

Ten new red variables in the ASAS-3 Database

STEFAN HÜMMERICH

Stiftstr. 4, D-56338 Braubach, ernham@rz-online.de

Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V. (BAV), Munsterdamm 90, D-12169 Berlin, Germany

BAV Mitteilungen No. 222

Abstract:

10 new red variable stars of semiregular and irregular types are presented, which were found in the ASAS-3 database: GSC 6993-00061, GSC 0595-01102, GSC 1183-00578, GSC 6417-00664, GSC 0633-00840, GSC 4704-00720, 2MASS J02460684-6853254, GSC 5497-00984, GSC 9449-00903, 2MASS J20373865-4151569.

The ASAS-3 database (**Pojmanski, 2002**) was searched for variable stars using two different methods.

Firstly, late-type stars (type M and C) from the Catalogue of Stellar Spectral Classifications (**Skiff, 2010**) were investigated and checked against ASAS-3 V data, which led to the discovery of the variability of GSC 6993-00061, GSC 0595-01102, GSC 1183-00578, GSC 6417-00664, GSC 0633-00840, GSC 4704-00720, 2MASS J02460684-6853254 and GSC 5497-00984.

Secondly, a coordinate-based approach was taken. Specific locations were entered in the ASAS All Star Catalogue and a search radius of 6000 arc-seconds was chosen. The resulting objects were copied into a spreadsheet application and sorted by magnitude (mag), error in brightness (err) and number of observations (Nobs). Only the V-band lightcurves of objects with $Nobs \geq 100$, $mag < 13$ and $err > 0.1$ were investigated, which resulted in a list of several variable stars. Of them, GSC 9449-00903 (2MASS J-K = 1.245) and 2MASS J20373865-4151569 (2MASS J-K = 1.09) were included into this paper as their 2MASS J-K values (**Skrutskie et al., 2006**) are well in agreement with red variable stars.

Amplitudes and predominant periods (along with corresponding uncertainties) of the semiregular stars were estimated by use of Period04 (**Lenz et al., 2005**). Folded lightcurves have been based on the whole measured interval of time. Although these lightcurves naturally show considerable scattering due to the semiregular nature of the stars, they indicate the existence of a predominant period over the given timespan.

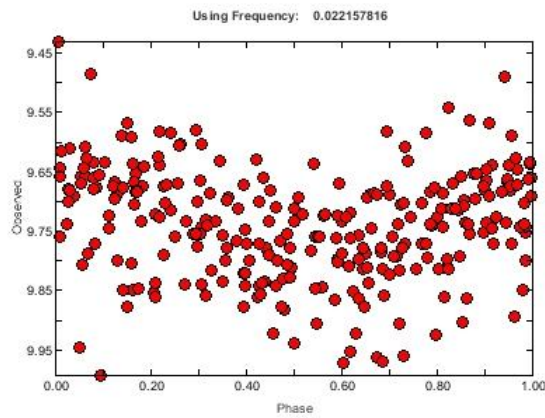
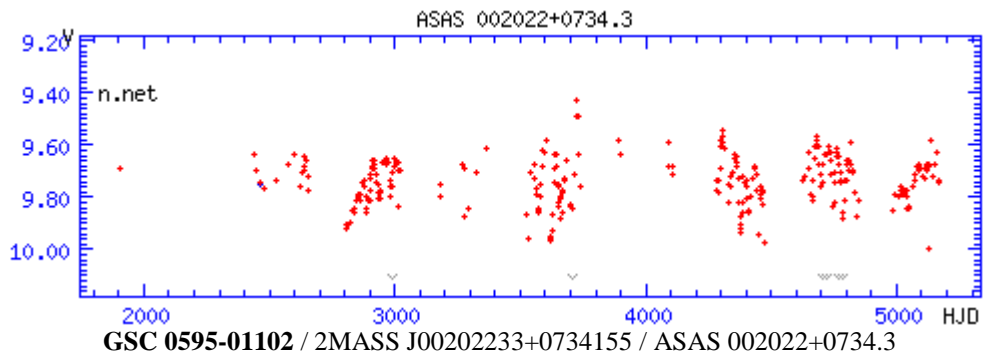
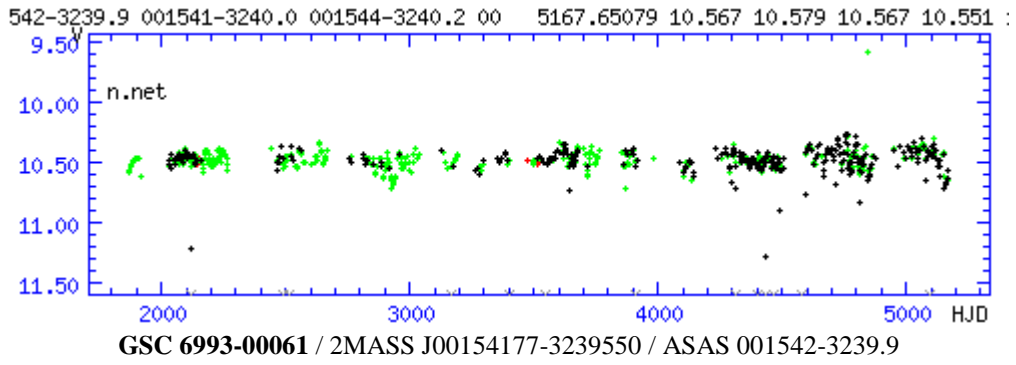
Spectral information was taken from the Catalogue of Stellar Spectral Classifications (**Skiff, 2010**) and – in the case of GSC 9449-00903 and 2MASS J20373865-4151569 – estimated by conversion of 2MASS J and K photometry (**Bessel et al., 1988**). All objects were checked against the Strasbourg CDS Vizier service (**Ochsenbein et al., 2000**), the International Variable Star Index (**Watson, 2006**) and the ASAS Catalogue of Variable Stars for pre-existence in variability catalogues.

