



First Elements for five New Variable Stars in Several Fields, Part VII

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Abstract: 5 new variable stars (UCAC3 236-213160, UCAC3 236-212219, UCAC3 238-156799, UCAC4 597-069471; UCAC3 238-157541) are presented, which were found in a search for new variable stars in the fields of several known variables.

Introduction

During the investigation of several known variable stars, five further variables were found in their surroundings, which are new to our knowledge (not included in AAVSO VSX and GCVS). This paper is the seventh part of a series dealing with numerous discoveries.

Some new variables were discovered on images made with 102mm-TeleVue-Refractor (P. Frank, Velden/Germany) by Peter Frank, some were discovered by Franz Agerer (Zweikirchen/Germany) on images made with a Celestron C14.

Further detailed observations were made using a 400mm-ASA-Astrograph (W. Moschner, Nerpio/Spain) and the 102mm-TeleVue-Refractor (P. Frank, Velden/Germany) in 2017 and earlier, which are discussed subsequently in detail:

MoV97 Vul	=	UCAC3 236-213160
MoV98 Vul	=	UCAC3 236-212219
Fr274 Lyr	=	UCAC3 238-156799
Fr275 Lyr	=	UCAC4 597-069471
Fr276 Lyr	=	UCAC3 238-157541

Observations

Some discovery observations (Fr274 Lyr, Fr275 Lyr, Fr276 Lyr) were carried out with a 102mm/f5.0 TeleVue-Refractor (Velden/Germany) and a SIGMA 1603 CCD-Camera containing a cooled Kodak KAF1603ME chip. Normally, the exposures were 90 s resp. 120 s through an IR & UV cut off filter.

Some discovery observations (MoV97 Vul, MoV98 Vul) were carried out with a Celestron C14 (Zweikirchen/Germany) and a SIGMA 1603 CCD-Camera containing a cooled Kodak KAF1603ME chip. Normally, the exposures were 30 s resp. 60 s through an IR & UV cut off filter.

Further observations for all new variables were carried out between June 2015 and January 2018 with a robotic telescope 400 mm f/3.7 ASA-Astrograph (Nerpio, Spain) equipped with a cooled FLI Proline 16803 CCD-Camera and V-filter. The exposure times were 120 seconds. The telescope was controlled from Lennestadt via internet.

Data analysis

Muniwin [1] and a self-written program by F. Agerer were used for the analysis of the frames, after bias, dark- and flatfield correction of the exposures.

Period analysis was performed with Peranso [2], the magnitudes of the variable stars (at maximum brightness) were obtained from the UCAC3 Catalog (Zacharis et al. 2010) [3], or the XPM Catalog (Fedorov et. al. 2009) [4].

Presented elements were calculated with Peranso or by taking into account all minima (see tables below) with the method of least squares. The given amplitudes are uncorrected instrumental values.

Explanations:

HJD = heliocentric UTC timings of the observed minima

mag = Magnitude

The coordinates are taken from the USNO-B1.0 catalogue.

Explanations to the lightcurves:

The colored coding of the symbols plots denotes data taken on different nights.

**MoV97 Vul = UCAC3 236-213160
= TYC 02147 01341**

Right ascension: 19h46m30.5413s (2000)

Declination: +27° 58' 38.780"

UCAC3 Catalog:

Jmag: 13.267 Kmag: 12.707 Jmag-Kmag = 0.560

Comparison star = UCAC3 236-213196

Check Star = UCAC3 236-213352

Amplitude: Min I: 0.37 mag (instr.) Min II: 0.35 mag (instr.)

Type: EW type eclipsing binary

Min I = HJD 2458017.4327 + 0.2956436*E
+ -0.0008 + -0.000017

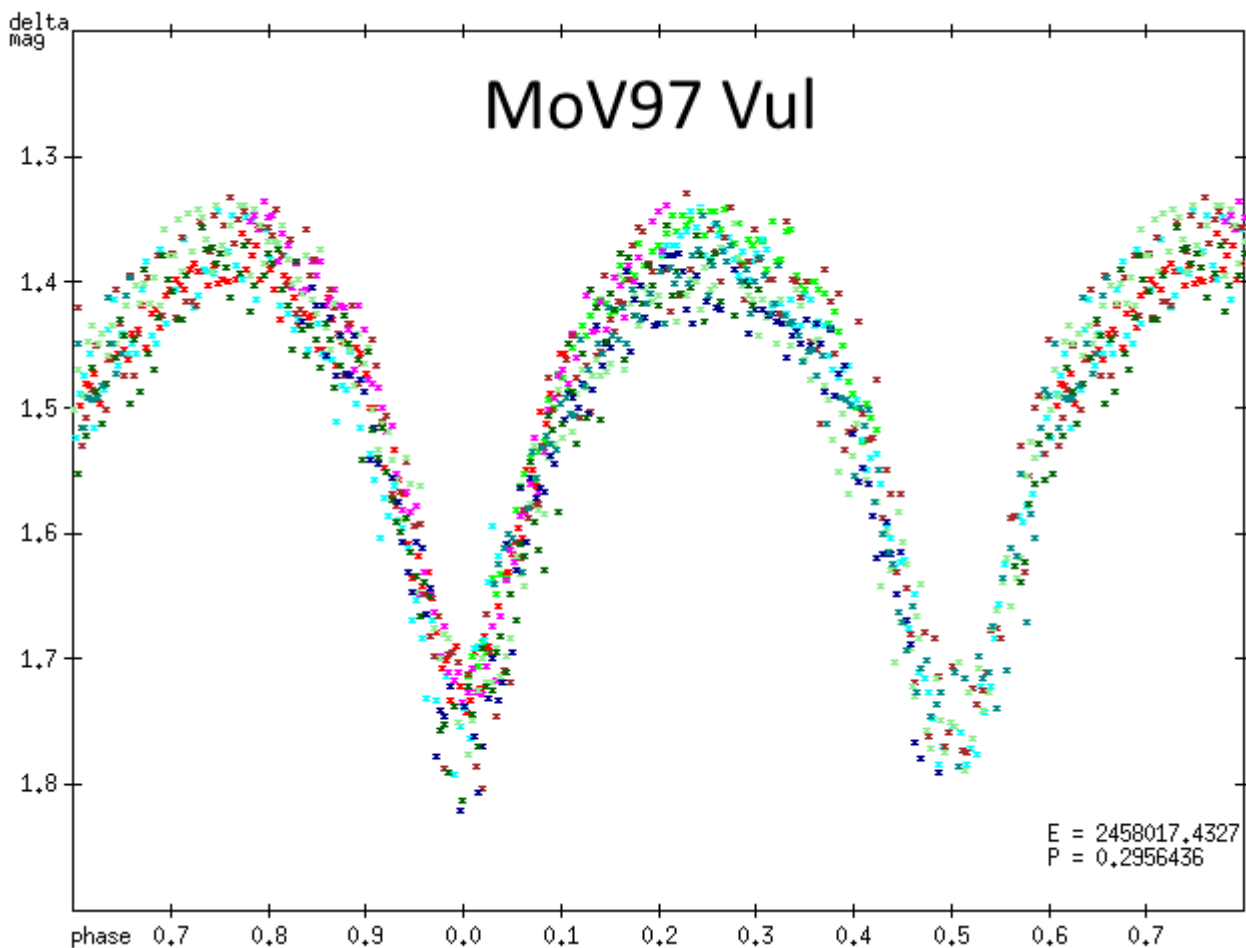


Fig 1: Phased lightcurve of MoV97 Vul = UCAC3 236-213160 using the ephemeris given above. FLI Proline 16803+V-filter (2016-2017). Presented elements were calculated by taking into account all minima (see tables below) with the method of least squares.

