OPEN EUROPEAN JOURNAL ON VARIABLE STARS
January 2009 http://var.astro.cz/oejv ISSN 1801-5964

Chromospherically active stars in the ASAS-3 database: Paper 1. 25 new variables

KLAUS BERNHARD [1,2], CLEMENS BERNHARD[1], MICHAEL BERNHARD[1]

1) A-4030 Linz, Austria; e-mail: klaus . bernhard@liwest . at
2) Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V. (BAV), Munsterdamm 90, D-12169 Berlin, Germany

BAV Mitteilungen Nr. 199

Abstract: 25 new chromospherically active stars are presented, which were found in the ASAS-3 database:
GSC 09500-00821, GSC 09390-00322, GSC 09473-00014, GSC 09486-00927, GSC 09356-01284, GSC 09384-01942, GSC 09411-01577, GSC 09442-01129, GSC 09444-02266, GSC 09288-00744, GSC 09235-01702, GSC 09214-00531, GSC 09338-02016, GSC 09275-02349, GSC 08906-00808, GSC 09034-00643, GSC 08923-01147, GSC 08950-00019, GSC 08933-01802, GSC 09014-00118, GSC 09031-04159, GSC 08983-00564, GSC 09010-04839, GSC 08870-00372, GSC 05275-00646

During a programme of optical identification of X-ray sources from the ROSAT All-Sky Bright Source Catalogue (1RXS) (Voges et al. 1999) in the ASAS3 database (Pojmanski, 2002) (http://www.astrouw.edu.pl/asas/?page=main) 25 new chromospherically active stars have been found. This research continues the search for new chromospherically active stars in the ROTSE-I database (Bernhard & Lloyd 2008).

The criteria for including a star in this list of chromospherically active stars were, i) the X-ray identification, ii) a suitable period after an analysis of the ASAS-3 data with Period 04 (Lenz and Breger 2005) and iii) appropriate B-V (Høg et al. 2000) and 2MASS J-K (Skrutskie et al. 2006, Table 8 in Gonzalez-Solares et al. 2008) colour indexes if available. Chromospherically active stars exhibit spectral types of F-K (these are mostly RS CVn systems, and a smaller number of FK Comae stars) and K-M (BY Dra variables). Partial information about LiI equivalents (Torres et al., 2006) is useful to identify young stellar objects among the variables.

Table 1: Positions, identifications and photometric data for the new chromospherically active stars

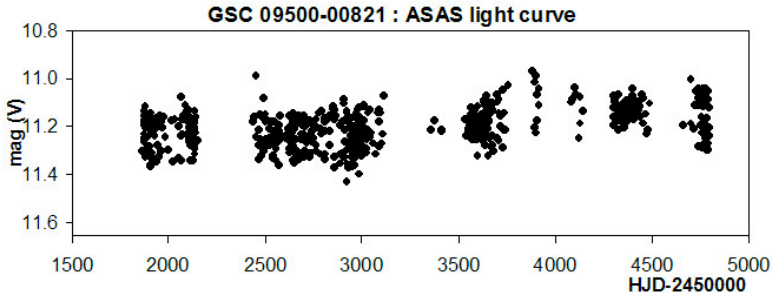
No.	GSC	RA (2000)	Dec	1RXS	Range(ASAS)	Epoch(Min)	Per.(d)
1	09500-00821	05 06 18.45	-86 41 44.6	J050623.6-864141	11.0-11.4	2131.74(7)	7.94026(6)
2	09390-00322	05 53 29.32	-81 56 53.1	J055327.9-815650	9.1-9.3	3983.85(1)	1.85769(4)
3	09473-00014	21 18 47.14	-81 45 17.9	J211839.2-814515	10.7-11.0	2069.69(2)	2.3028(3)
4	09486-00927	21 25 27.48	-81 38 27.6	J212529.0-813836	11.6-12.0	3866.840(5)	0.541945(2)
5	09356-01284	01 23 17.20	-79 41 32.3	J012326.1-794139	10.1-10.3	2895.676(3)	0.380781(2)
6	09384-01942	07 05 09.12	-78 25 17.8	J070510.2-782519	9.1-9.4	2221.6(8)	88.9(2)
7	09411-01577	11 25 47.95	-76 30 29.1	J112545.4-763035	9.0-9.2	3828.7(2)	21.608(9)
8	09442-01129	16 14 46.04	-76 01 49.9	J161444.0-760204	10.1-10.3	3802.81(9)	9.867(1)
9	09444-02266	17 23 29.60	-75 38 57.0	J172327.2-753852	12.1-12.4	2443.65(5)	5.6999(4)
10	09288-00744	17 18 47.55	-73 25 13.4	J171850.0-732527	9.5-9.8	4256.65(7)	7.145(1)
11	09235-01702	12 21 05.13	-71 16 49.3	J122107.9-711642	11.6-11.9	1981.69(6)	6.855(2)
12	09214-00531	10 03 56.12	-70 53 53.2	J100355.7-705406	11.9-12.3	2055.47(1)	1.58759(8)
13	09338-02016	23 21 52.50	-69 42 11.8	J232151.4-694211	9.8-10.0	2133.73(1)	1.8746(3)
14	09275-02349	17 05 42.53	-67 42 41.5	J170541.8-674211	12.4-12.7	3104.86(3)	3.69137(1)
15	08906-00808	06 23 10.75	-67 25 24.2	J062310.4-672532	9.5-9.7	4330.90(1)	1.098464(8)
16	09034-00643	15 26 49.19	-65 53 35.7	J152648.5-655341	9.6-9.8	3160.72(3)	3.8981(1)
17	08923-01147	07 54 08.84	-65 41 30.7	J075407.7-654137	10.5-11.2	1919.7(1)	15.270(9)
18	08950-00019	09 47 03.89	-65 35 05.0	J094704.4-653501	11.5-11.7	4180.77(3)	3.0561(4)
19	08933-01802	08 27 09.56	-65 04 42.6	J082709.9-650447	9.3-9.8	1908.70(4)	4.43723(7)
20	09014-00118	14 19 54.08	-64 38 17.5	J141952.6-643808	9.9-10.1	4352.5(6)	63.2(1)
21	09031-04159	15 59 58.01	-64 33 59.0	J155957.8-643350	9.3-9.6	4235.7(5)	54.76(8)
22	08983-00564	12 21 30.78	-64 03 52.7	J122125.6-640346	10.7-11.0	2703.74(6)	6.0746(3)
23	09010-04839	14 32 08.35	-63 42 14.5	J143208.7-634230	9.7-9.9	4150.8(5)	57.9(1)
24	08870-00372	03 31 48.87	-63 31 53.5	J033149.8-633155	10.7-11.0	1913.53(2)	2.7321(2)
25	05275-00646	01 01 45.32	-12 08 02.5	J010145.4-120751	10.0-10.4	4756.7(2)	28.48(1)

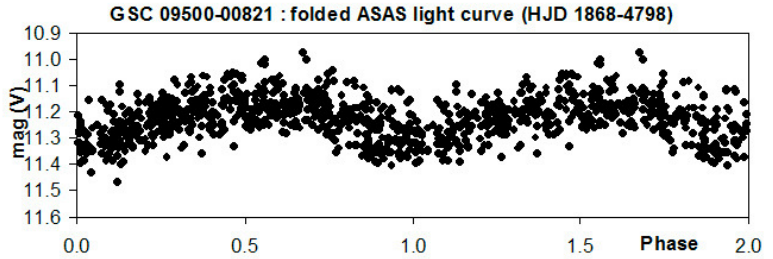
The ASAS-3 telescopes are situated at Las Campanas Observatory in Chile, V and I filters are used in combination with 200/2.8 lenses and AP-10 CCD cameras. The aperture suggested by the ASAS-3 system (first row of the ASAS data) was taken for the calculations of the ephemeris and the figures. Figures in brackets denote errors (sigma) in units of the last decimal.

