BAV Journal

2017 No. 16 ISSN 2366-6706

Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V.

http://bav-astro.de

First Elements for six New Variable Stars in Several Fields, Part III

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June 2017

Abstract: *6 new variable stars (*GSC 2695-03472, UCAC3 249-234814, GSC 2696-02034, UCAC3 284-090447, UCAC3 284-091086, UCAC3 284-090934*) 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, six further variables were found in their surroundings, which are new to our knowledge (not included in AAVSO VSX and GCVS). This paper is the third part of a series dealing with numerous discoveries.

These new variables were discovered on images of the 102mm-TeleVue-Refractor (P. Frank, Velden/Germany) by Peter Frank.

Further detailed observations were made using a 400mm-ASA-Astrograph (W. Moschner, Nerpio/ Spain) and the 102mm-TeleVue-Refractor (P. Frank, Velden/Germany) in 2016 and earlier, which are discussed subsequently in detail:

Fr194 Cyg = GSC 2695-03472
Fr195 Cyg = UCAC3 249-234814
Fr201 Cyg = GSC 2696-02034
Fr179 Aur = UCAC3 284-090447
Fr180 Aur = UCAC3 284-091086
Fr181 Aur = UCAC3 284-090934

Observations

The discovery observations were carried out with a 102mm/5.0 TeleVue-Refractor (Velden/Germany) and a SIGMA 1603 CCD-Camera containing a cooled Kodak KAF1603ME chip. Normally, the exposures are 60 s through an IR & UV cut off filter.

Further observations were carried out between June 2015 and September 2016 with a robotic telescope 0.40 m f/3.7 ASA-Astrograph (Nerpio, Spain) equipped with a cooled FLI Proline 16803 CCD-Camera and V-filter. The exposure times were between 60 and 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 NOMAD 1 Catalog (Zacharias et al. 2015) [3] or the APASS DR9 Catalog (Henden et al. 2016) [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 colour coding of the symbols plots denotes data taken on different nights.

Fr194 Cyg = GSC 2695-03472
Right ascension: 20h 47m 25.70s (2000)
Declination: +33° 57' 06.185"
APASS DR9 Catalog:
Vmag: 12.828 /Bmag: 13.282 /Bmag-Vmag = 0.454

