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NEW ECLIPSING BINARIES FOUND IN THE NSVS DATABASE I.

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The variability of the stars listed in this study was found in the public data release from the Northern Sky Variablity Survey (NSVS; Wozniak et al., 2004). Using the SQL interface available from the Skydot website (`http://skydot.lanl.gov/nsvs/nsvs.php`), stars were selected on the basis of a number of statistical criteria. The stars needed to have at least 100 data points, and a significantly larger standard deviation compared to the average value for their magnitude. It was also required that the mean of squared successive magnitude differences for a star was larger than about 30% of the standard deviation, thus excluding long period variables. Finally, the skewness calculated from a star's magnitudes had to be positive, favouring stars spending more time at maximum than at minimum. Standard flagged data and data with the APINCOMPL mask set (Wozniak et al., 2004) were not taken into account during these calculations. Because of obvious limitations of the available data, this study does not claim to give an exhaustive list of eclipsing binaries in the areas searched. Most of the stars in the current paper were in fact found during a search for Cepheids along the Northern Milky Way (Wils and Greaves, 2004).

ASAS-3 (Pojmanski, 2002) and NSVS data have been combined to prepare this first list with elements for 100 new eclipsing binaries.

The method of bisected chords was used to determine times of minima. The accuracy depends on the quantity and quality of the observations. Elements were found with AVE (Barberá, 1999) and a Microsoft Excel period search utility.

Unfiltered NSVS ROTSE1 magnitudes were shifted to match the ASAS-3 V magnitude of the stars. In all cases but one (GSC 4835 1947) the amplitude of the eclipses were the same for both datasets so the combination was successful. For stars North of +28 degrees, where no ASAS observations exist, the original ROTSE1 magnitudes are given.

Table 1 shows the list of variables. The first column gives the GSC designation. The following columns give another identifier; the brightness range of the variable (V = ASAS-3 V magnitudes; *= ROTSE1 magnitudes), with the magnitude of secondary eclipse between brackets; the epoch of minimum light derived from all the data available; the period; the variability class and the spectral type with a note to the spectral type source.

