faint data points below the mean magnitude level correspond to eclipses. ASAS-3 data used.

#19 – Classified as EA with a period of 22.242 d. or a multiple in the GCVS.
#20 – Classified as ED/ESD with a wrong period of 1.366620 d. in the ASAS catalogue.
#22 – Also E: (0.06 mag.) in the NSV catalogue. Known spectroscopic binary with a period of 89.0653 d. **(Carquillat et al., 1983)**. Scatter at maximum may be due to chromospheric activity.
#23 – Light curve similar to V3903 Sgr (See note on #42 and Fig. 57).
#24 – Classified as EW with a period of 0.6973125 d. in the GCVS. The right period was published in the ASAS and Hipparcos catalogues and also in **Dvorak (2004)**. Combination of ASAS-3 and Hipparcos data shows that this system shows apsidal motion (See Fig. 56). The period given is for Min I. Min II period is 2.318557(4) d. Times of minimum II are: Hipparcos = HJD 2448446.368(4); ASAS = HJD 2453827.739(4) (2321 orbital cycles after Hip's ToM).

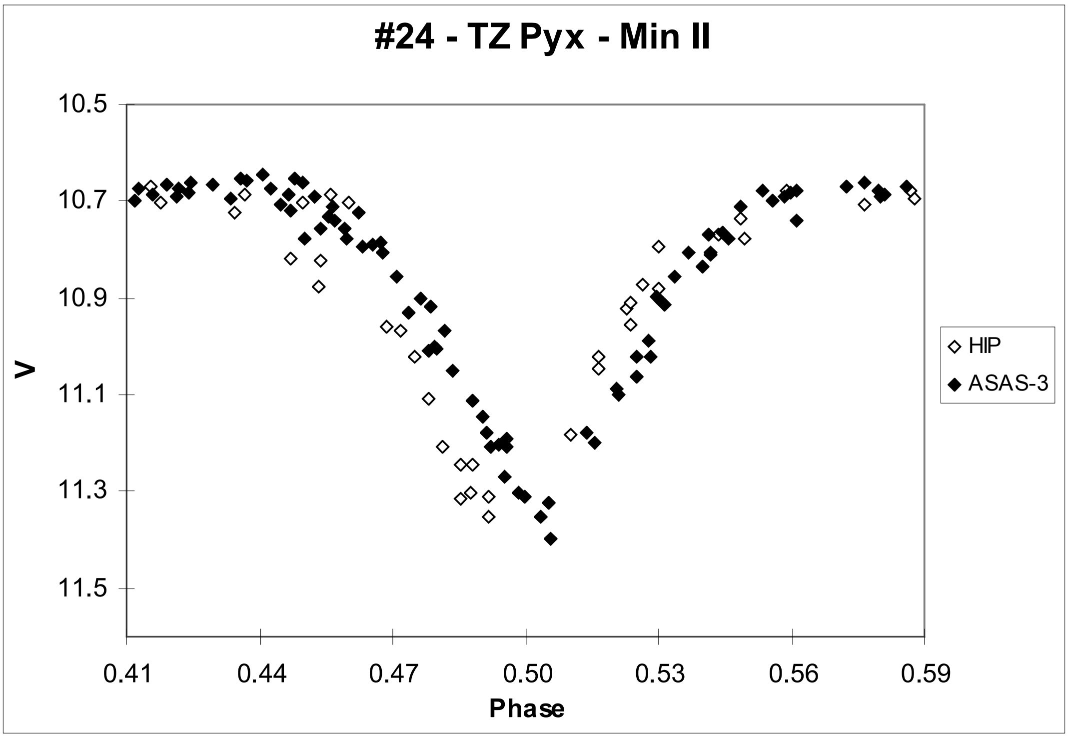


Figure 56: Min II light curve of TZ Pyx showing ASAS-3 and Hipparcos observations folded with the primary eclipse period of 2.318546 d. The phase shift of Min II between Hipparcos (1989-1993) and ASAS (2000-2006) datasets is evident.