Comparison star = GSC 2695 03793
Check Star = GSC 2695-03585

Amplitude Max-Min: 0.11 mag (instr.)
Type: DSCT

Max = HJD 2456682.4727+ 0.1201786*E
+-0.0005 +-0.0000004

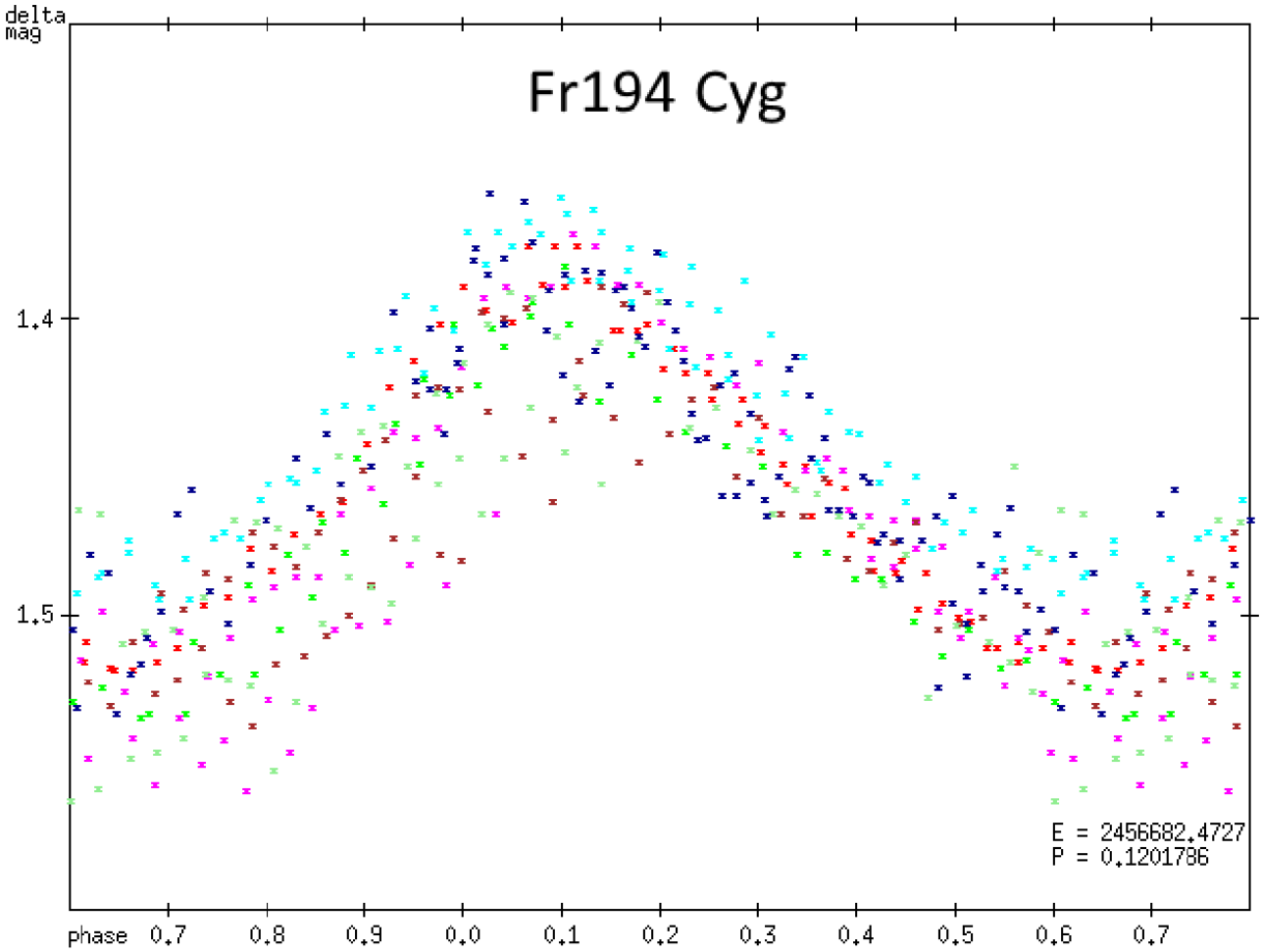

Fig 1: Phased lightcurve of Fr194 Cyg = GSC 2695-03472 using the ephemeris given above. SIGMA 1603 CCD-Camera and IR & UV cut off filter. Presented elements were calculated by taking into account all maxima (see tables below) with the method of least squares.

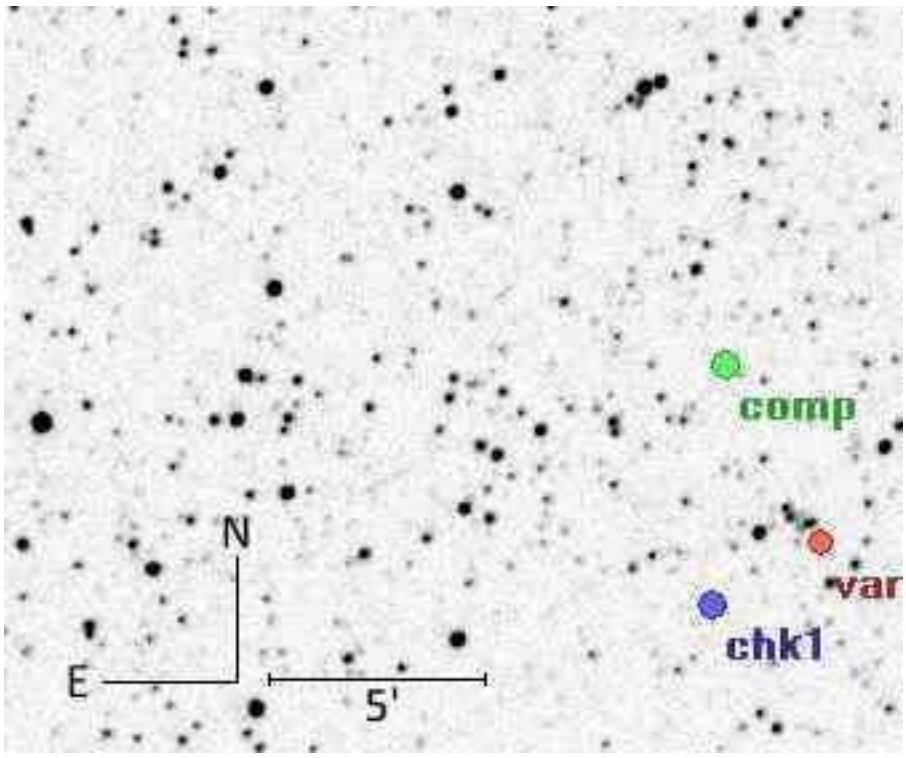

Fig 2: Fr194 Cyg = GSC 2695-03472 (var) in the field of V2021 Cyg; (comp) is the comparison star and (chk1) is the check star.

Table 1: Maxima of Fr194 Cyg = GSC 2695-03472

Observer	HJD-Date Maximum	Type	Epoch	O-C (d)	Source
P.Frank	2454682,4727		0	0,0000	BAVM
P.Frank	2454719,3663		307	-0,0012	BAVM
P.Frank	2456159,4719		12290	0,0042	BAVM
P.Frank	2456159,5858		12291	-0,0021	BAVM
P.Frank	2456650,2809		16374	0,0038	BAVM
P.Frank	2456654,2427		16407	-0,0003	BAVM
P.Frank	2456657,2478		16432	0,0003	BAVM
P.Frank	2456937,3788		18763	-0,0050	BAVM
Moschner/Frank	2457692,3458		25045	0,0001	
Moschner/Frank	2457692,4613		25046	-0,0046	
Moschner/Frank	2457693,3091		25053	0,0019	