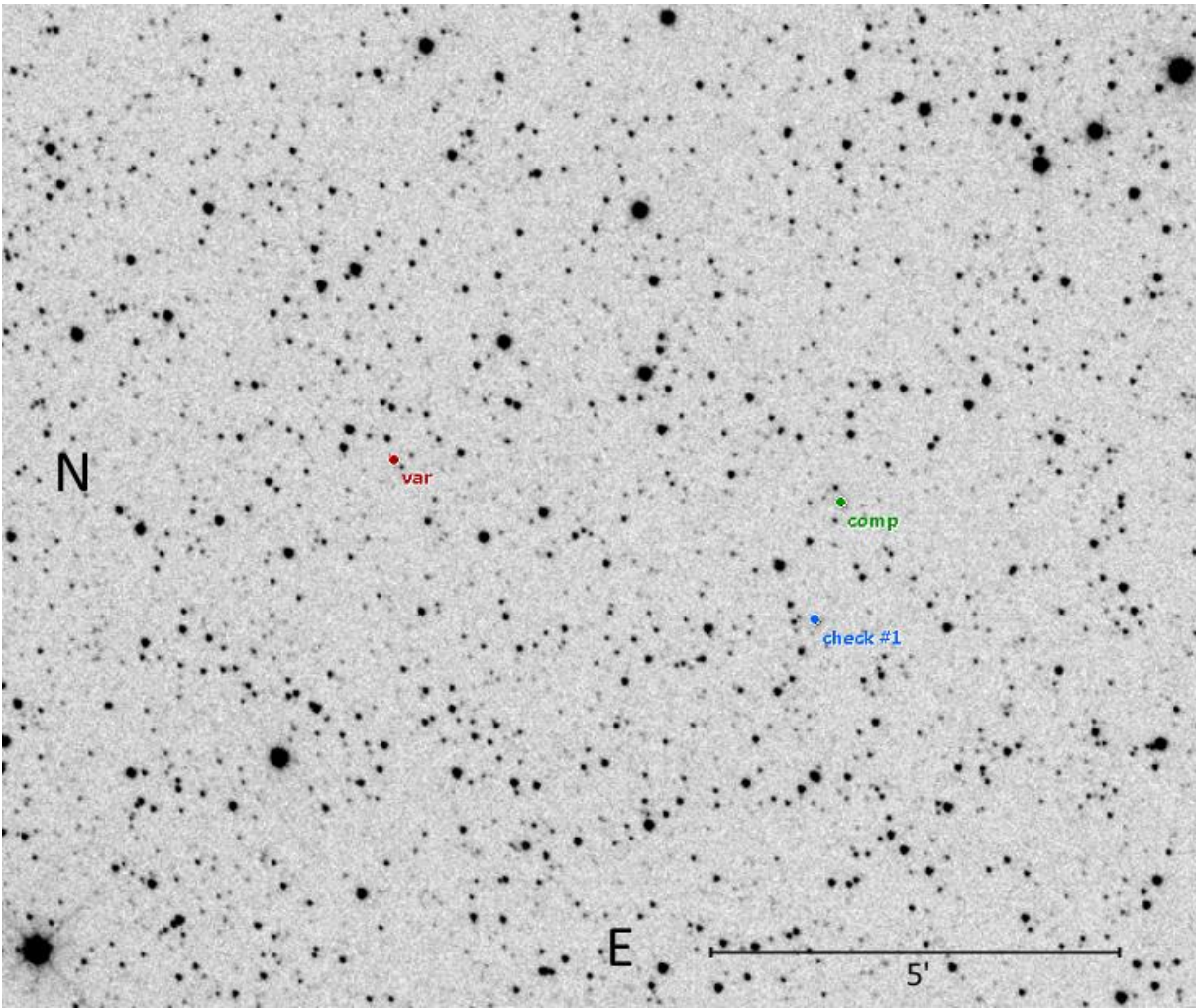


Fig 2: MoV97 Vul = UCAC3 236-213160 (**var**) in the field of GO Vul; (**comp**) is the comparison star and (**chk1**) is the check star.

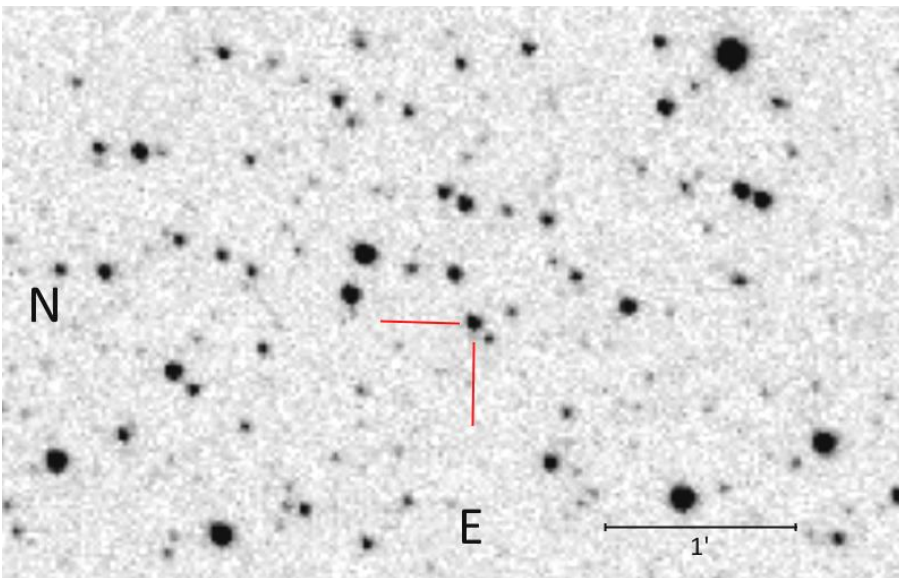


Fig 3: MoV97 Vul = UCAC3 236-213160

Table 1: MoV97 Vul = UCAC3 236-213160

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
F. Agerer	2454639,4093	I	-11426	0,0004	private com.
F. Agerer	2454639,5565	II	-11425,5	-0,0002	private com.
F. Agerer	2455430,4029	II	-8750,5	-0,0005	private com.
F. Agerer	2455430,5512	I	-8750	0,0000	private com.
F. Agerer	2455776,4533	I	-7580	-0,0009	private com.
W. Moschner	2457593,4797	I	-1434	-0,0001	
W. Moschner	2457621,4189	II	-1339,5	0,0008	
W. Moschner	2457621,5622	I	-1339	-0,0037	
W. Moschner	2457699,3211	I	-1076	0,0009	
W. Moschner	2457937,4601	II	-270,5	-0,0010	
W. Moschner	2457937,6088	I	-270	-0,0001	
W. Moschner	2457945,4443	II	-243,5	0,0008	
W. Moschner	2457945,5937	I	-243	0,0024	
W. Moschner	2457956,3839	II	-206,5	0,0016	
W. Moschner	2457956,5327	I	-206	0,0026	
W. Moschner	2457986,3906	I	-105	0,0005	
W. Moschner	2458017,4327	I	0	0,0000	
W. Moschner	2458042,4147	II	84,5	0,0001	

Remarks:

The variability of this star was discovered by Franz Agerer on Aug. 21/22 2010.

MoV98 Vul = UCAC3 236-212219

Right ascension: 19h45m57.1939s (2000)

Declination: +27° 48' 08.780"

UCAC3 Catalog:

Jmag: 12.320 Kmag: 12.118 Jmag-Kmag = 0.202

Comparison star = UCAC3 236-212436

Check Star = UCAC3 236-211904

Amplitude: Min I: 0.48 mag (instr.) Min II: 0.42 mag (instr.)