#28 – It might be EB-type.
#30 – In Collinder 240.
#31 – Also intrinsic variable?
#32 – Period of 2.084 d. in **Balona (1992)**. Uncertain period of 2.0842 d. in **Mayer et al. (1992)**. Times of minima from Balona and Mayer et al. included in the light curve. Primary minima is the same as in those papers but it may actually be min II. Quadruple system. A= 7.10; B= 7.42; C= 10.30 Hp. Sep: AB= 0"37. AC= 1".64. **(Perryman et al., 1997)**. A fourth component of mag. 12.0 at 9".6 **(Dommanget and Nys, 2002)**.
#33 – Spectroscopic period of 2.7045 d. in the SB9 catalogue **(Pourbaix et al., 2004)**.
#35 – Total eclipses.
#36 – Visual 11th mag. companion at 17".9 **(Dommanget and Nys, 2002)**. A is the eclipsing binary with a spectroscopic period of 2.4439 d. in **Mayor and Mazeh (1987)**.
#37 – Eccentric system. Lambda Bootis star **(Paunzen et al., 2001)**.
#38 – Eccentric system. Primary eclipse might be the secondary.
#39 – Only one data point suggests a secondary eclipse at phase 0.65.
#40 – Uncertain period of 5.030460 d. in the GCVS.
#41 – In open cluster NGC 6231.
Confusion in the literature regarding its identification.
The star was wrongly denoted as HD 152291 (which is a degree North) on chart 196 of the HDE **(Braes, 1968)**.
The name CD-41 11051 was wrongly assigned in SIMBAD to the 10.6-mag. star HD 326319 (A0) = GSC 7876-2096 = LS 19583 = NGC 6231 769 at 16 54 31.139 -41 38 40.71 (J2000.0) (UCAC2 position). Relative magnitudes of nearby CD stars are consistent with the above identification **(Skiff, 2007)**.
García and Mermilliod (2001) say that the star is a B0.5V spectroscopic binary but wrongly identifies it as NGC 6231 769 (which is HD 326319). They took the cluster numbers from **Raboud et al. (1997)**.
Identification chart in **Raboud et al. (1997)** in fact wrongly labels the star as NGC 6231 769 but even this wrong entry is completely missing from their electronic table because the NGC 6231 769 name corresponding to the Seggewiss numbering system **(Seggewiss, 1968)** is confused with the name *Cl NGC 6231 SBL 769 from the numbering system in **Sung et al. (1998)** belonging to the star HD 326334 (NGC 6231 169) which is then listed twice, first as Cl* NGC 6231 SBL 769 (O9V; V= 9.20, the magnitude for the new eclipser) at 16 54 53.40 -41 47 07.8 (J2000.0) and then as NGC 6231 169 (its true identification, B2-3V; V= 10.73) at the same position.
Correct cross-IDs for the new eclipsing binary are: CPD-41 7746 = CD-41 11051 = SAO 227397 = PPM 322367 = GSC 7876-2235 = LS 16066. The star has no cluster designation and no HD number due to all the above confusions.

ASAS V-magnitudes are contaminated by HD 326319 and its light has been subtracted using the GCPD **(Mermilliod et al., 1997)** published V-magnitude of the eclipsing binary at maximum as a reference.
#42 – EA showing large proximity effect like V3903 Sgr, a massive detached O-type binary (Vaz et al., 1997). A light curve of V3903 Sgr is shown in Fig. 57 folded with a period of 1.744194(2) days, determined from Hipparcos and ASAS-3 data. Similar irregularities at maximum are seen in both systems. Fig. 58 is a larger version of Fig. 42 for comparison between both systems.