Light curves, folded light curves (with the period given above) and comments:

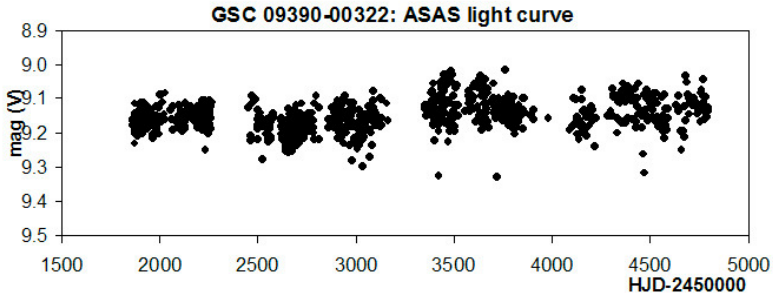
Some of the following stars showed a clear variation of the shape of the light curves.
Therefore the folded light curves are given for a distinct time period of time (described in figure as HJD 245 ....-....). This is somewhat typical of chromospherically active stars which can show secular variation in mean magnitude and/or amplitude as a result of starspot cycles similar in nature to the Suns`s sunspot cycle.

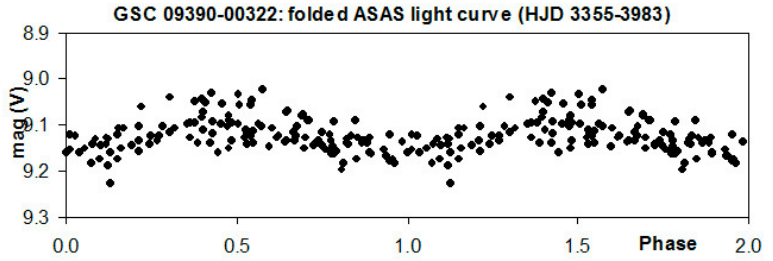
No. 1: GSC 09500-00821
2MASS J-K: 0.846
Tycho-2: 09500-00821-1: Johnson B-V=1.176 (derived from Tycho-2)
Spectral type: K0IIIe (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 130 (Torres et al., 2006)
ASAS variable (type DCEP-FU/ESD)
Likely an RS CVn variable



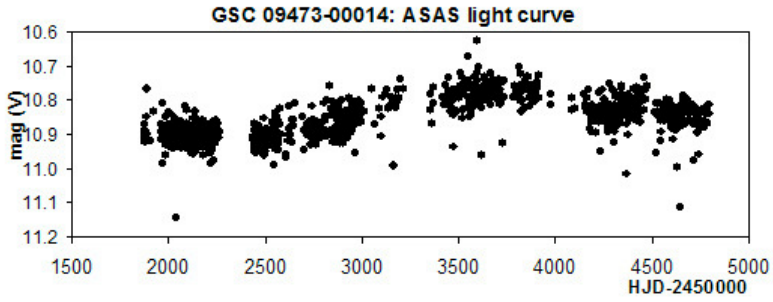


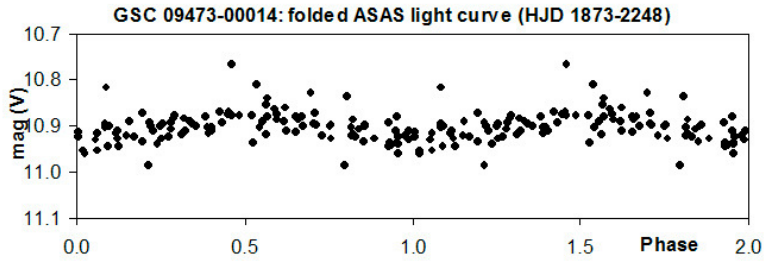
No. 2: GSC 09390-00322
2MASS J-K: 0.588
Tycho-2: 09390-00322 -1: Johnson B-V= 0.753 (derived from Tycho-2)
Spectral type: K0/1 IV/V (Wright et al., 2003)
Likely an RS CVn variable



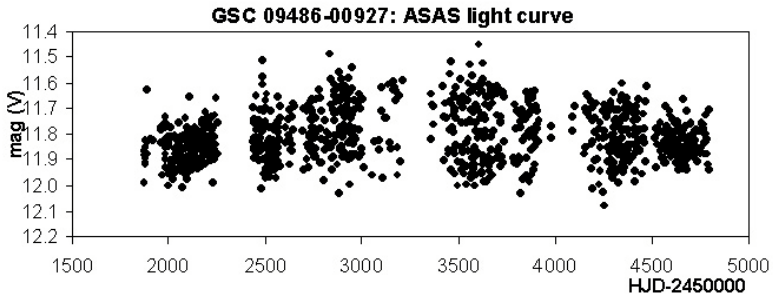


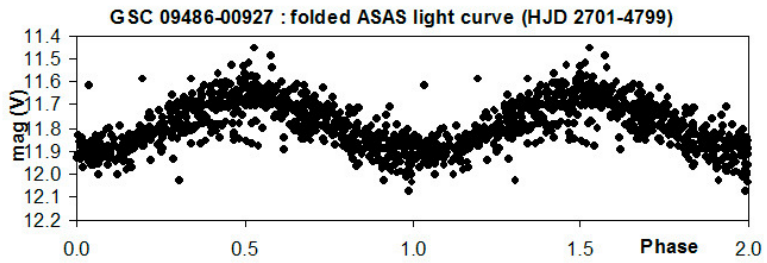
No. 3: GSC 09473-00014
2MASS J-K: 0.575
Tycho-2: 09473-00014-1: Johnson B-V= 0.936 (derived from Tycho-2)
Spectral type: K0V (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 120 (Torres et al., 2006)
Not to distingiush between RS CVn and BY Dra