Type: EA type eclipsing binary

Min I = HJD 2457621.4513 + 1.235307*E
+0.0006 +-0.000007

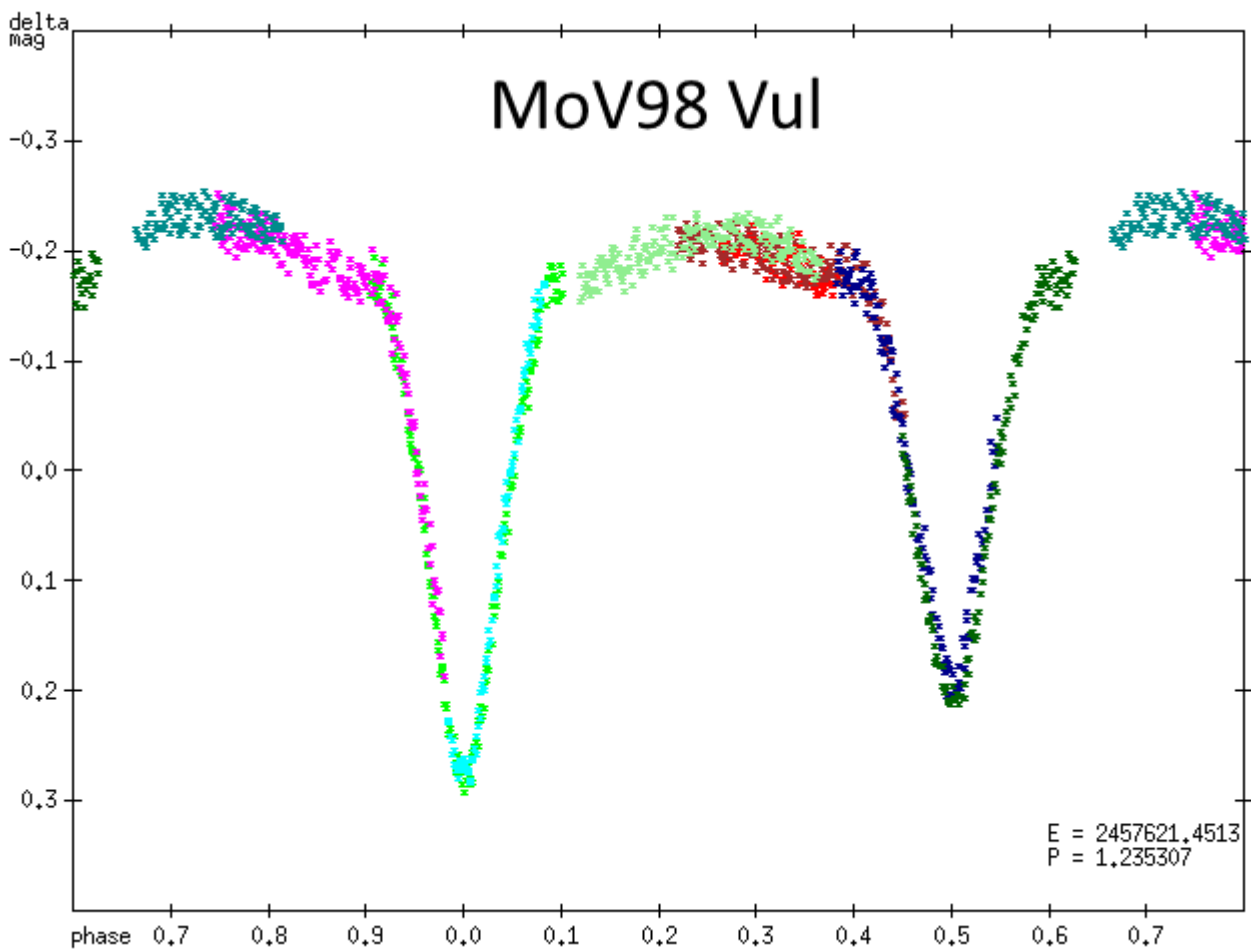


Fig 4: Phased lightcurve of MoV98 Vul = UCAC3 236-212219 using the ephemeris given above. FLI Proline 16803+V-filter (2016-2017). Presented elements were calculated by taking into account all minima (see tables below) with the method of least squares.

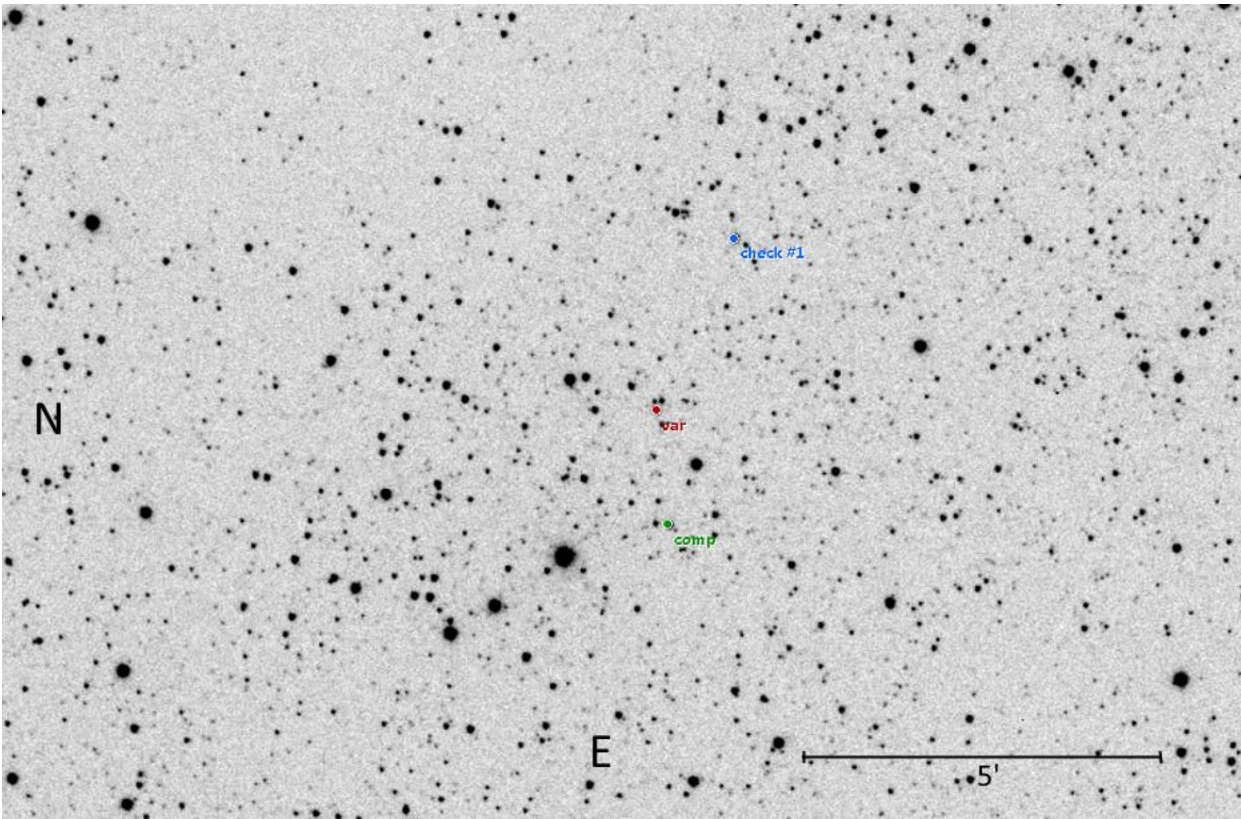


Fig 5: MoV98 Vul = UCAC3 236-212219 (*var*) in the field of GO Vul; (*comp*) is the comparison star and (*chk1*) is the check star.