The table below contains essential data of the variables which is followed by the original ASAS-3 lightcurves (all dates refer to HJD-2450000) and the corresponding folded lightcurves. Raw data (ASAS-3 V photometry) is given in the appendix.

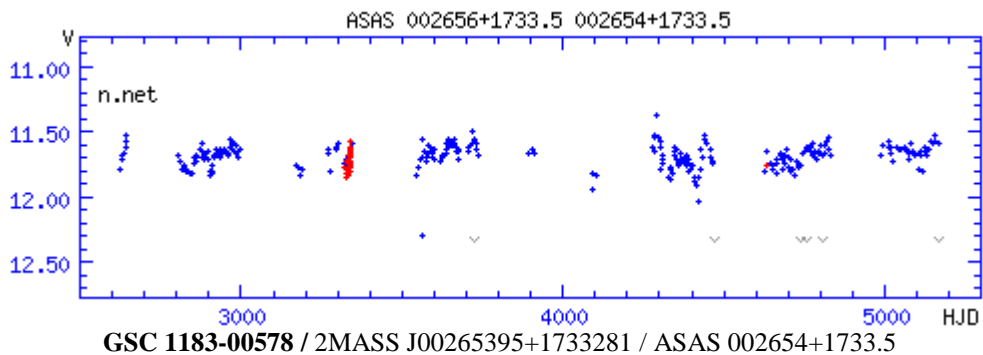
Name / 2MASS-Identifler / GSC-Identifler	RA (J2000)	Dec (J2000)	Mag. range (V)	Type	Spectral Type	Period
GSC 6993-00061 2MASS J00154177-3239550 ASAS 001542-3239.9	00 15 41.78	-32 39 55.1	10.3 – 10.7	L	M3	-
GSC 0595-01102 2MASS J00202233+0734155 ASAS 002022+0734.3	00 20 22.33	+07 34 15.6	9.4 – 10.0	SR	M4	45±1d
GSC 1183-00578 2MASS J00265395+1733281 ASAS 002654+1733.5	00 26 53.95	+17 33 28.2	11.4 – 12.0	L	C	-
GSC 6417-00664 2MASS J00310053-2516520 ASAS 003101-2516.9	00 31 00.55	-25 16 52.1	11.6 – 12.5	L	M2	-
GSC 0633-00840 2MASS J02062731+1112462 ASAS 020627+1112.8	02 06 27.30	+11 12 46.3	10.4 – 11.5	L	M0	-
GSC 4704-00720 2MASS J02384781-0526508 ASAS 023848-0526.8	02 38 47.82	-05 26 50.7	11.2 – 12.2	SR	M5/6	81±4d
2MASS J02460684-6853254 ASAS 024607-6853.4	02 46 06.85	-68 53 25.7	7.9 – 8.5	SRb	M4III	53±1.5d
GSC 5497-00984 2MASS J10320280-1458556 ASAS 103203-1458.9	10 32 02.82	-14 58 55.4	9.9 – 10.7	SR	M6	53±0.5d
GSC 9449-00903 2MASS J18353947-7722296 ASAS 183539-7722.4	18 35 38.7	-77 22 26.4	11.8 – 12.7	SR(b)	M5III ^{*1}	57±1d
2MASS J20373865-4151569 ASAS 203738-4151.9	20 37 38.3	-41 51 57.3	11.7 – 12.6	L(b)	M2III ^{*1}	~55d; ~58d; ~440d ^{*2}