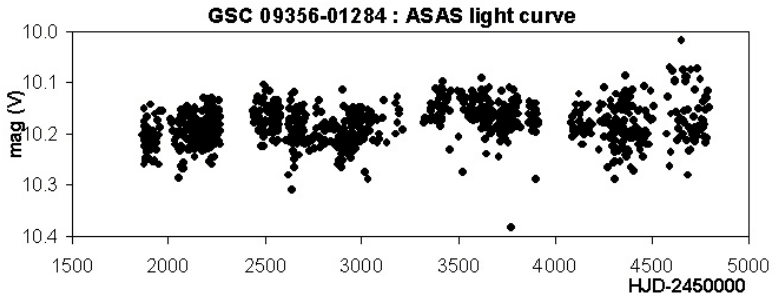


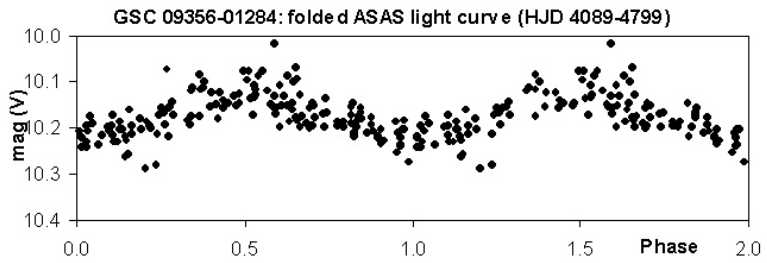
No. 4: GSC 09486-00927
2MASS J-K: 0.898
ASAS variable (type MISC)
Spectral type: M1Ve (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 104 (Torres et al., 2006)
Probable BY Dra variable



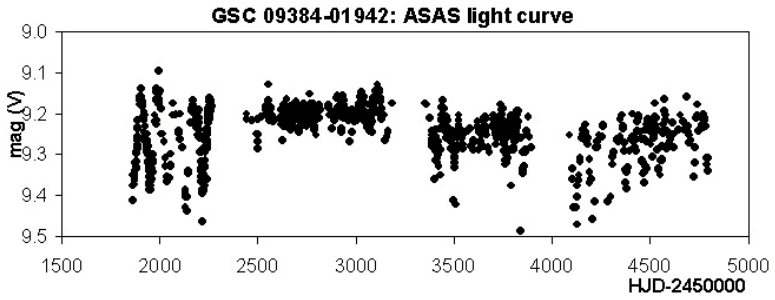


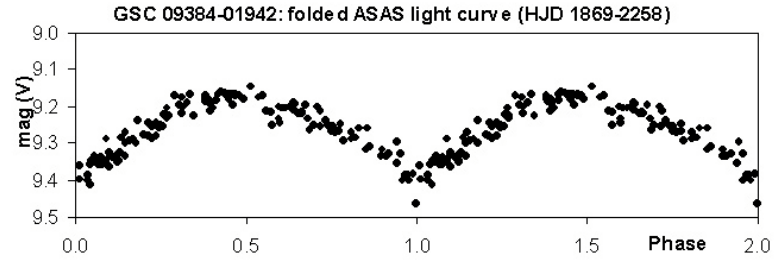
No. 5: GSC 09356-01284
2MASS J-K: 0.899
Tycho-2: 09356-01284-1: Johnson B-V=1.109 (derived from Tycho-2)
Probable BY Dra variable



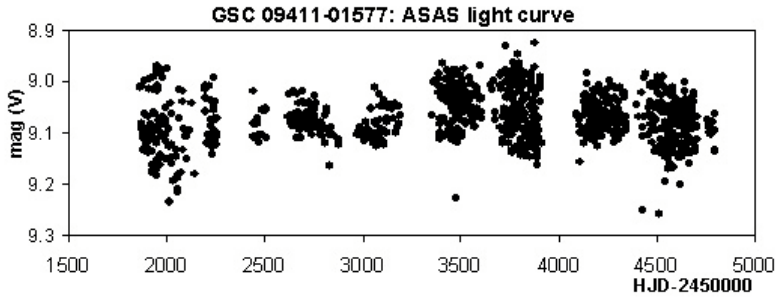


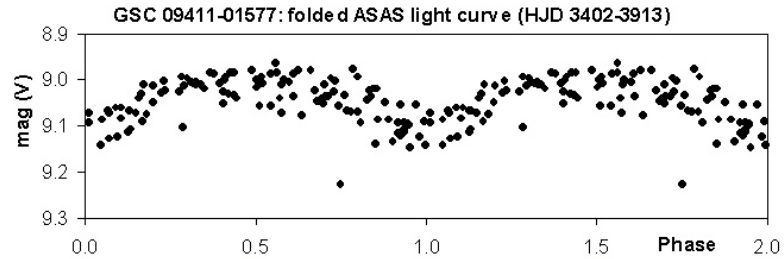
No. 6: GSC 09384-01942
2MASS J-K: 0.804
Tycho-2: 09384-01942-1: Johnson B-V= 1.050 (derived from Tycho-2)
Spectral type: G8 III/IV (Wright et al., 2003)
Spectral type: K0III (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 0 (Torres et al., 2006)
ASAS variable (type MISC)
Likely an RS CVn variable



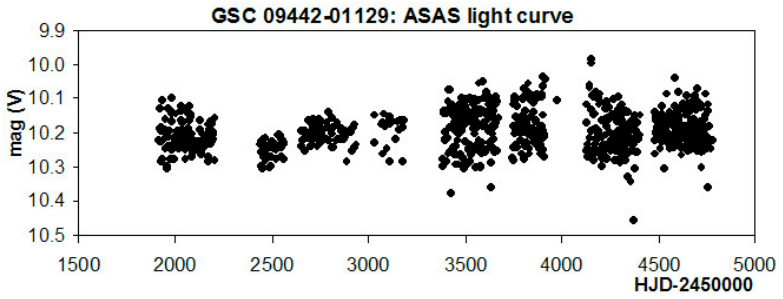


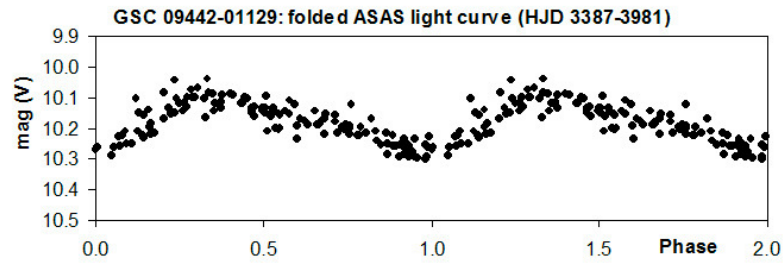
No. 7: GSC 09411-01577
2MASS J-K: 0.796
Tycho-2: 09411-01577-1: Johnson B-V=1.178 (derived from Tycho-2)
Spectral type: K0 III (Houk et al., 1975)
ASAS variable (type MISC)
Likely an RS CVn variable