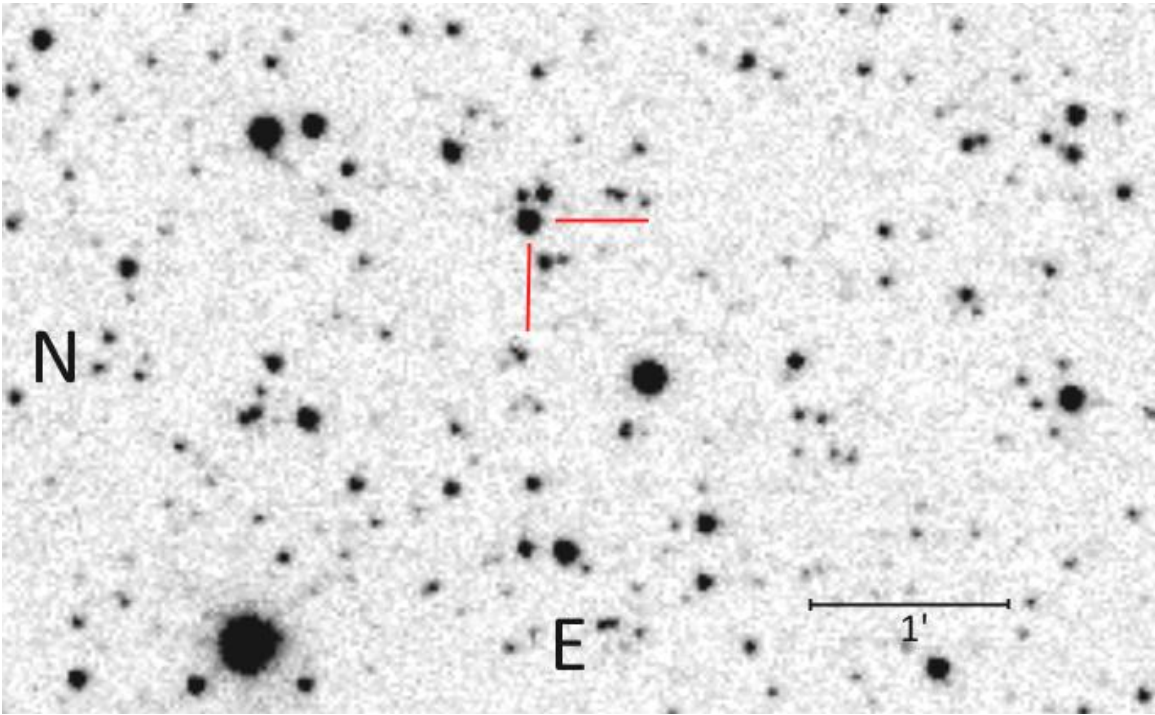


Fig 6: MoV98 Vul = UCAC3 236-212219

Table 2: MoV98 Vul = UCAC3 236-212219

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
F. Agerer	2454639,4206	I	-2414	0,0004	private com.
F. Agerer	2455776,5197	II	-1493,5	-0,0006	private com.
W. Moschner	2457621,4513	I	0	0,0000	
W. Moschner	2457699,2744	I	63	-0,0012	
W. Moschner	2457986,4840	II	295,5	-0,0005	
W. Moschner	2458017,3681	II	320,5	0,0009	

Remarks:

The variability of this star was discovered by Franz Agerer on Sep. 28/29 2009.
 Since January 2018 a lightcurve with a period of 1.2353 days is available by ASAS-SN [5]

Fr274 Lyr = UCAC3 238-156799

Right ascension: 19h06m31.2551s (2000)

Declination: +28° 59' 10.980"

XPM Catalog:

Vmag: 15.818 Bmag: 16.4 Bmag-Vmag = 0.582

Comparison star = UCAC3 238-156694

Check Star = UCAC3 239-157384

Amplitude: Min I: 0.38 mag (instr.) Min II: 0.33 mag (instr.)

Type: EW type eclipsing binary

Min I = HJD 2455074.4748 + 0.4507113*E
+ -0.0011 + -0.0000023

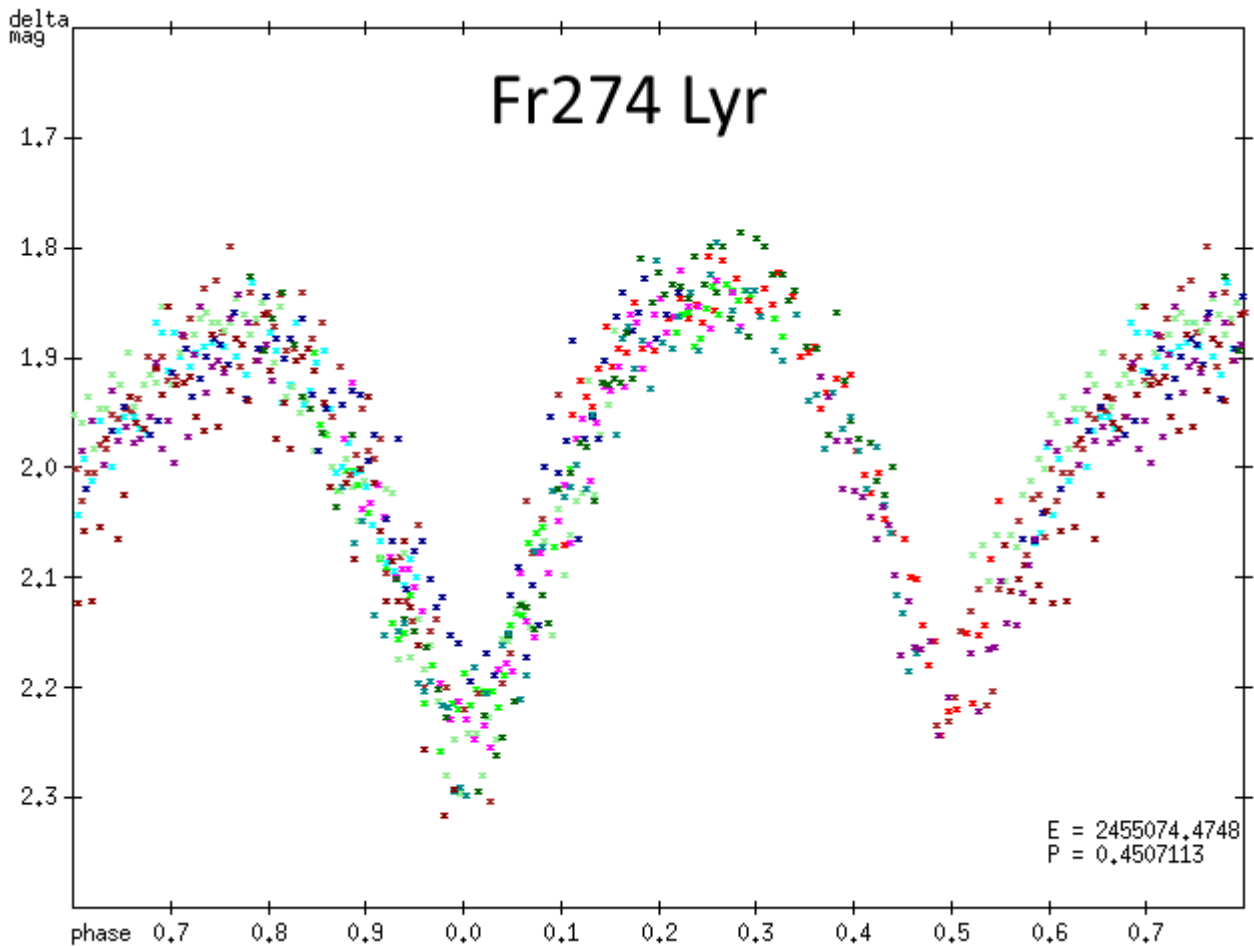


Fig 7: Phased lightcurve of Fr274 Lyr = UCAC3 238-156799 using the ephemeris given above. FLI Proline 16803+V-filter (2016-2017). Presented elements were calculated by taking into account all minima (see tables below) with the method of least squares.