Star Name		Magnitude range	Epoch	Period	Type	Spectral type
GSC ID	Other ID		(HJD2440000+)	(days)		
0140 0964	AC 0043437	11.92– 12.8 (12.65)V	11525.891	0.298305	EW/KW	
0140 1869	AC 0042265	12.89– 13.6 (13.6)V	11508.815	1.45065	EA	
0143 0226*	HD 252984	10.13– 10.73(10.63)V	12946.750	4.21618	EA	A0 (33)
0145 2357	AC 0257934	12.28– 12.83(12.80)V	11498.710	10.0209	EA	
0155 1091	HD 261744	10.89– 11.41(11.39)V	12714.509	2.95379	EA	F8 (33)
0155 2294	HD 261717	10.35– 10.67(10.63)V	11566.624	1.85270	EA	A0V (51)
0158 0541	HD 260764	10.62– 11.15:(10.82)V	11604.760	3.06895	EA	A2 (33)
0159 0812	HD 261685	11.27– 11.72(11.44)V	12521.868	2.88420	EA	A (33)
0159 1018	HD 261449	10.31– 10.59(10.57)V	11549.733	1.41626	EA	F8 (33)
0160 1934	HD 264769	10.85– 11.17(11.15)V	11465.840	2.13583	EA	B (33)
0170 1717*	AC 0063381	10.90– 11.17(11.16)V	11522.719	0.361883	EW	
0410 2795	AC 0345491	10.89– 11.49(11.12)V	12775.769	0.490383	EB	
0437 0438	AC 0151782	12.54– 13.37(13.32)V	12760.797	2.14220	EA	
0441 0916	AC 0151695	12.75– 14.0 (12.77:)V	11450.710	3.3749	EA	
0448 0415*		12.41– 13.2 (13.2)V	12725.340	99.4022	EA	
0469 0914		12.45– 12.95 (12.8)V	12196.500	72.35	EB	
0471 0860*	AC 0157271	10.87– 11.28(11.23)V	11320.786	0.345897	EW	
0473 3466	AC 0160195	11.93– 12.6:(12.5:)V	12853.755	2.1085	EA	
0485 0658		13.15– 13.7 (13.7)V	11420.616	0.290570	EW/KW	
0493 0801	BD+6 4353	10.42– 11.30(10.62)V	12524.606	0.986783	EA	
0613 1099	AC 0208368	11.35– 12.00(11.95)V	12873.909	0.336338	EW	
0646 0946	BD+13 453	10.28– 10.55(10.54)V	11382.902	0.282336	EW/KW	
0684 1316*	SAO 112139	10.32– 10.55(10.53)V	11594.630	0.377198	EW/KW	K0 (24)
0714 0096	BD+9 932	10.40– 10.84(10.62)V	12751.489	0.498858	EB	F0 (33)
0723 0980	HD 247317	9.97 – 10.42(10.31)V	11567.838	1.78018	EA	F2 (33)
0724 0973	AC 0479701	12.10– 12.77(12.35)V	11504.970	9.7857	EA	
0748 0686*	HD 267307	10.87– 11.50(11.38)V	12714.524	2.087092	EA	A5,A2 (53)
0748 2137	AC 0269265	11.56– 12.63 (11.7)V	12995.698	1.62398	EA	
0748 2423	HD 266430	9.63 – 9.97 (9.93)V	12761.545	4.00951	EA	A0 (33)
1040 0399	HD 178215	10.34– 11.00(10.48)V	11332.759	1.27428	EA	A0 (33)
1042 2191	HD 182314	9.14 – 9.49 (9.45)V	12812.702	0.423796	EW:	F5 (24)
1045 0882	HD 180244	10.34– 10.92(10.8:)V	11475.666	6.8855	EA	A2 (33)
1045 1028	AC 0386762	11.46– 12.2:(12.10)V	12403.733	0.3348417	EW	
1077 0828	HD 192169	8.78 – 9.34 (9.30)V	12879.640	1.705523	EA	F8 (24)
1113 0877	BD+12 4581	9.15 – 9.35 (9.28)V	12816.827	0.486707	EB	F0 (28)
1294 1710*	HD 285166	10.86– 11.48(11.37)V	12645.558	12.8075	EA	F8 (9)
1305 1430	AC 0654855	10.90– 11.20(11.20)V	11467.823	0.2955252	EW/KW	
1318 0042	ALS 25	11.12– 11.48 (11.4)V	12970.180	13.6435	EB	OBe (34)(25)
1322 0294	AC 0672161	11.03– 11.65(11.64)V	11521.695	0.287842	EW/KW	
1335 1907*	HD 265879	10.77– 11.20(11.06)V	11548.730	3.47041	EA	A5 (33)
1577 0974*	HD 348698	11.45– 12.05(12.01)V	11442.689	7.14615	EA	G0 (9)
1578 0728	HD 348901	10.60– 10.92(10.98)V	11403.882	4.59618	EA	F2 (9)
1582 0100	AC 0765199	11.46– 12.16(11.84)V	12747.884	5.5598	EA	
1588 0632*		12.80–13.84:(13.53:)V	11362.705	1.41924	EA	
1588 1802		12.38– 13.08(12.68)V	13130.770	7.6706	EA:	
1594 1043	HD 349787	10.84– 11.27(11.22)V	12724.899	2.11434	EA	G0 (9)
1619 0051	HD 350416	10.46– 10.76(10.65)V	11414.728	2.30593	EB	B8 (9)
1620 0599*	HD 354081	10.03– 10.32(10.22)V	11454.669	1.37599	EB	F2 (9)
1624 0493*	HD 350731	9.53 – 9.97 (9.93)V	12830.816	1.63514	EA	B9 (9)
1639 1340*	HD 352143	10.48– 10.77(10.71)V	11322.917	0.911325	EW:	F2 (9)
1641 1245	AC 0808903	11.89– 12.75(12.35)V	12879.688	7.2432	EA	
1643 1880	AC 0803127	12.44– 13.0:(12.6:)V	11332.770	0.73574	EA	
1761 1934	AC 0870736	10.38– 11.02(10.98)V	11525.671	0.299376	EW/KW	
1836 0131*		12.60– 14.5:(13.1:)V	11531.669	6.9098	EA	
1913 1513	AC 0926226	10.93– 11.33(11.07)V	11515.678	0.491507	EB/KW	
2157 0387*	HD 346723	10.39– 11.03(10.60)V	11467.654	1.551913	EB:	A0 (9)
2385 0341	HD 279999	10.11– 10.75(10.7:)*	11603.766	0.990715	EA	F0 (9)
2407 0767	HD 244128	10.75– 11.07(10.85:)*	11514.840	1.6192	EA	B5 (33)