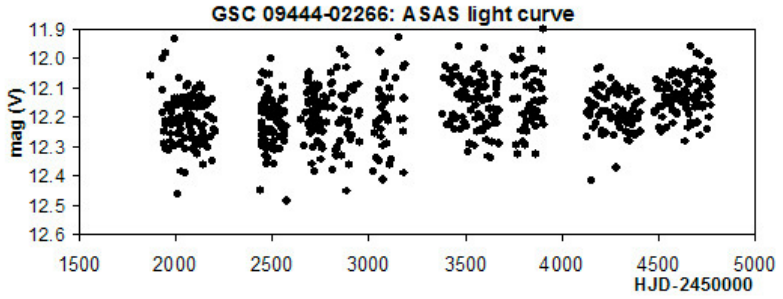


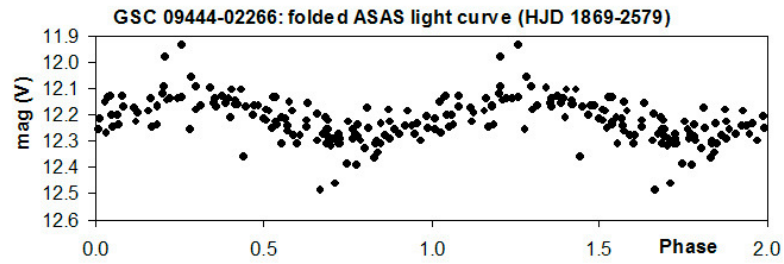
No. 8: GSC 09442-01129
2MASS J-K: 0.557
Tycho-2: 09442-01129-1: Johnson B-V= 0.975 (derived from Tycho-2)
Spectral type: G9III(e) (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 105 (Torres et al., 2006)
ASAS variable (type MISC)
Likely an RS CVn variable



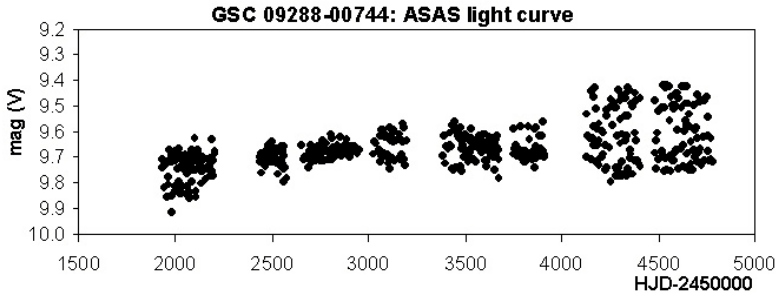


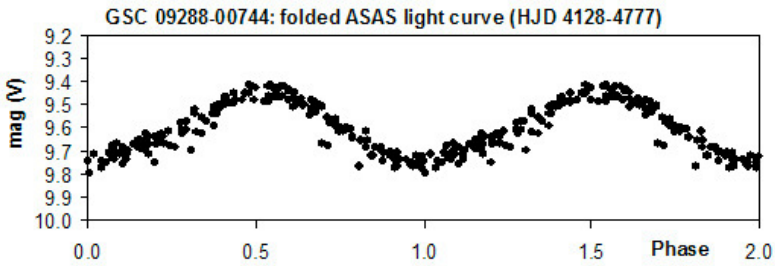
No. 9: GSC 09444-02266
2MASS J-K: 0.900
Not to distinguish between RS CVn and BY Dra



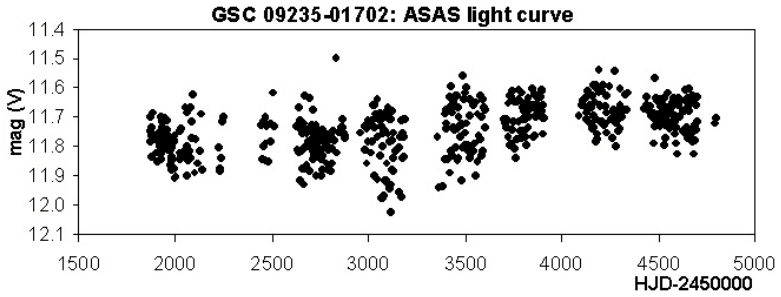


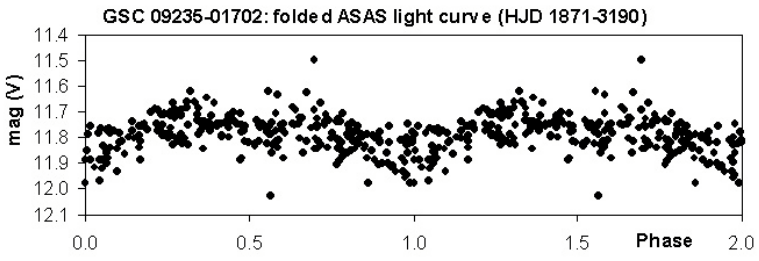
No. 10: GSC 09288-00744
2MASS J-K: 0.736
Tycho-2: 09288-00744-1: Johnson B-V=0.911 (derived from Tycho-2)
Spectral type: K0IIIe (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 130 (Torres et al., 2006)
Likely an RS CVn variable



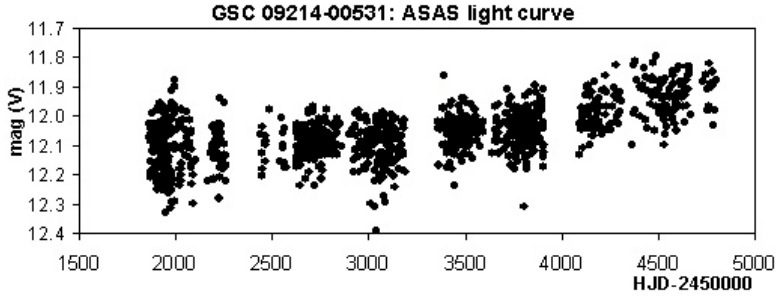


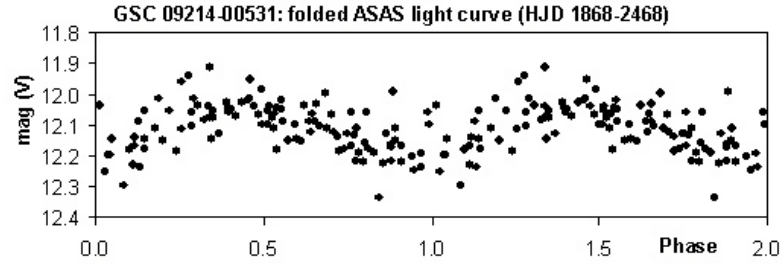
No. 11: GSC 09235-01702
2MASS J-K: 0.847
Spectral type: K7 (Riaz et al., 2006)
Probable BY Dra variable