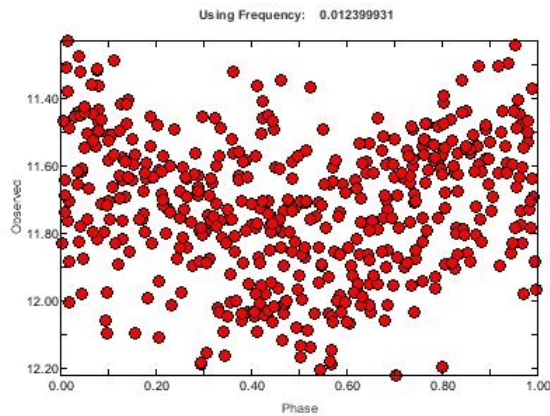
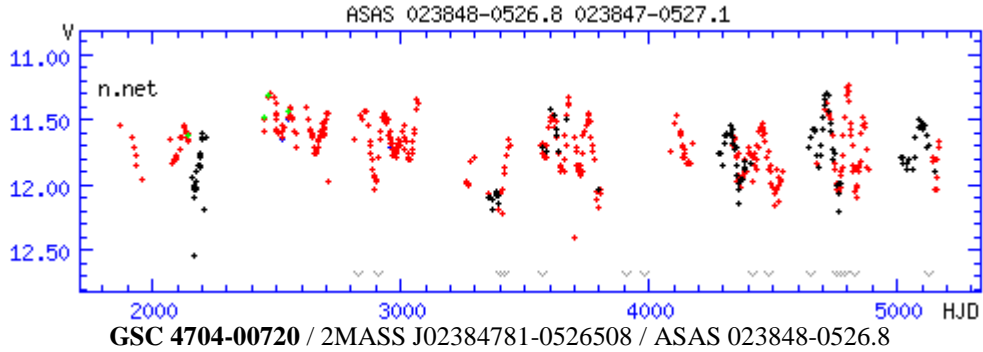
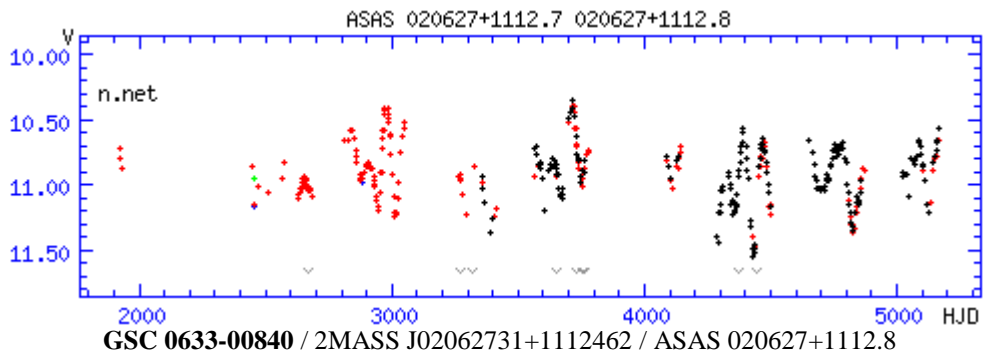
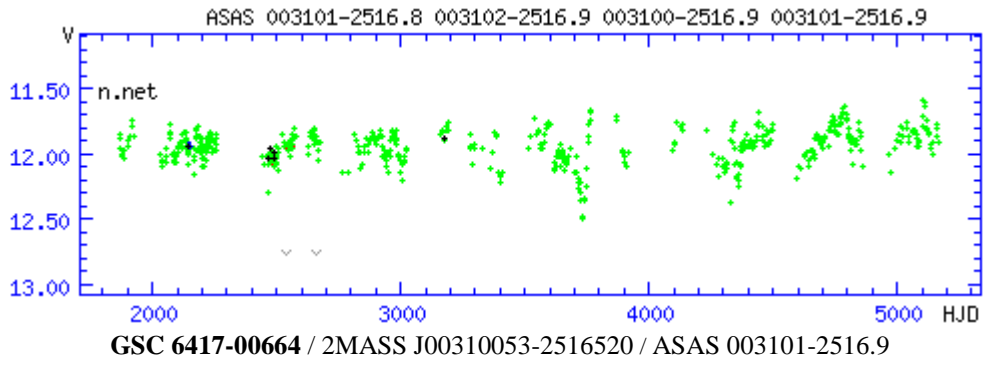
^{*1} Estimated by conversion of 2MASS J and K photometry.