Star Name		Magnitude range	Epoch	Period	Type	Spectral type
GSC ID	Other ID		(HJD2440000+)	(days)		
2409 0101	AC 0897066	12.95– 13.9:(13.25)*	11537.633	0.99282	EA	
2685 1186	HD 332325	11.37– 11.93(11.92)*	11358.748	0.62279	EW	F5 (9)
2695 1848	AC 1265359	12.21– 12.81(12.76)*	11325.791	0.93536	EA	
2704 1999*	BD+30 4459	10.70– 11.00(10.92)*	11341.764	0.610855	EB	
2711 0645*	AC 1270603	12.20– 12.61(12.59)*	11537.610	0.506738	EW	
2846 0404*	AC 1301247	10.71– 11.04(11.01)*	11494.882	0.387374	EW/KW	K0IV (50)
2863 0755	HD 275743	10.55– 10.82(10.70)*	11613.738	3.2554	EA	G5 (9)
2933 1972	AC 1448061	12.90– 13.65(13.65)*	11274.691	0.50488	EA	
3171 0761*		11.92– 12.62(12.31)*	11371.150	39.6	EB/GS:	
3181 0654*	ALS 11810	10.56– 11.1:(11.1:)*	11338.750	47.615	EA	OB (43)
3252 0981*	BD+47 116	9.89 – 10.10 (10.05)*	11542.625	20.30	EB/GS:	
3314 0544*	BD+47 768	10.73– 11.25(11.21)*	11466.660	12.807	EA	
3319 0399		12.00– 12.55(12.05)*	11612.520	24.146	EA	
3429 0424*	AC 1604650	11.00– 11.80(11.70)*	11563.948	0.473522	EW	
3493 1324*	AC 1618923	11.10–11.45:(11.45:)*	11277.840	7.654	EA	
3574 1420*	BD+44 3531	10.28– 10.48(10.44)*	11421.720	22.425	EB/GS:	
3581 1856	AC 1647164	10.87– 11.27(11.21)*	11448.682	0.2785137	EW/KW	G5-8V (41)
3626 0107*	AC 1680379	10.40– 10.7:(10.6:)*	11401.100	19.9615	EA/GS:	
3633 2139*	AC 1677493	10.30–10.83:(10.69:)*	11441.210	17.915	EA/GS:	
3708 1325*	BD+56 704	10.92– 11.5:(11.38)*	11421.719	3.0240	EA	OB (43)
3712 1820	Lanning 54	11.15– 11.49(11.47)*	11421.708	0.960968	EW/KE	B5(V) (18)
3900 0615*	HD 238692	10.39– 11.09(10.70)*	11403.845	0.533529	EB	F3IV (49)
3950 0275	AC 1647107	10.75– 11.00(10.98)*	11461.908	0.242324	EW	
4021 0238*	ALS 6464	11.30– 11.80(11.73)*	11349.919	0.457606	EW/KE:	B2 (28)
4276 0398*	ALS 12480	10.76– 10.98(10.87)*	11364.751	3.8053	EA	OBe (25)
4280 1816*	ALS 13003	11.20– 11.48(11.48)*	11462.625	1.94145	EA/KE	OB (43)
4286 0049*	BD+64 1740	10.62– 10.92(10.86)*	11295.837	1.85197	EA	
4296 0222	BD+67 97	9.95 – 10.15(10.14)*	11608.823	13.651	EA	
4297 1664*		11.85– 12.39(12.28)*	11473.568	4.159	EA	
4338 0429	BD+72 167	9.78 – 10.25(10.22:)*	11602.607	3.4572	EA	
4339 0250*		12.45– 13.01(13.01)*	11421.782	0.84040	EA	
4420 1984	AC 2045693	11.55–12.15 (12.12)*	11356.754	0.61927	EW	
4421 1217	AC 2047724	12.11– 12.89(12.75)*	11318.723	0.3472223	EW	
4436 1300*	AC 2053572	11.77– 12.12(12.07)*	11338.851	0.457033	EB/KE	
4527 0161	AC 1991853	10.94– 11.22(11.21)*	11525.793	0.619753	EA/RS:	
4614 1442*	AC 2102233	11.08– 12.00(11.34)*	11356.739	1.54912	EA/RS	
4650 1055*	AC 2093265	11.78– 12.28(12.23)*	12856.842	0.328692	EW	
4822 2853*	HD 052433	8.30 – 8.55 (8.52)V	12625.800	5.95575	EA	B9 (24)
4835 1947*	BD−2 2221	9.05:– 9.70:(9.48:)V	13057.664	0.637705	EB	A5 (28)
4854 0362*	HD 067093	8.84 – 9.18 (9.18)V	11927.725	4.33593	EA	A3/5mA7-F0 (5)
4902 1190*	BD−4 2739	9.96 – 10.50(10.46)V	12705.725	1.43916	EA	
5146 0728*	PPM 708078	10.16– 10.33(10.30)V	12437.759	0.523673	EB/KE:	

Sources of spectral type: (5) Houk and Swift, 1999. (9) Nesterov et al., 1995. (17) Buscombe, 1998. (18) Buscombe, 1999. (24) Ochsenbein, 1980. (25) Wackerling, 1970. (28) Kharchenko, 2001. (33) Cannon and Pickering, 1993. (34) Stephenson and Sanduleak, 1971. (41) Motch et al., 1997. (43) Hardorp et al., 1959-1965. (49) Bartaya, 1983. (50) Li and Hu, 1998. (51) Voroshilov et al., 1985. (53) Schmidt and Carruthers, 1993.