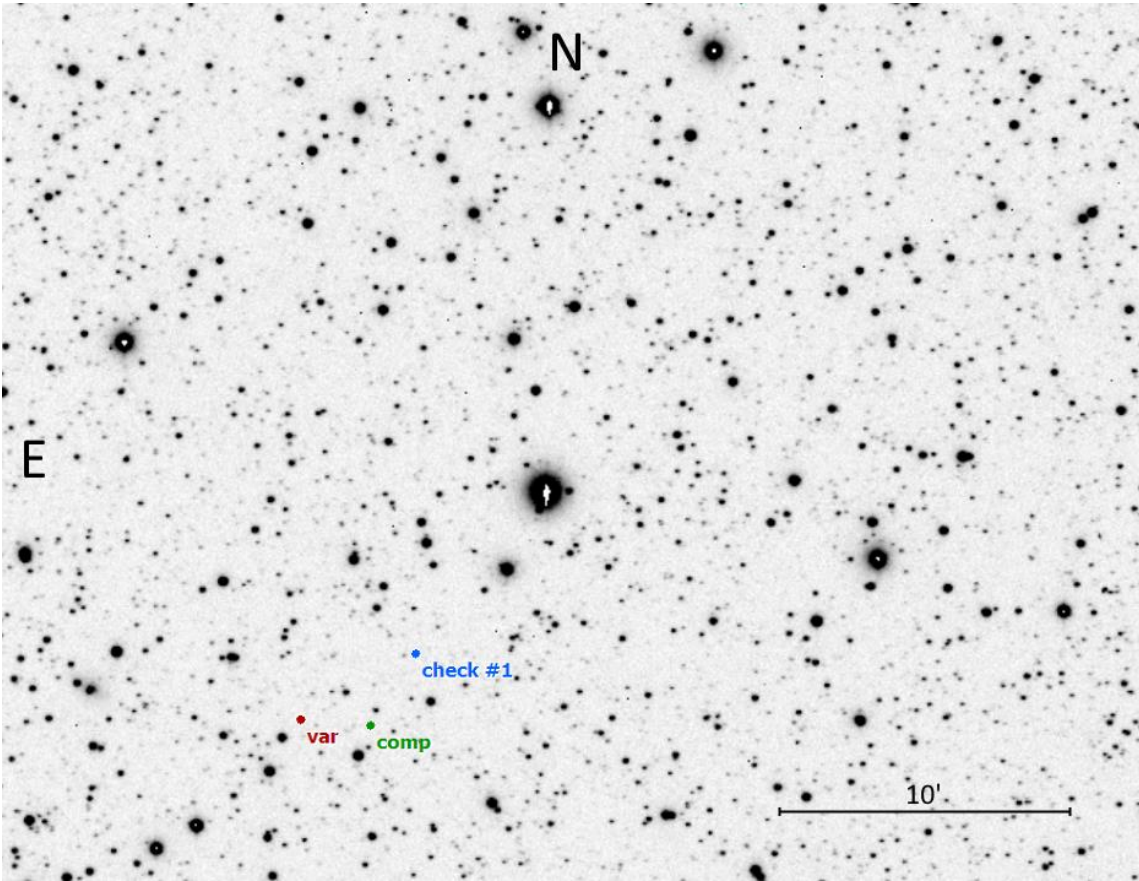


Fig 8: Fr274 Lyr = UCAC3 238-156799 (*var*) in the field of AA Lyr; (*comp*) is the comparison star and (*chk1*) is the check star.

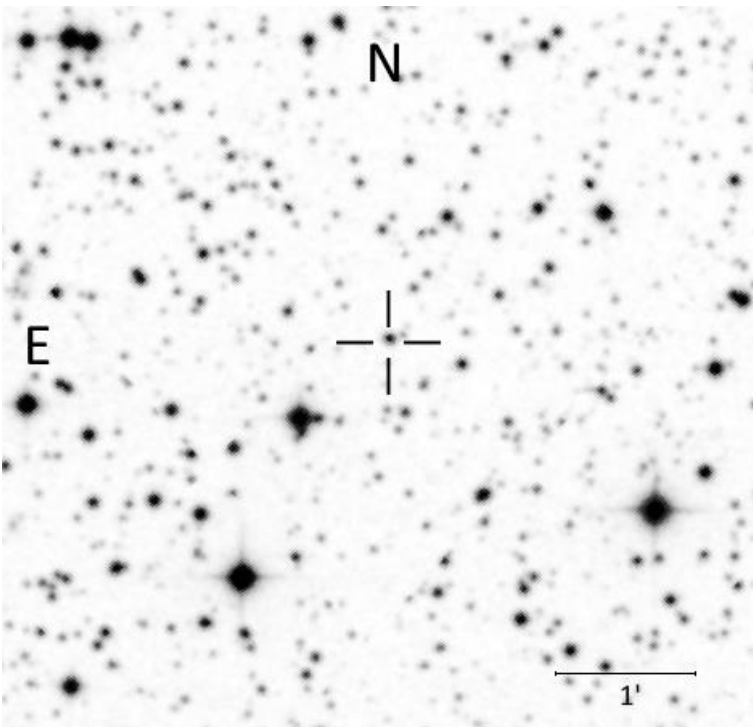


Fig 9: Fr274 Lyr = UCAC3 238-156799, Image from Aladin

Table 3: Minima of Fr274 Lyr = UCAC3 238-156799

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
P. Frank	2455074,4748	I	0	0,0000	
P. Frank	2455096,3373	II	48,5	0,0030	
P. Frank	2455380,5001	I	679	-0,0077	
P. Frank	2455385,4606	I	690	-0,0050	
P. Frank	2455387,4916	II	694,5	-0,0022	
P. Frank	2455429,4162	II	787,5	0,0063	
P. Frank	2456568,3636	II	3314,5	0,0062	
P. Frank	2456596,3031	II	3376,5	0,0016	
P. Frank	2456624,2492	II	3438,5	0,0036	
P. Frank	2456918,3267	I	4091	-0,0080	
Moschner/Frank	2457618,5148	II	5644,5	0,0001	
Moschner/Frank	2457626,4001	I	5662	-0,0021	
Moschner/Frank	2457899,5376	I	6268	0,0044	
Moschner/Frank	2457921,6186	I	6317	0,0005	
Moschner/Frank	2457935,5916	I	6348	0,0015	
Moschner/Frank	2457949,5651	I	6379	0,0029	
Moschner/Frank	2457950,4663	I	6381	0,0027	
Moschner/Frank	2457978,4033	I	6443	-0,0044	
Moschner/Frank	2458022,3537	II	6540,5	0,0016	
P. Frank	2458043,3078	I	6587	-0,0023	

Remarks: none

Fr275 Lyr = UCAC4 597-069471

Right ascension: 19h03m53.223s (2000)

Declination: +29° 18' 47.64"

XPM Catalog:

Vmag: 15.966 Bmag: 16.5 Bmag-Vmag = 0.534

Comparison star = UCAC3 239-156121

Check Star = UCAC3 239-156091

Amplitude: Min I: 0.47 mag (instr.) Min II: 0.38 mag (instr.)