Remarks: none

Fr195 Cyg = UCAC3 249-234814
Right ascension: 20h 46m 53.5575s (2000)
Declination: +34° 26' 46.262"
NOMAD 1 Catalog:
Vmag: 14.220 /Bmag: 15.050 /Bmag-Vmag = 0.830

Comparison star = GSC 2695 03746
Check Star = GSC 2695-01294

Amplitude Min I: 0.37 mag (instr.) Min II: 0.37 mag (instr.)
Type: WUMa type eclipsing binary

Max = HJD 2457703.3202 + 0.349701*E
+-0.0007 +-0.000005

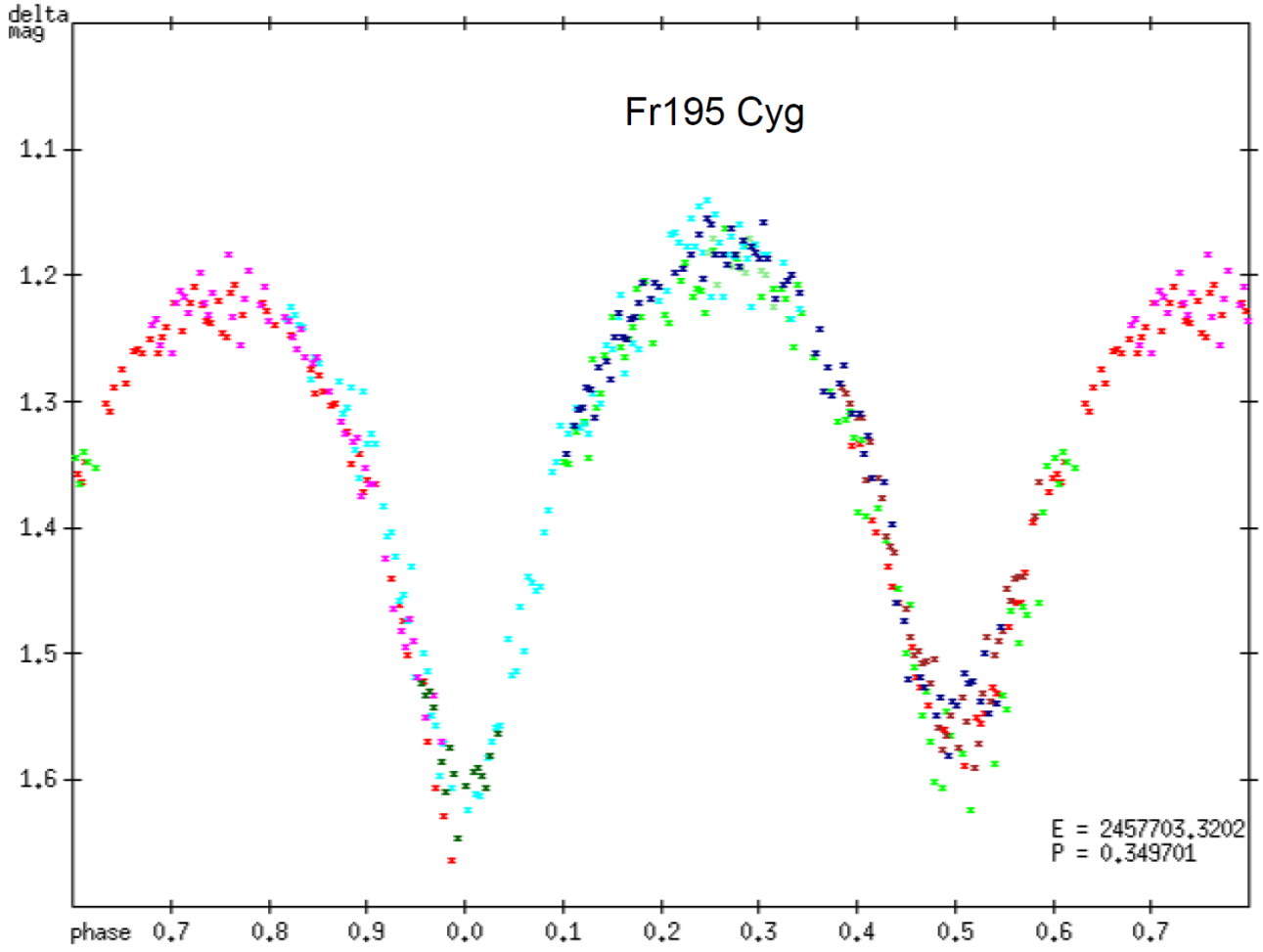

Fig 3: Phased lightcurve of Fr195 Cyg = UCAC3 249-234814 using the ephemeris given above. FLI Proline 16803+V-filter. Presented elements were calculated by taking into account all minima (see tables below) with the method of least squares.