^{*2} Range of timescales given; for further details see below.

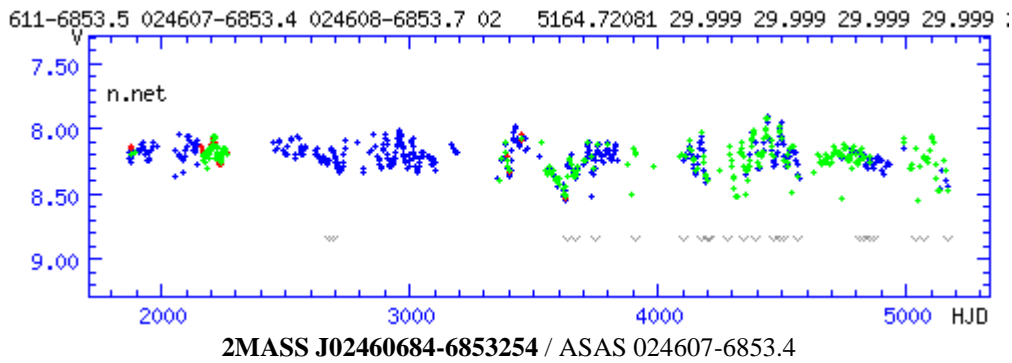


GSC 0595-01102 / 2MASS J00202233+0734155 / ASAS 002022+0734.3 – folded lightcurve (P=45±1d)



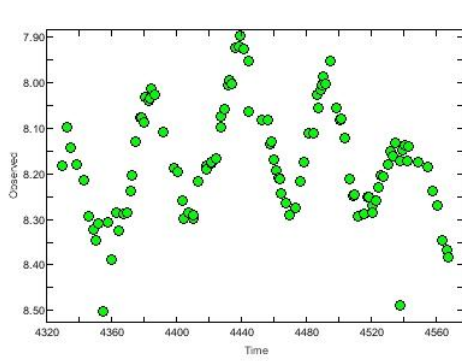


GSC 4704-00720 / 2MASS J02384781-0526508 / ASAS 023848-0526.8 – folded lightcurve (P=81±4d)

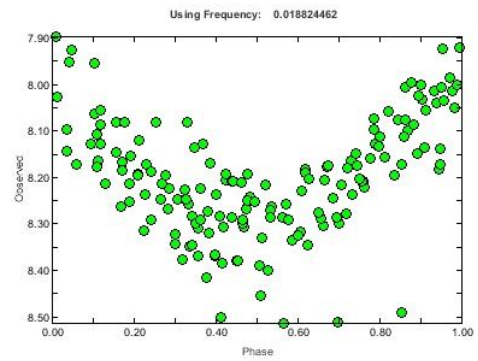


The star's predominant pulsation period of 53d (± 1.5 d) can be followed throughout most of the observed timespan. As is the case in many semiregular variables, the period is subject to spontaneous shifts (hence the observed error margin of ± 1.5 d) and even seems to cease altogether during the interval from HJD 2453350 - HJD 2453630, in which the star exhibits a peculiar hump-like feature. The star is furthermore characterized by changes in amplitude, as can be seen e.g. in the intervals from HJD 2454300 - HJD 2454600 (amplitude: 0.6mag) and HJD 2454600 - HJD 2454950 (amplitude: 0.2mag), respectively.