Notes on individual stars:

GSC 0143 0226 = Eccentric system. Visual companion (9.8 Vt; sp. K5)(Wright et al., 2003) at 5.″0 (Worley and Douglass, 1997)
GSC 0170 1717 = Slight O'Connell effect.
GSC 0448 0415 = Primary eclipse might be the secondary.
GSC 0471 0860 = Slight O'Connell effect.
GSC 0684 1316 = Changing O'Connell effect.
GSC 0748 0686 = Spectrum is for a blend (Schmidt and Carruthers, 1993). Spectrum G5

in Cannon and Pickering (1993) is not consistent with 2MASS and Tycho-2 colors.
GSC 1294 1710 = Eccentric system.
GSC 1335 1907 = Eccentric system.
GSC 1577 0974 = Eccentric system.
GSC 1588 0632 = Slightly eccentric.
GSC 1620 0599 = Visual binary. $A = 10\overset{m}{.}7$; $B = 10\overset{m}{.}9$ Vt. Sep. $0''.57$ (Fabricius et al., 2002).
GSC 1624 0493 = Eccentric system.
GSC 1639 1340 = Might be EB-type.
GSC 1836 0131 = Slightly eccentric system.
GSC 2157 0387 = Might be EA-type.
GSC 2704 1999 = O'Connell effect.
GSC 2711 0645 = O'Connell effect.
GSC 2846 0404 = Very strong O'Connell effect. Max II= 10.82. Possible T Tauri star (Li and Hu, 1998).
GSC 3171 0761 = H-alpha star (Kohoutek et al., 1997) and infrared source (Egan et al., 2003).
GSC 3181 0654 = Eccentric system. Primary eclipse might be the secondary.
GSC 3252 0981 = Visual binary. $A = 10\overset{m}{.}7$; $B = 11\overset{m}{.}2$ Vt. Sep. $0''.66$ (Fabricius et al., 2002). Tycho-2 $B - V$ for the combined light is $1\overset{m}{.}08$ (Hog et al., 2000).
GSC 3314 0544 = Eccentric system.
GSC 3429 0424 = Slight O'Connell effect.
GSC 3493 1324 = Slightly eccentric system.
GSC 3574 1420 = $B - V$ from Tycho-2= $0\overset{m}{.}98$.
GSC 3626 0107 = $B - V$ from Tycho-2= $1\overset{m}{.}26$.
GSC 3633 2139 = $B - V$ from Tycho-2= $1\overset{m}{.}42$.
GSC 3708 1325 = Eccentric system.
GSC 3900 0615 = O'Connell effect. Max. II= 10.43.
GSC 4021 0238 = Might be EB/KE.
GSC 4276 0398 = Also possibly BE or WR-type.
GSC 4280 1816 = Primary eclipse might be the secondary.
GSC 4286 0049 = Eccentric system.
GSC 4297 1664 = Slightly eccentric system.
GSC 4339 0250 = Primary eclipse might be the secondary.
GSC 4436 1300 = O'Connell effect.
GSC 4614 1442 = RS period = orbital period.
GSC 4650 1055 = Slight O'Connell effect. Max. II= 11.81.
GSC 4822 2853 = Eccentric system.
GSC 4835 1947 = Data contaminated by nearby GSC 4835 2059. ASAS-3 data used is that of the smaller aperture reduction. NSVS amplitude reduced by the light contamination.
GSC 4854 0362 = Wils and Dvorak (2003) give a period of 2.16780 d. and suggest the real period might be double.
GSC 4902 1190 = Wils and Dvorak (2003) give a period of 0.71958 d. and suggest the real period might be double.
GSC 5146 0728 = Might be EW/KE.

Figure 1. Light curve of GSC 0143 0226 showing NSVS and ASAS-3 observations.

Figure 2. Light curve of GSC 0684 1316 showing NSVS and ASAS-3 observations.

Figure 3. Light curve of GSC 0714 0096 showing NSVS and ASAS-3 observations.

Figure 4. Light curve of GSC 2846 0404 showing NSVS observations.

Figure 5. Light curve of GSC 4614 1442 showing NSVS observations.

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ERRATUM FOR IBVS 5570

In the list of new eclipsers GSC 1294-1710 should be GSC 1294-0710.

S. Otero