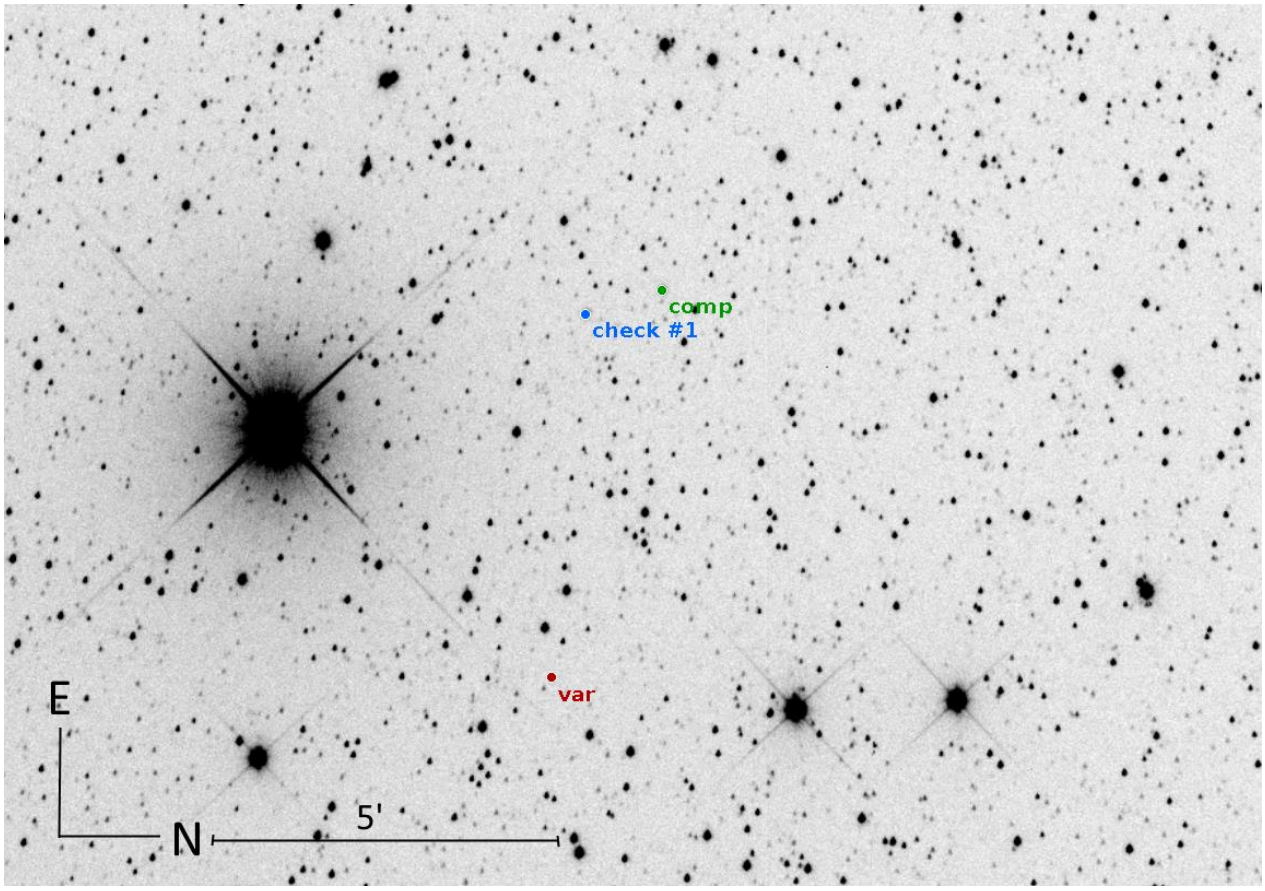

Fig 4: Fr195 Cyg = UCAC3 249-234814 (var) in the field of V2021 Cyg; (comp) is the comparison star and (check#1) is the check star.

Table 2: Minima of Fr195 Cyg = UCAC3 249-234814

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
P. Frank	2454684,5270	II	-8632,5	0,0007	
P. Frank	2455050,4890	I	-7586	0,0006	
P. Frank	2456159,3900	I	-4415	-0,0003	
P. Frank	2456159,5660	II	-4414,5	0,0009	
P. Frank	2456650,3734	I	-3011	0,0029	
P. Frank	2456654,2173	I	-3000	0,0001	
P. Frank	2456937,2993	II	-2190,5	-0,0009	
P. Frank	2457287,3524	II	-1189,5	0,0015	
P. Frank	2457297,3173	I	-1161	0,0000	
P. Frank	2457297,4946	II	-1160,5	0,0024	
P. Frank	2457298,3649	I	-1158	-0,0015	
P. Frank	2457307,4590	I	-1132	0,0003	
P. Frank	2457658,3855	II	-128,5	0,0019	
P. Frank	2457658,5561	I	-128	-0,0024	
P. Frank	2457684,2610	II	-54,5	-0,0005	
P. Frank	2457684,4375	I	-54	0,0012	
Moschner/Frank	2457692,3052	II	-31,5	0,0006	
Moschner/Frank	2457693,3557	II	-28,5	0,0020	
Moschner/Frank	2457701,3993	II	-5,5	0,0025	
Moschner/Frank	2457703,3202	I	0	0,0000	
Moschner/Frank	2457704,3681	I	3	-0,0012	