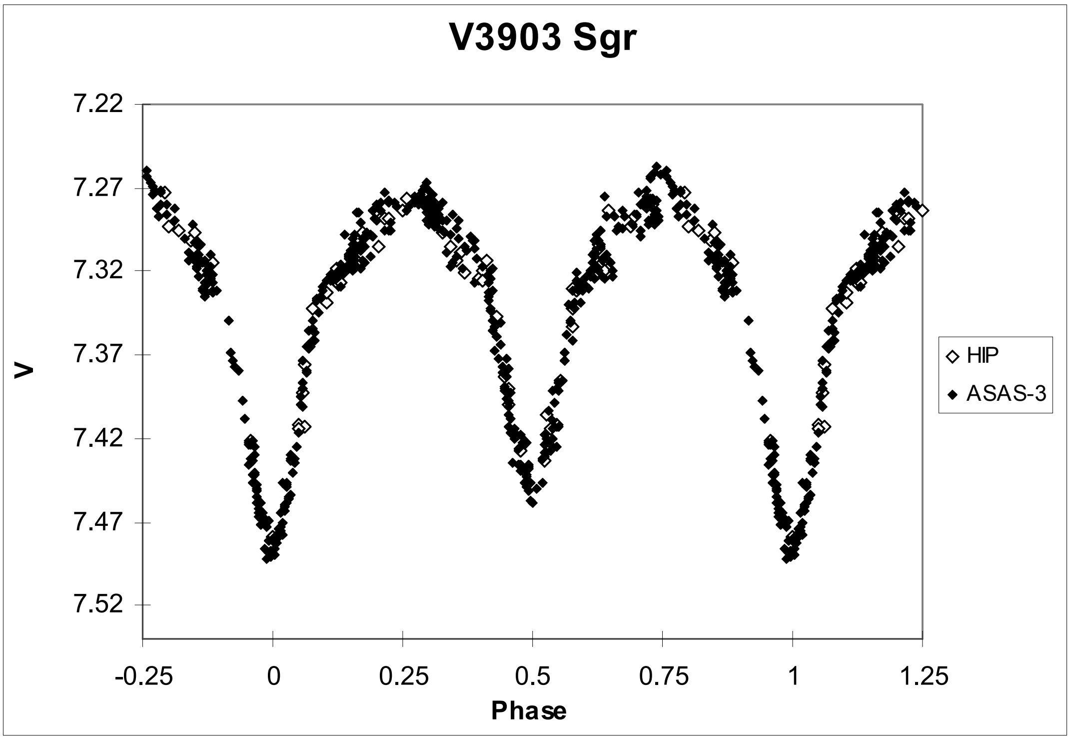


Figure 57: Light curve of V3903 Sgr, a detached massive binary. This type of light curve is seen in stars #23 (HD 73699) and #42 (V1090 Sco).

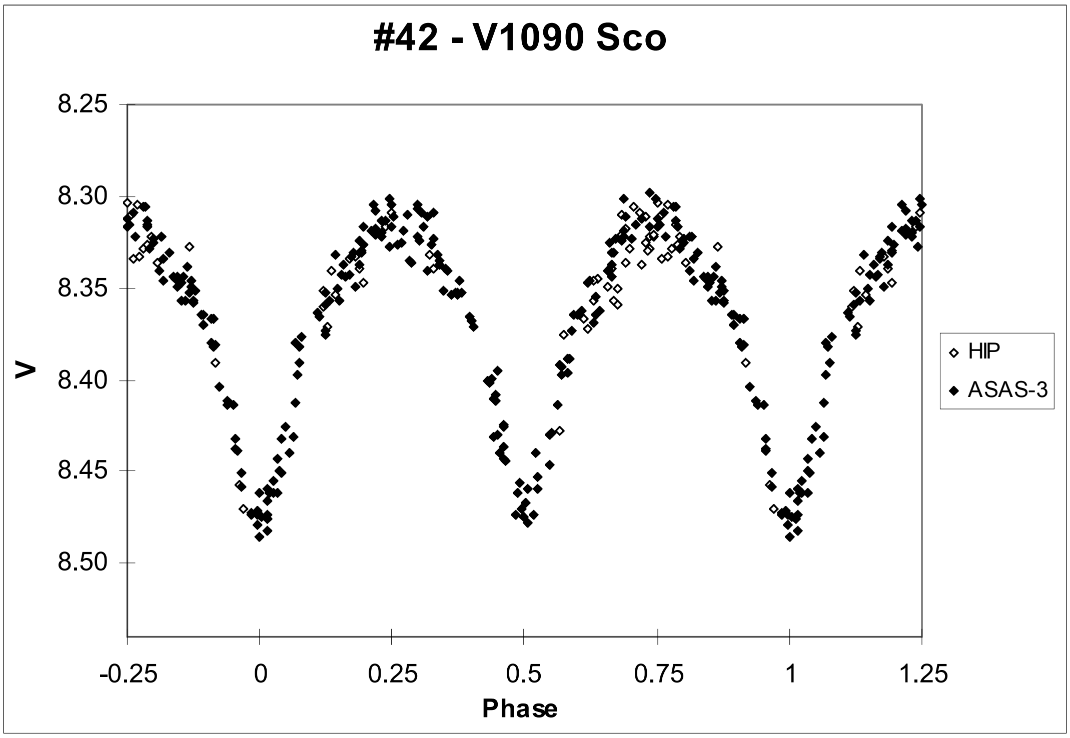


Figure 58: Light curve of V1090 Sco, a B-type binary showing a similar light curve to V3903 Sgr. This type of EW-like light curve is not unusual among detached systems with early type components of similar luminosity.

#43 – Visual companion, mag. 11.2, sep. 1".9 **(Worley et al., 1997)**.
#44 – Period might be twice the value given.
#45 – Visual binary. A= 7.37; B= 10.16 Hp, sep. 0".34. A is the eclipsing binary with a known spectroscopic period of 4.2435 d. **(Tanner, 1949)**.
#46 – Slightly eccentric system. TASS **(Droege, 2003)** Ic data combined and shifted to the ROTSE1 magnitude scale.
#47 – Classified as EA/SD with a period of 5.93015 d in the GCVS.
#48 – ACV-type in the GCVS based on the Hipparcos catalogue. ACV-variability with a possible period of 9.51 d. is not excluded. Spectroscopic period of 8.480322 d. in **Carrier et al. (2002)**.
#50 – ASAS data could not be used due to light contamination problems. NSVS amplitude is strongly reduced by light from GSC 1642-1863. Classified as EA/SD: in the GCVS with an uncertain period of 2 d.
#51 – Luminosity class from **Nordström et al. (2004)**.
#53 – Classified as IS: in the GCVS with a range 14.0 - 16.3 p.

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