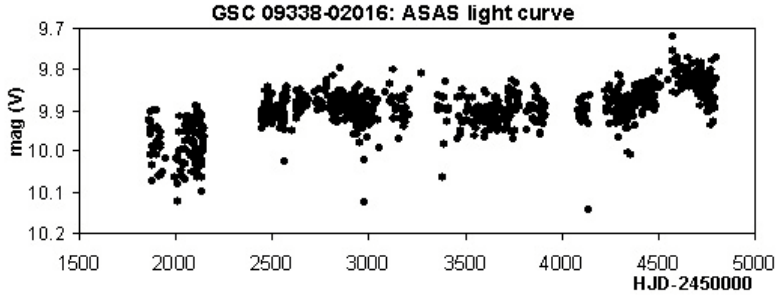


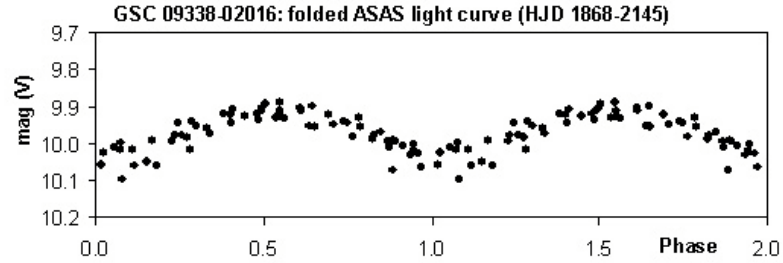
No. 12: GSC 09214-00531
2MASS J-K: 0.791
ASAS variable (type DCEP-FO/EC/ESD)
Likely an RS CVn variable



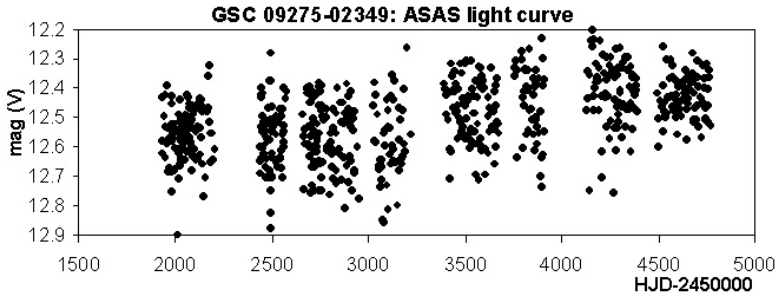


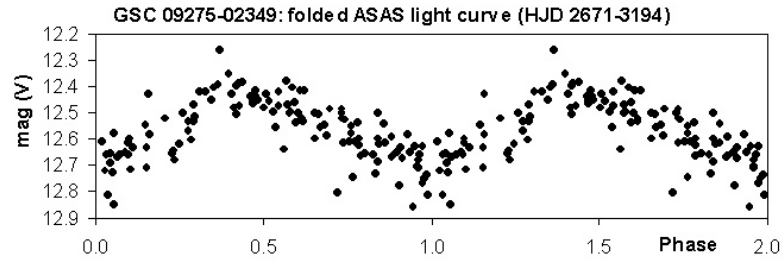
No. 13: GSC 09338-02016
2MASS J-K: 0.453
Tycho-2: 09338-02016-1: Johnson B-V= 0.704 (derived from Tycho-2)
Spectral type: G5 IV (Wright et al., 2003)
Spectral type: G8V (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 259 (Torres et al., 2006)
ASAS variable (type DCEP-FO)
Likely a young stellar object



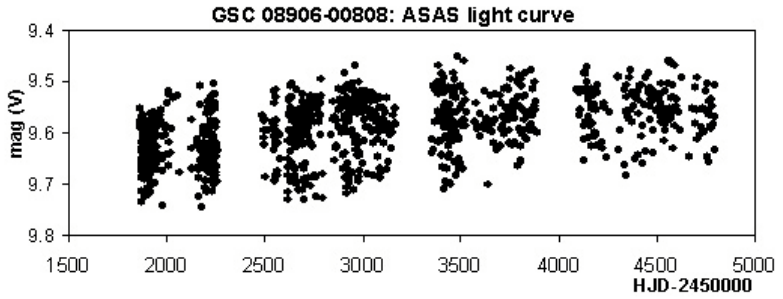


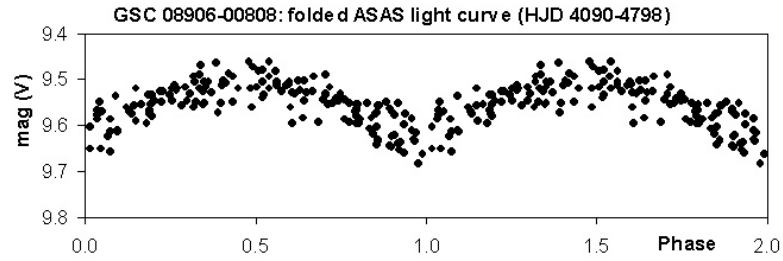
No. 14: GSC 09275-02349
2MASS J-K: 0.862
Not to distinguish between RS CVn and BY Dra



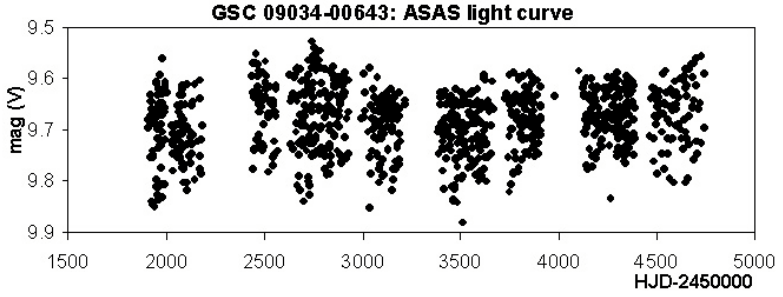


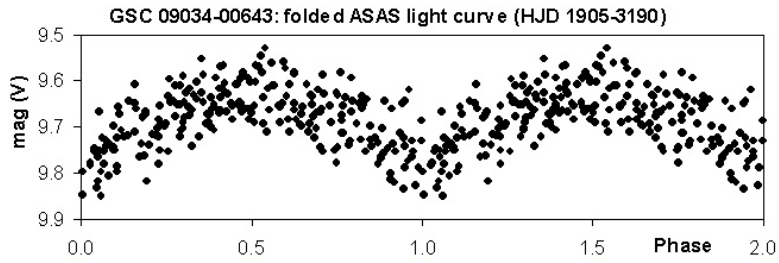
No. 15: GSC 08906-00808
2MASS J-K: 0.484
Tycho-2: 08906-00808-1 :Johnson B-V= 0.762 (derived from Tycho-2)
Spectral type: G7III (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 0 (Torres et al., 2006)
ASAS variable (type EC/ESD)
Likely an RS CVn variable