Type: EW type eclipsing binary

Min I = HJD 2457978.4925 + 0.3754845*E
 +/-0.0011 +/-0.0000019

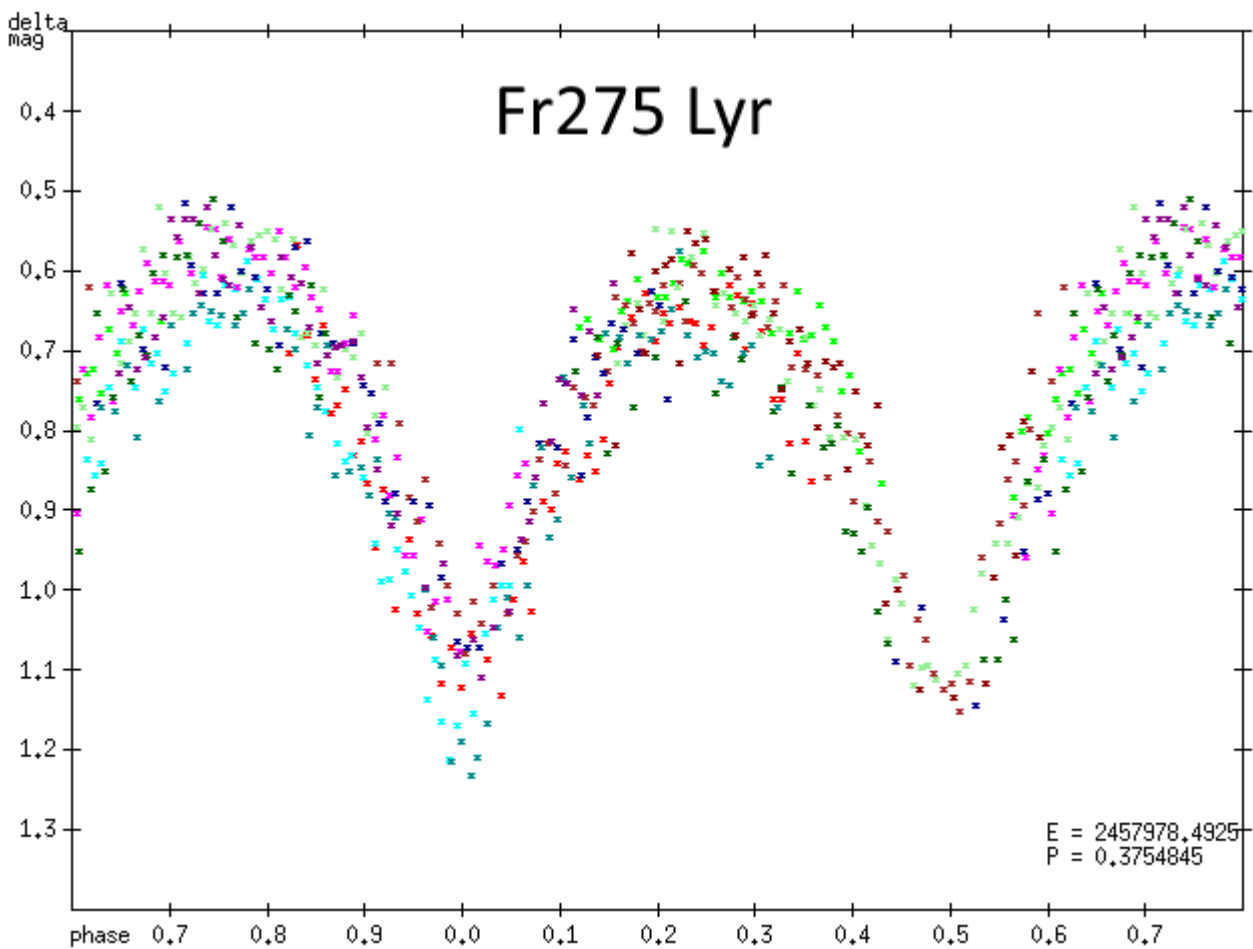


Fig 10: Phased lightcurve of Fr275 Lyr = UCAC4 597-069471 using the ephemeris given above. FLI Proline 16803+V-filter (2016-2017). Presented elements were calculated by taking into account all minima (see tables below) with the method of least squares.

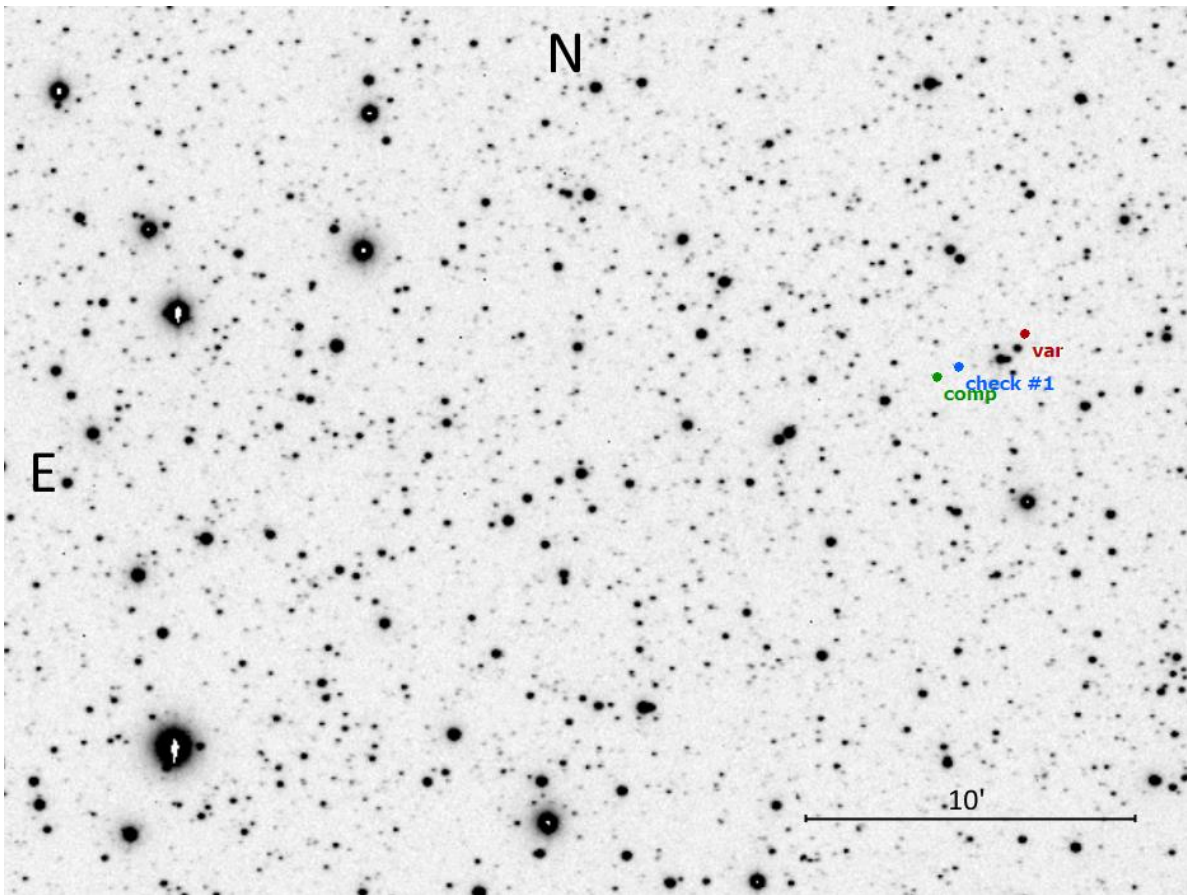


Fig 11: Fr275 Lyr = UCAC4 597-069471 (**var**) in the field of AA Lyr; (**comp**) is the comparison star and (**chk1**) is the check star.