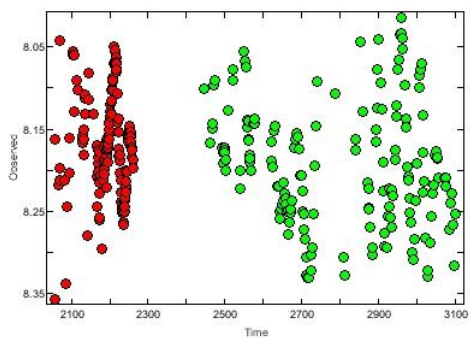
The accompanying graphics illustrate examples of period shifts. Whereas the period remains stable and clearly recognizable in the interval from HJD 2454320 to HJD 2454567 (as shown in (1)+(2)), it is less obvious from HJD 2452056 to HJD 2452261 (coloured red in (3)+(4)) and deteriorates further in the interval from HJD 2452447 to HJD 2453102 (coloured green in (3)+(4)). However, it is still recognizable – albeit with considerable scatter – as a predominant feature of the whole measured timespan (see folded lightcurve on next page).



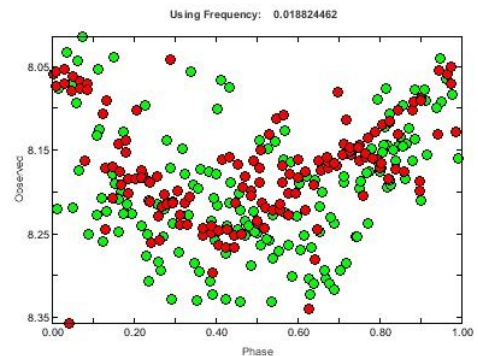
(1) HJD 2454320 - HJD 2454567



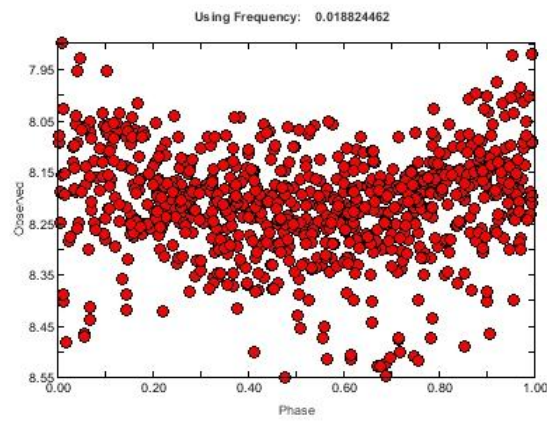
(2) HJD 2454320 - HJD 2454567
 folded with a period of 53.12d



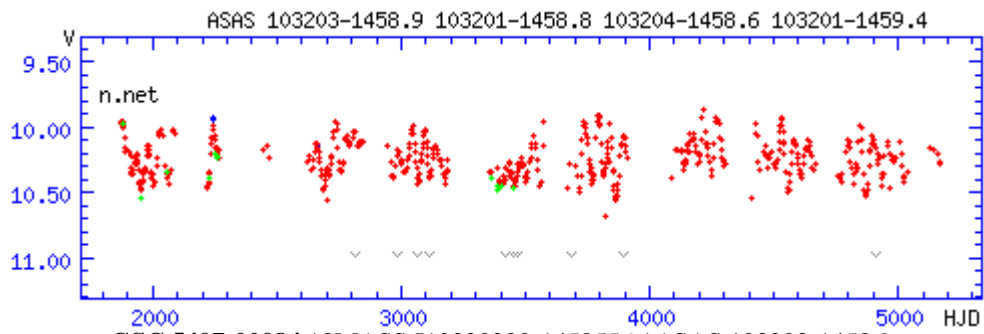
(3) HJD 2452056 - HJD 2452261 (red)
 HJD 2452447 - HJD 2453102 (green)