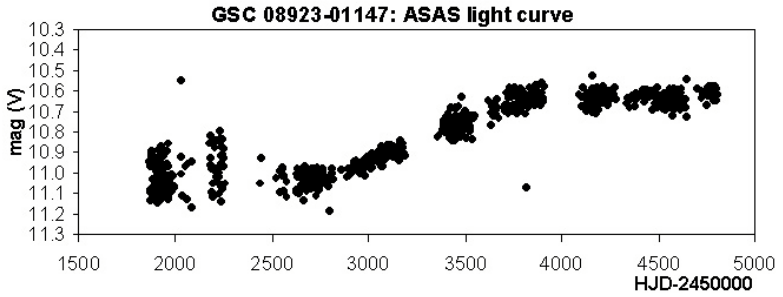


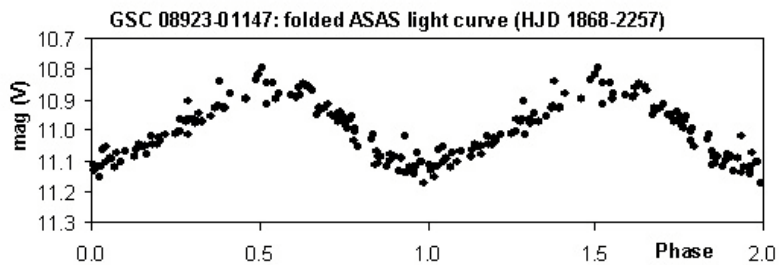
No. 16: GSC 09034-00643
2MASS J-K: 0.749
Tycho-2: 09034-00643-1: Johnson B-V=1.036 (derived from Tycho-2)
Spectral type: K1III (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 0 (Torres et al., 2006)
ASAS variable (type MISC)
Likely an RS CVn variable



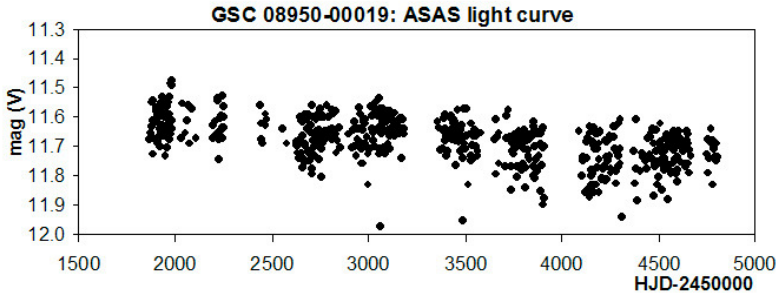


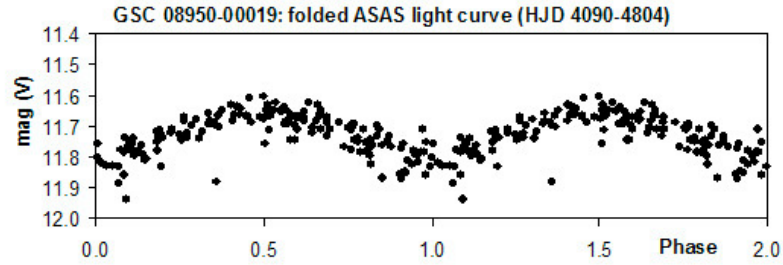
No. 17: GSC 08923-01147
2MASS J-K: 0.838
Tycho-2: 08923-01147-1: Johnson B-V= 0.639 (derived from Tycho-2)
Spectral type: K0IIIe (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 100 (Torres et al., 2006)
ASAS variable (type MISC)
Likely an RS CVn variable



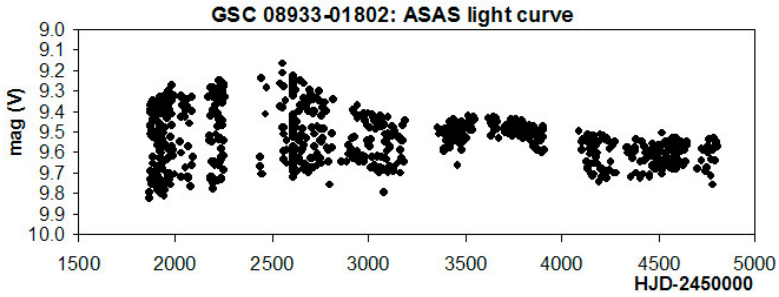


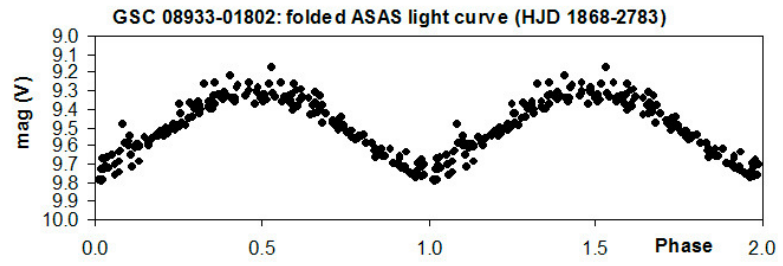
No. 18: GSC 08950-00019
2MASS J-K: 0.790
ASAS variable (type DCEP-FO/DCEP-FU/EC/E)
Not to distinguish between RS CVn and BY Dra



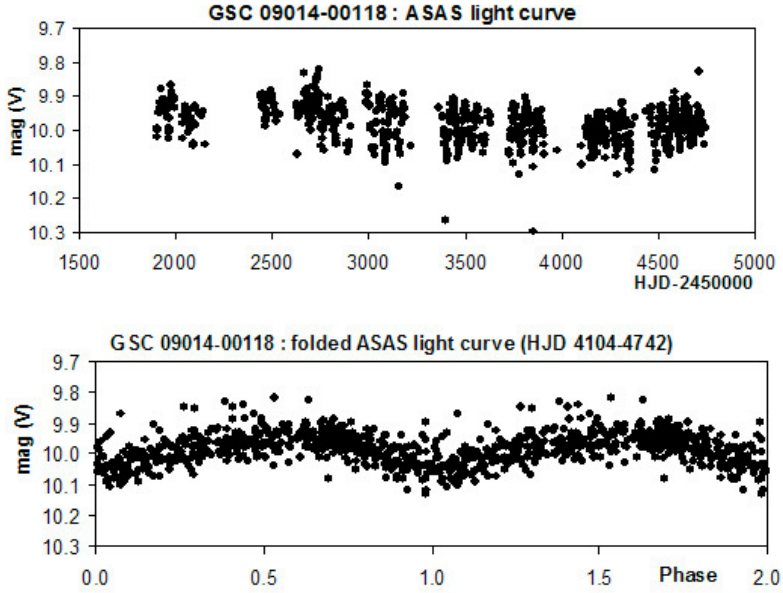


No. 19: GSC 08933-01802
2MASS J-K: 0.815
Tycho-2: 08933-01802-1: Johnson B-V=1.111 (derived from Tycho-2)
Spectral type: K2IIIe (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 170 (Torres et al., 2006)
ASAS variable (type DCEP-FO)
Likely an RS CVn variable