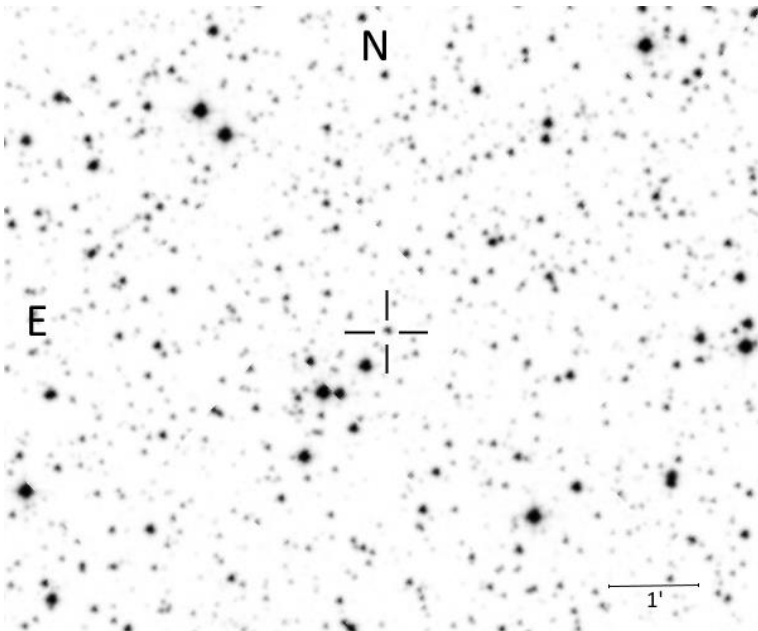


Fig 12: Fr275 Lyr = UCAC4 597-069471, Image from Aladin

Table 4: Minima of Fr275 Lyr = UCAC4 597-069471

Observer	HJD-Date	Type	Epoch	O-C (d)	Source
	Minimum				
P. Frank	2455074,4919	I	-7734	-0,0035	
P. Frank	2455380,5168	I	-6919	0,0016	
P. Frank	2455385,4066	I	-6906	0,0101	
P. Frank	2455387,4582	II	-6900,5	-0,0035	
P. Frank	2455409,4230	I	-6842	-0,0046	
P. Frank	2455418,4350	I	-6818	-0,0042	
P. Frank	2455429,5112	II	-6788,5	-0,0048	
P. Frank	2456568,3610	II	-3755,5	0,0005	
P. Frank	2456590,3333	I	-3697	0,0070	
P. Frank	2456596,3424	I	-3681	0,0083	
Moschner/Frank	2457618,4043	I	-959	0,0014	
Moschner/Frank	2457626,4757	I	-937,5	-0,0001	
Moschner/Frank	2457893,6290	I	-226	-0,0040	
Moschner/Frank	2457899,6383	I	-210	-0,0025	
Moschner/Frank	2457921,4252	I	-152	0,0063	
Moschner/Frank	2457921,6018	II	-151,5	-0,0048	
Moschner/Frank	2457935,4955	II	-114,5	-0,0040	
Moschner/Frank	2457949,5844	I	-77	0,0042	
Moschner/Frank	2457950,5156	II	-74,5	-0,0033	
Moschner/Frank	2457978,4925	I	0	0,0000	
Moschner/Frank	2458009,4672	II	82,5	-0,0028	
Moschner/Frank	2458022,4237	I	117	-0,0005	

Remarks: none

Fr276 Lyr = UCAC3 238-157541

Right ascension: 19h07m50.3140s (2000)

Declination: +28° 58' 48.120"

XPM Catalog:

Vmag: 14.627 Bmag: 15.4 Bmag-Vmag = 0.773

Comparison star = UCAC3 239-158442

Check Star = UCAC3 238-157597

Amplitude: Min I: 0.59 mag (instr.) Min II: 0.39 mag (instr.)

Type: EW type eclipsing binary

Min I = HJD 2456577.3112 + 0.3374952*E
+ -0.0009 + -0.0000024

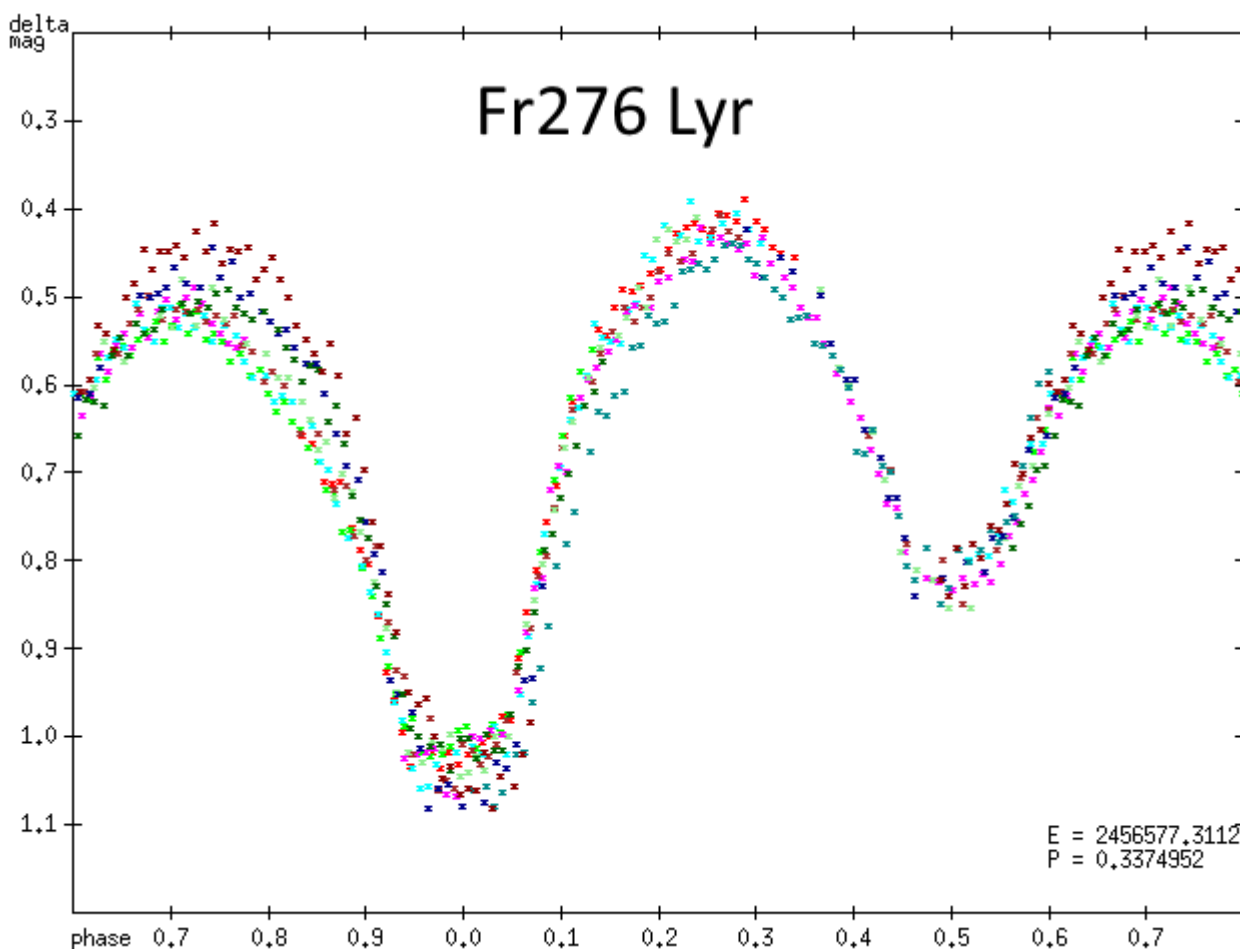


Fig 13: Phased lightcurve of Fr276 Lyr = UCAC3 238-157541 using the ephemeris given above. FLI Proline 16803+V-filter (2016-2017). The named period represent the observations good only until approx. JD 2457000.