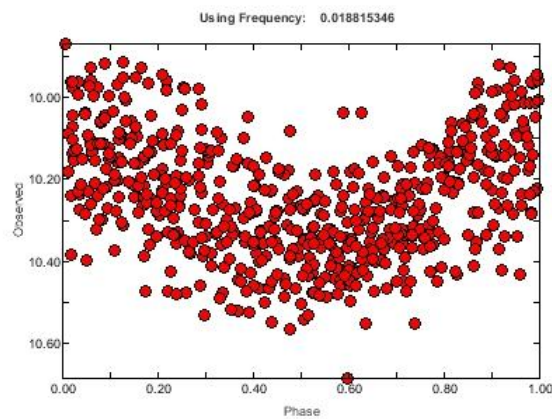
(4) HJD 2452056 - HJD 2452261 (red)
 HJD 2452447 - HJD 2453102 (green)
 folded with a period of 53.12d



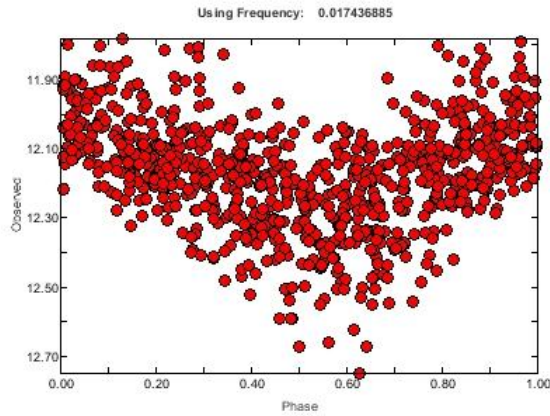
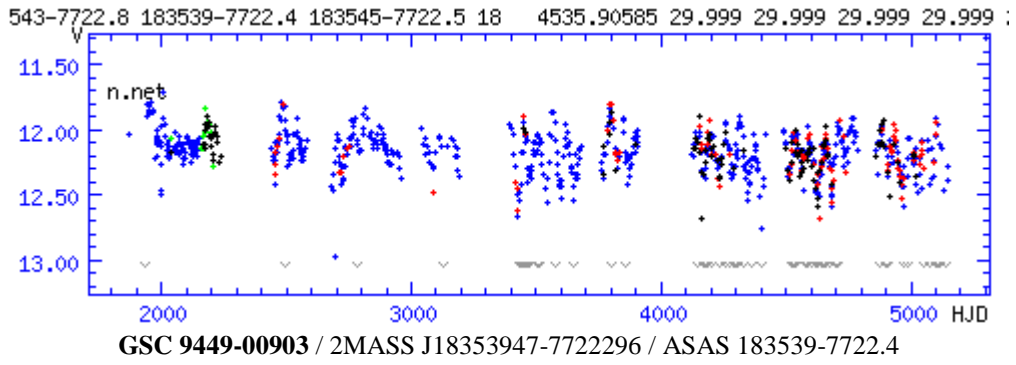
2MASS J02460684-6853254 / ASAS 024607-6853.4 – folded lightcurve ($P=53\pm 1.5d$)



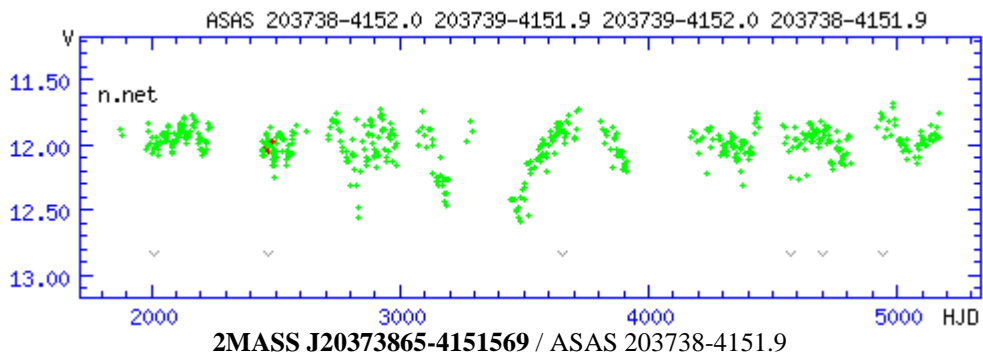
GSC 5497-00984 / 2MASS J10320280-1458556 / ASAS 103203-1458.9