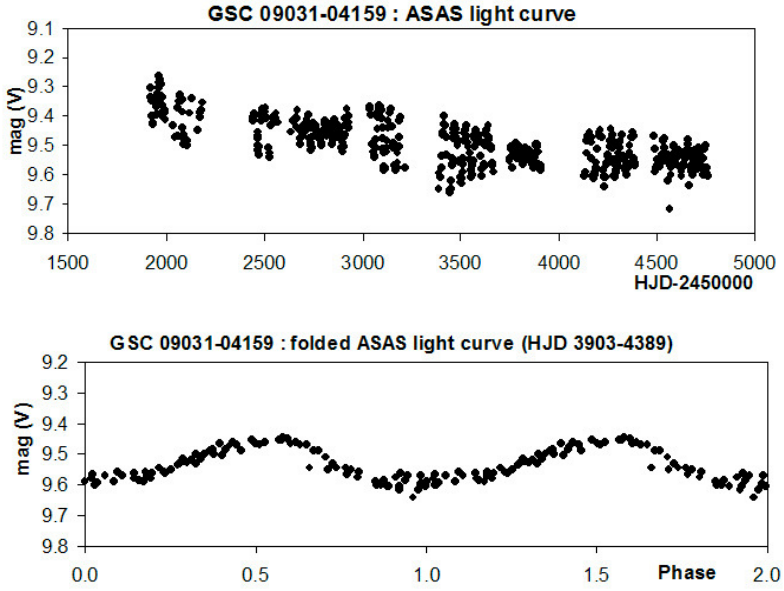




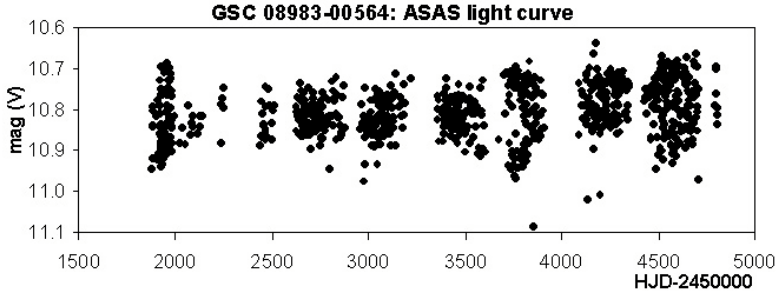
No. 20: GSC 09014-00118
2MASS J-K: 0.782
Tycho-2: 09014-00118-1: Johnson B-V=1.183 (derived from Tycho-2)
Spectral type: K0III (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 50 (Torres et al., 2006)
ASAS variable (type MISC)
Likely an RS CVn variable

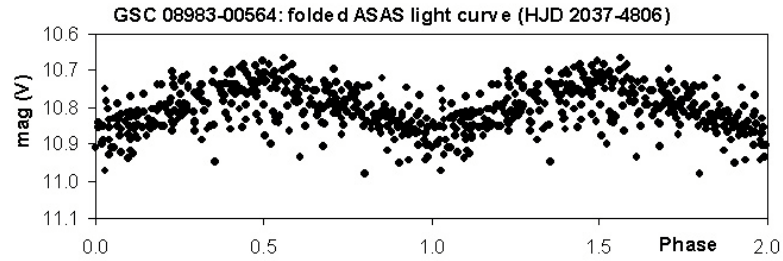


No. 21: GSC 09031-04159
2MASS J-K: 0.779
Tycho-2: 09031-04159-1: Johnson B-V=1.173 (derived from Tycho-2)
Spectral type: K2III (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 110 (Torres et al., 2006)
ASAS variable (type MISC/SR)
Likely an RS CVn variable

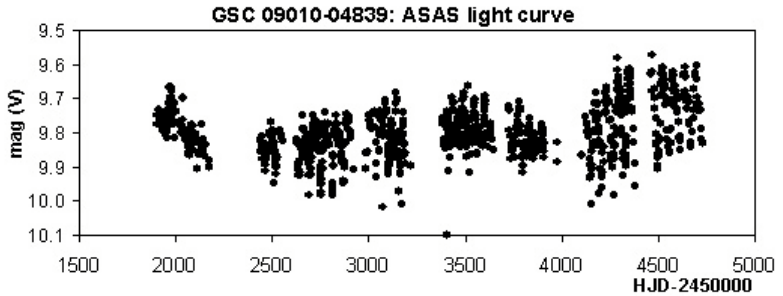


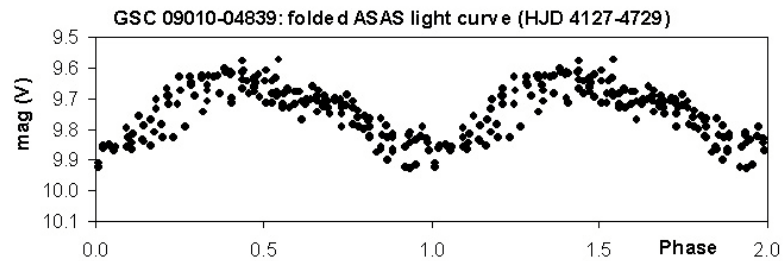
No. 22: GSC 08983-00564
2MASS J-K: 0.836
Tycho-2: 08983-00564-1: Johnson B-V=1.307 (derived from Tycho-2)
Spectral type: K2 (Skiff, 2008)
Not to distinguish between RS CVn and BY Dra



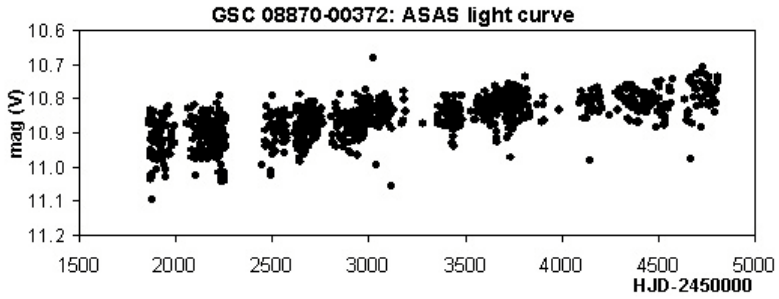


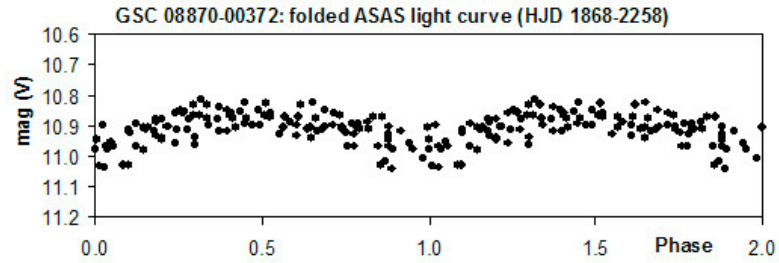
No. 23: GSC 09010-04839
2MASS J-K: 0.815
Tycho-2: 09010-04839-1: Johnson B-V=1.005 (derived from Tycho-2)
Spectral type: K 1 III (Buscombe, 1999)
Spectral type: K1III(e) (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 150 (Torres et al., 2006)
Likely an RS CVn variable