Moschner/Frank	**2457706,2932**	**II**	**8,5**	**0,0005**
Moschner/Frank	**2457708,3892**	**II**	**14,5**	**-0,0017**
Moschner/Frank	**2457709,2646**	**I**	**17**	**-0,0005**
P. Frank	**2457722,2073**	**I**	**54**	**0,0032**
P. Frank	**2457722,3793**	**II**	**54,5**	**0,0004**
P. Frank	**2457731,2964**	**I**	**80**	**0,0001**
P. Frank	**2457733,2202**	**II**	**85,5**	**0,0006**
P. Frank	**2457733,3913**	**I**	**86**	**-0,0032**

Remarks: none

Fr201 Cyg = GSC 2696-02034
Right ascension: 20h 52m 57.31s (2000)
Declination: +34° 16' 11.2"
APASS DR9 Catalog:
Vmag: 13.440 /Bmag: 14.085 /Bmag-Vmag = 0.645

Comparison star = GSC 2696 01902
Check Star = GSC 2696-02757

Amplitude Min I: 0.37 mag (instr.) Min II: 0.25 mag (instr.)
Type: EB type eclipsing binary

Min = HJD 2457703.3771 + 0.6244045*E
+-0.0007 +-0.0000040

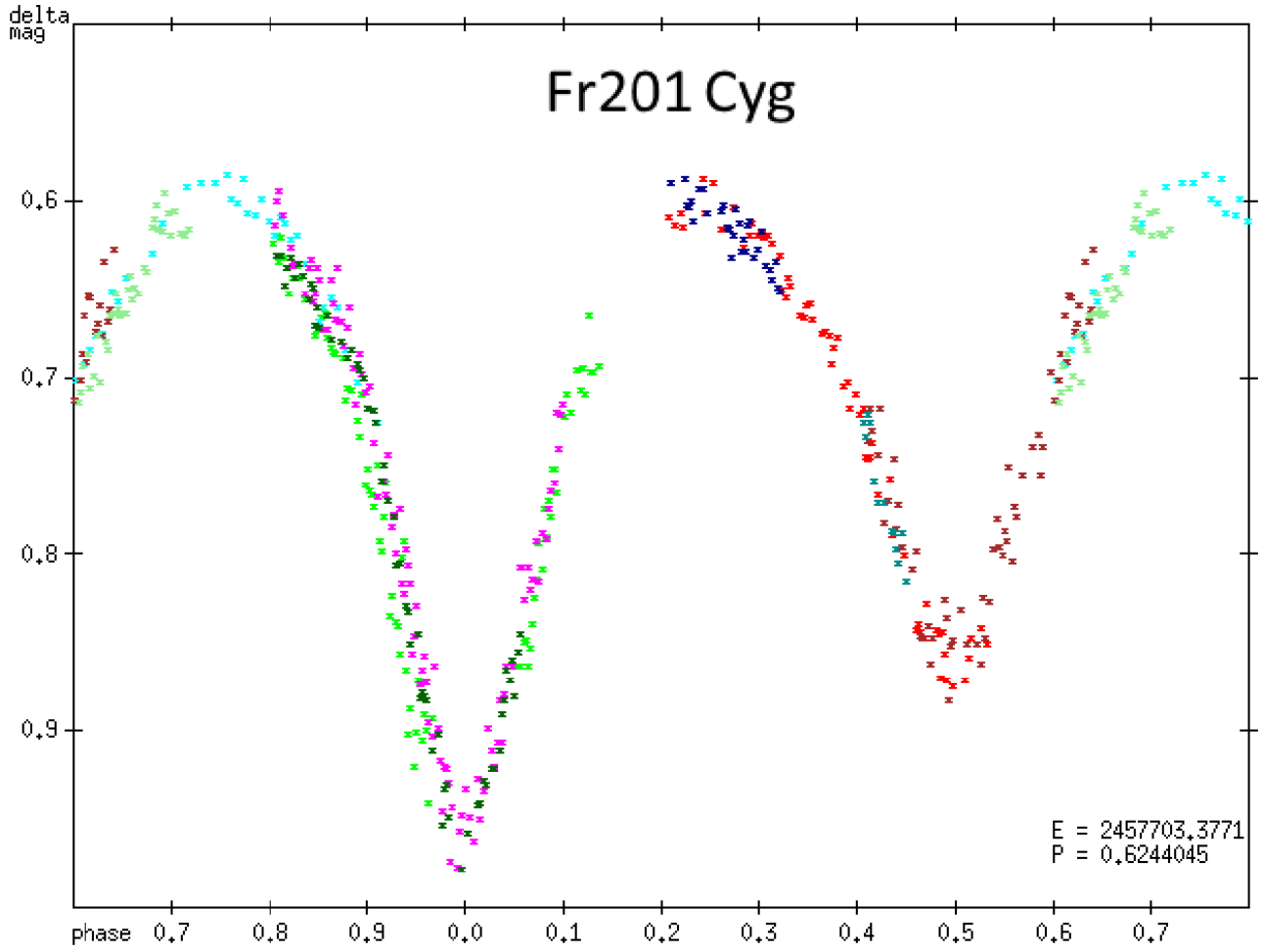

Fig 5: Phased lightcurve of Fr201 Cyg = GSC 2696-02034 using the ephemeris given above. FLI Proline 16803+V-filter. Presented elements were calculated by taking into account all minima (see tables below) with the method of least squares.