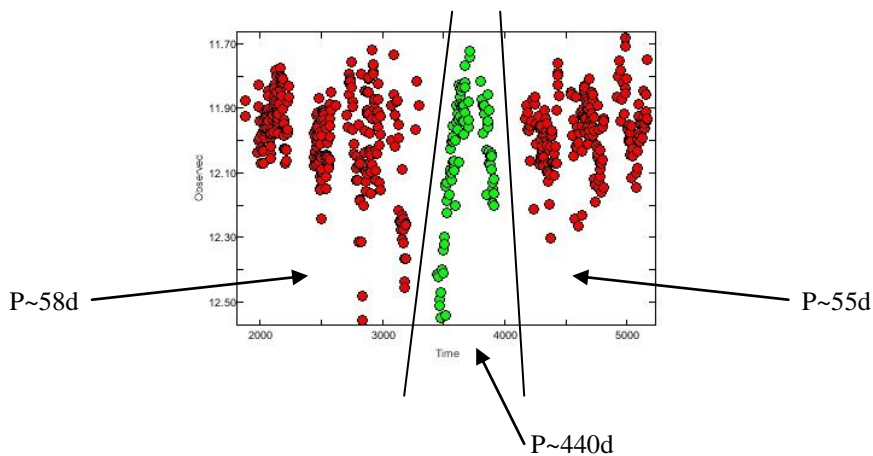
GSC 5497-00984 / 2MASS J10320280-1458556 / ASAS 103203-1458.9 – folded lightcurve ($P=53\pm 0.5d$)



GSC 9449-00903 / 2MASS J18353947-7722296 / ASAS 183539-7722.4 – folded lightcurve ($P=57\pm 1d$)



In addition to roughly semiregular variations, this star is characterized by a singular "Mira-like" hump between HJD 2453475 and HJD 2453912. This feature is highlighted in the graphic below and approximate periods are given. Further photometric studies are necessary to decide whether this phenomenon is of transient nature or appears with some regularity.



Acknowledgements:

This publication makes use of the SIMBAD and VizieR databases operated at the Centre de Données Astronomiques (Strasbourg) in France, of the International Variable Star Index (VSX, AAVSO) and of the Two Micron All Sky Survey (2MASS), which is a joint project of the University of Massachusetts and the Infrared Processing and Analysis Center/California Institute of Technology, funded by the National Aeronautics and Space Administration and the National Science Foundation. The author thanks Klaus Bernhard for his invaluable assistance in preparing this publication and the anonymous referees for their help in improving the paper.

References:

- Bessell M. S., Brett J. M., JHKLM photometry - Standard systems, passbands, and intrinsic colors, *Astronomical Society of the Pacific, Publications* (ISSN 0004-6280), vol. 100, Sept. 1988, p. 1134-1151 ([1988PASP..100.1134B](#))
- Lenz P., Breger M., 2005, *Period04, Communications in Asteroseismology*, 146, 53 (<http://www.univie.ac.at/tops/Period04/>)
- Ochsenbein F., Bauer P., Marcout J., *The VizieR Database of Astronomical Catalogues* ([2000A&AS..143...23O](#))
- Pojmanski G., 2002, *Acta Astronomica*, 52, 397 ([2002AcA....52..397P](#))
- Skiff B.A., 2010, *Catalogue of Stellar Spectral Classifications* ([2009yCat....102023S](#))
- Skrutskie M. F., Cutri R. M., Stiening R., Weinberg M. D., Schneider S., Carpenter J. M., Beichman C., Capps R., Chester T., Elias J., Huchra J., Liebert J., Lonsdale C., Monet D. G., Price S., Seitzer P., Jarrett T., Kirkpatrick J. D., Gizis J. E., Howard E., Evans T., Fowler J., Fullmer L., Hurt R., Light R., Kopan E. L., Marsh K. A., McCallon H. L., Tam R., Van Dyk S., Wheelock S., 2006, *The Two Micron All Sky Survey (2MASS)*, *AJ*, 131, 1163 ([2006AJ....131.1163S](#))
- Watson C. L., 2006, *The International Variable Star Index (VSX)* ([2006SASS...25...47W](#))