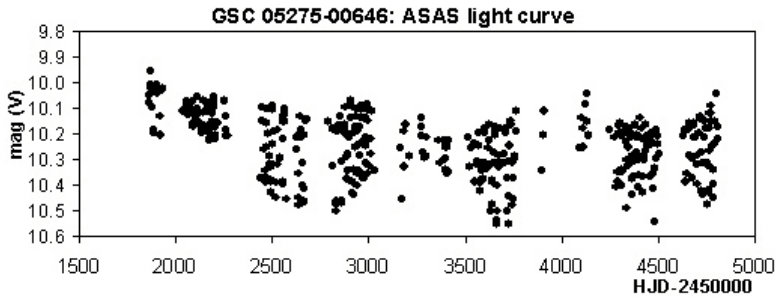


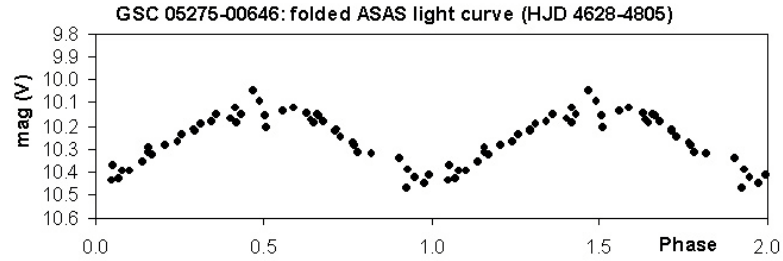
No. 24: GSC 08870-00372
2MASS J-K: 0.498
Tycho-2: 08870-00372-1: Johnson B-V=0.672 (derived from Tycho-2)
Spectral type: K0V (Torres et al., 2006)
LiI equivalent width in milli-Angstroms: 300 (Torres et al., 2006)
ASAS variable (type DCEP-FU/ESD)
Probable a young stellar object





No. 25: GSC 05275-00646
2MASS J-K: 0.735
Tycho-2: 05275-00646-1: Johnson B-V=1.042 (derived from Tycho-2)
Spectral type: K0IIIe (Torres et al., 2006)
LiI equivalent width in milli-Angstroms:0 (Torres et al., 2006)
ASAS variable (type DCEP-FU)
Likely an RS CVn variable





Acknowledgements: This research has made use of the SIMBAD and VizieR databases operated at the Centre de Données Astronomiques (Strasbourg) in France, of the Smithsonian/NASA Astrophysics Data System, of the International Variable Star Index (AAVSO) and of the Two Micron All Sky Survey. It is a pleasure to thank John Greaves, UK for his suggestions and helpful comments.

References:

Bernhard K., Lloyd C., 2008, OEJV, 92
http://var.astro.cz/oejv/issues/oejv0092.pdf

Buscombe, 1999, 14th General Catalogue of MK Spectral Classification, Northwestern Univ., Evanston, Illinois
http://vizier.u-strasbg.fr/viz-bin/VizieR?-source=III/222

González-Solares, E. A.; Walton, N. A.; Greimel, R.; Drew, J. E.; Irwin, M. J.; Sale, S. E.; Andrews, K.; Aungwerojwit, A.; Barlow, M. J.; van den Besselaar, E.; Corradi, R. L. M.; Gänsicke, B. T.; Groot, P. J.; Hales, A. S.; Hopewell, E. C.; Hu, Haili; Irwin, J.; Knigge, C.; Lagadec, E.; Leisy, P.; Lewis, J. R.; Mampaso, A.; Matsuura, M.; Moont, B.; Morales-Rueda, L.; Morris, R. A. H.; Naylor, T.; Parker, Q. A.; Prema, P.; Pyrzas, S.; Rixon, G. T.; Rodríguez-Gil, P.; Roelofs, G.; Sabin, L.; Skillen, I.; Suso, J.; Tata, R.; Viironen, K.; Vink, J. S.; Witham, A.; Wright, N. J.; Zijlstra, A. A.; Zurita, A.; Drake, J.; Fabregat, J.; Lennon, D. J.; Lucas, P. W.; Martín, E. L.; Phillipps, S.; Steeghs, D.; Unruh, Y. C., 2008, MNRAS, 388, 89
http://arxiv.org/abs/0712.0384

Høg E., Fabricius C., Makarov V.V., Urban S., Corbin T., Wycoff G., Bastian U., Schwekendiek P., Wicenec A., 2000, Astron. Astrophys., 355, L27 (2000A&A...355L..27H)
http://aa.springer.de/papers/0355002/2300l27.pdf

Houk N., Cowley A.P. , 1975, Michigan Catalogue of two dimentional spectral types for the HD stars. (Vol.1, -90deg < δ < -53deg), Univ. of Michigan
http://vizier.u-strasbg.fr/viz-bin/VizieR?-source=III/31B

Lenz P., Breger M., 2005, Comm. in Asteroseismology, 146, 53 (2005CoAst.146...53L)
http://adsabs.harvard.edu/abs/2005CoAst.146...53L

Pojmanski, G., 2002, Acta Astronomica, 52, 397
http://arxiv.org/abs/astro-ph/0210283

Riaz B., Gizis J.E., Harvin J., 2006, Astron. J., 132, 866-872
http://adsabs.harvard.edu/abs?bibcode=2006AJ....132..866R&

Skiff, 2008, Catalogue of Stellar Spectral Classifications, Lowell Observatory
http://vizier.u-strasbg.fr/viz-bin/VizieR?-source=B/mk

Skrutskie, R.M. Cutri, R. Stiening, M.D. Weinberg, S. Schneider, J.M. Carpenter, C. Beichman, R. Capps, T. Chester, J. Elias, J. Huchra, J. Liebert, C. Lonsdale, D.G. Monet, S. Price, P. Seitzer, T. Jarrett, J.D. Kirkpatrick, J. Gizis, E. Howard, T. Evans, J. Fowler, L. Fullmer, R. Hurt, R. Light, E.L. Kopan, K.A. Marsh, H.L. McCallon, R. Tam, S. Van Dyk, and S. Wheelock, 2006, AJ, 131, 1163
http://adsabs.harvard.edu/abs/2006AJ....131.1163S

Torres C.A.O., Quast G.R., da Silva L., de la Reza R., Melo C.H.F., Sterzik M., 2006, Astron. Astrophys. 460, 695
http://simbad3.u-strasbg.fr/cgi-bin/cdsbib?2006A%26A...460..695T

Voges W., Aschenbach B., Boller T., Braeuninger H., Briel U., Burkert W., Dennerl K., Englhauser J., Gruber R., Haberl F., Hartner G., Hasinger G., Kuerster M., Pfeffermann E., Pietsch W., Predehl P., Rosso C., Schmitt J.H.M.M., Truemper J., Zimmermann H.U. 1999, Astron. Astrophys. 349, 389
http://simbad3.u-strasbg.fr/cgi-bin/cdsbib?1999A%26A...349..389V

Wright C.O., Egan M.P., Kraemer K.E., Price S.D., 2003, Astron. J., 125, 359
http://simbad3.u-strasbg.fr/cgi-bin/cdsbib?2003AJ....125..359W