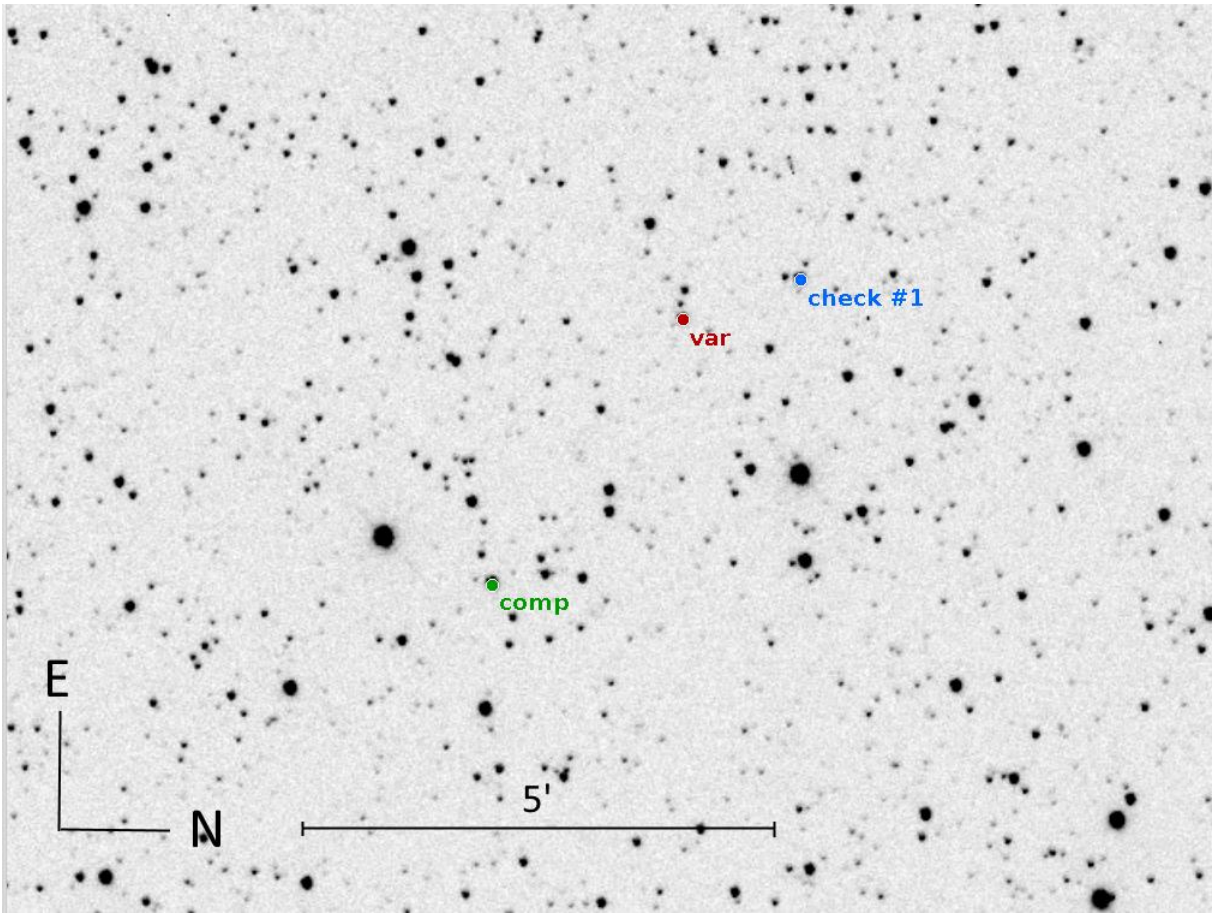

Fig 6: Fr201 Cyg = GSC 2696-02034 (var) in the field of V2021 Cyg; (comp) is the comparison star and (check#1) is the check star.

Table 3: Minima of Fr201 Cyg = GSC 2696-02034

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
P. Frank	2454682,5097	I	-4838	0,0016	IBVS 6084
P. Frank	2454719,3454	I	-4779	-0,0026	
P. Frank	2455480,4983	I	-3560	0,0012	
P. Frank	2456159,5389	II	-2472,5	0,0019	
P. Frank	2456650,3203	II	-1686,5	0,0014	
P. Frank	2457297,5139	I	-650	-0,0003	
P. Frank	2457298,4521	II	-648,5	0,0013	
P. Frank	2457307,5065	I	-634	0,0019	
P. Frank	2457658,4199	I	-72	-0,0001	
P. Frank	2457684,3304	II	-30,5	-0,0024	
Moschner/Frank	2457693,3866	I	-16	0,0000	
Moschner/Frank	2457703,3771	I	0	0,0000	
Moschner/Frank	2457704,3119	II	1,5	-0,0018	
Moschner/Frank	2457708,3716	I	8	-0,0007	
P. Frank	2457727,4186	II	38,5	0,0019	
P. Frank	2457733,3503	I	48	0,0018	

Remarks: The first minima from table 3 was published by J. Hübscher (2013) in IBVS 6084 [5]. Since 2017 Fr201 Cyg has been included in the VSX-Database without elements.