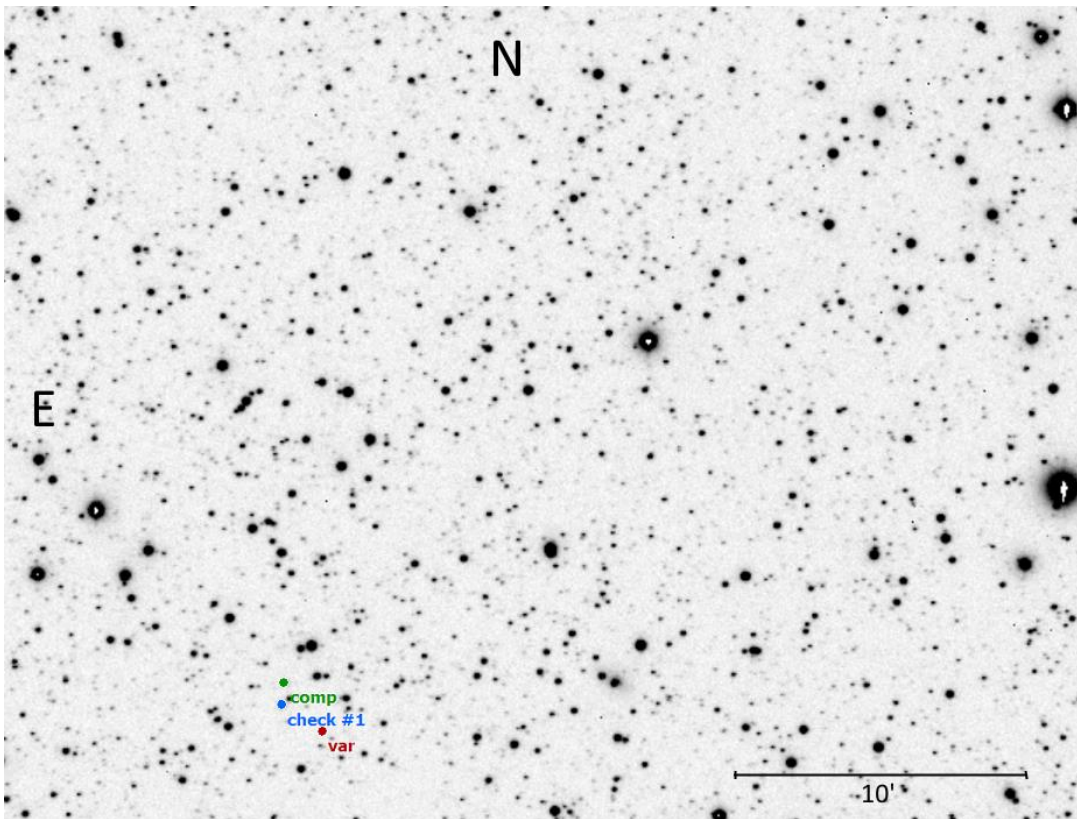


Fig 14: Fr276 Lyr = UCAC3 238-157541 (*var*) in the field of AA Lyr; (*comp*) is the comparison star and (*chk1*) is the check star.

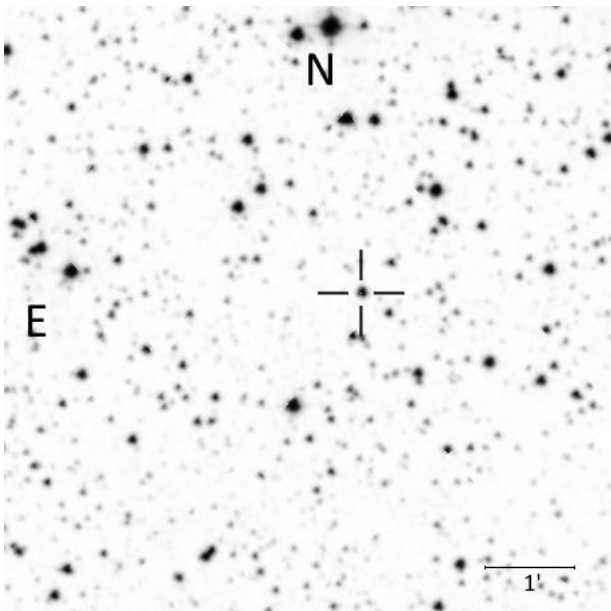


Fig 15: Fr276 Lyr = UCAC3 238-157541, Image from Aladin

Table 5: Minima of Fr276 Lyr = UCAC3 238-157541

Observer	HJD-Date	Type	Epoch	O-C (d)	Source
	Minimum				
P. Frank	2455074,4648	I	-4453	0,0197	
P. Frank	2455380,3984	II	-3546,5	0,0139	
P. Frank	2455380,5656	I	-3546	0,0124	
P. Frank	2455385,4591	II	-3531,5	0,0122	
P. Frank	2455387,4841	II	-3525,5	0,0122	
P. Frank	2455409,4214	II	-3460,5	0,0123	
P. Frank	2455409,5846	I	-3460	0,0068	
P. Frank	2455418,3698	I	-3434	0,0171	
P. Frank	2455418,5316	II	-3433,5	0,0102	
P. Frank	2455429,3332	II	-3401,5	0,0119	
P. Frank	2455429,5053	I	-3401	0,0153	
P. Frank	2456500,5327	II	-227,5	0,0017	
P. Frank	2456568,3654	II	-26,5	-0,0022	
P. Frank	2456577,3112	I	0	0,0000	
P. Frank	2456579,3373	I	6	0,0011	
P. Frank	2456590,3026	II	38,5	-0,0022	
P. Frank	2456596,3763	II	56,5	-0,0034	
P. Frank	2456624,2251	I	139	0,0021	
P. Frank	2456918,3479	II	1010,5	-0,0022	
P. Frank	2456918,5182	I	1011	-0,0006	
Moschner/Frank	2457618,4820	I	3085	-0,0019	
Moschner/Frank	2457626,4124	II	3108,5	-0,0026	
Moschner/Frank	2457893,5380	I	3900	-0,0045	
Moschner/Frank	2457899,6123	I	3918	-0,0051	
Moschner/Frank	2457921,5494	I	3983	-0,0052	
Moschner/Frank	2457935,5620	II	4024,5	0,0014	
Moschner/Frank	2457949,3987	II	4065,5	0,0008	
Moschner/Frank	2457949,5633	I	4066	-0,0034	
Moschner/Frank	2457950,4113	II	4068,5	0,0009	
Moschner/Frank	2457950,5755	I	4069	-0,0037	
Moschner/Frank	2457978,4223	II	4151,5	-0,0002	
Moschner/Frank	2457978,5913	I	4152	0,0000	
Moschner/Frank	2458009,4699	II	4243,5	-0,0022	
Moschner/Frank	2458022,4703	I	4282	0,0047	
P. Frank	2458043,3924	I	4344	0,0021	

Remarks:

Since January 2018 a lightcurve with a period of 0.3375 days is available by ASAS-SN [5]

Our observations show since JD 2456000 there is the suspicion of alteration of the period. Further observations are necessary to confirm about an period-change.

Acknowledgements

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The authors thank Franz Agerer (BAV) for providing his personal data-analysis program.

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