Fr179 Aur = UCAC3 284-090447
Right ascension: 06h 02m 47.81s (2000)
Declination: +51° 57' 30.3"
APASS DR9 Catalog:
Vmag: 16.130 /Bmag: 17.181 /Bmag-Vmag = 1.051

Comparison star = UCAC3 285-090700
Check Star = UCAC3 285-090478

Amplitude Min I: 0.38 mag (instr.) Min II: 0.35 mag (instr.)
Type: WUMa type eclipsing binary

Max = HJD 2456013.3412 + 0.269476*E
+-0.0007 +-0.000005

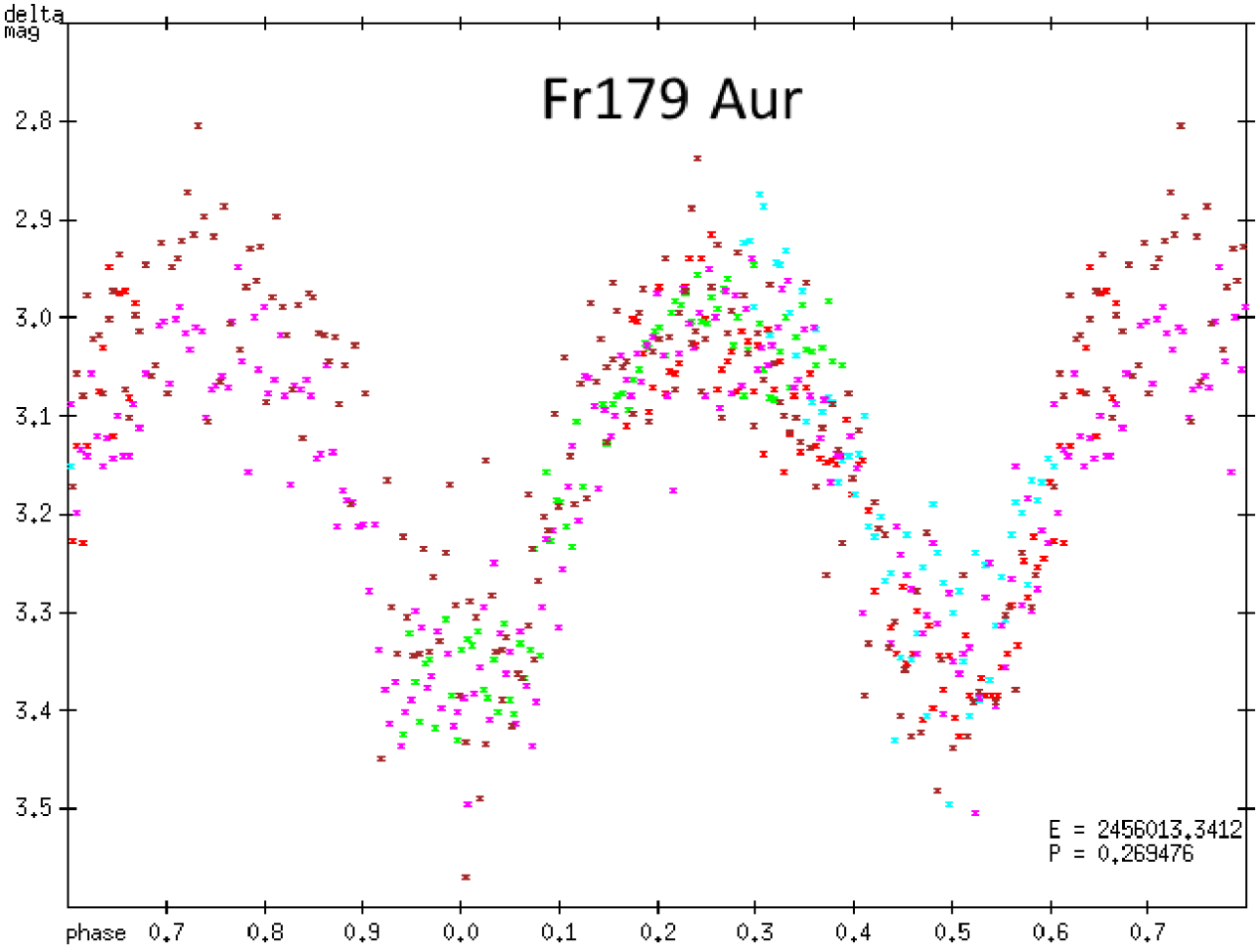

Fig 7: Phased lightcurve of Fr179 Aur = UCAC3 284-090447 using the ephemeris given above. FLI Proline 16803+V-filter. Presented elements were calculated by taking into account all minima (see tables below) with the method of least squares.

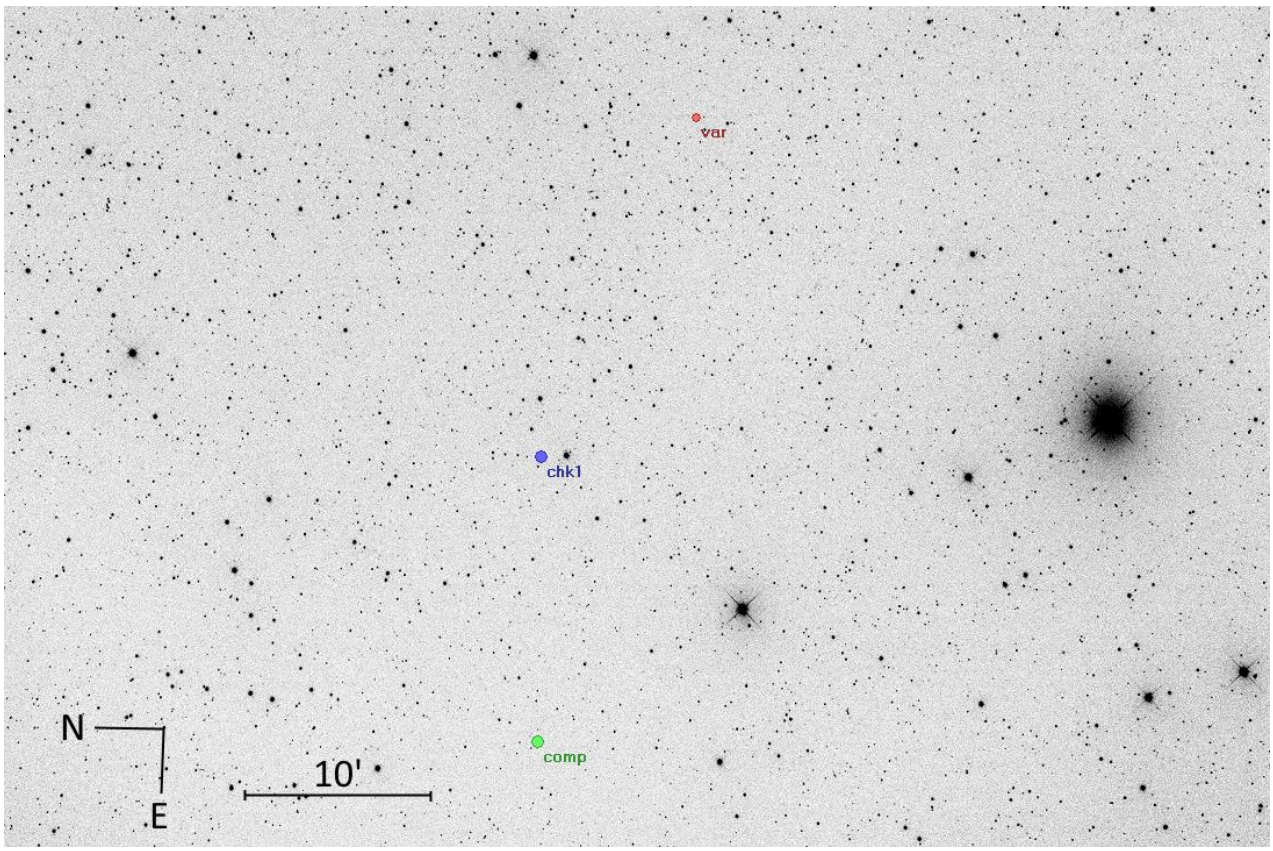

Fig 8: Fr179 Aur = UCAC3 284-090447 (var) in the field of KL Aur; (comp) is the comparison star and (chk1) is the check star.

Table 4: Minima of Fr179 Aur = UCAC3 284-090447

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
P. Frank	2456013,3412	I	0	0,0000	
P. Frank	2456013,4797	II	0,5	0,0038	
P. Frank	2456747,3993	I	2724	0,0055	
W. Moschner	2457690,6960	II	6224,5	0,0014	
W. Moschner	2457704,7066	II	6276,5	-0,0007	
W. Moschner	2457756,5807	I	6469	-0,0007	
W. Moschner	2457763,4532	II	6494,5	0,0001	
W. Moschner	2457763,5764	I	6495	-0,0114	
W. Moschner	2457814,3829	II	6683,5	-0,0011	

Remarks: total eclipse

Fr180 Aur = UCAC3 284-091086
Right ascension: 06h 06m 55.72s (2000)
Declination: +51° 47' 49.9"
APASS DR9 Catalog:
Vmag: 15.873 /Bmag: 16.751 /Bmag-Vmag = 0.878

Comparison star = UCAC3 284-091060
Check Star = UCAC3 285-090478

Amplitude Min I: 0.37 mag (instr.) Min II: 0.32 mag (instr.)
Type: WUMa type eclipsing binary

Min = HJD 2457763.5279 + 0.364163*E
+-0.0007 +-0.000006

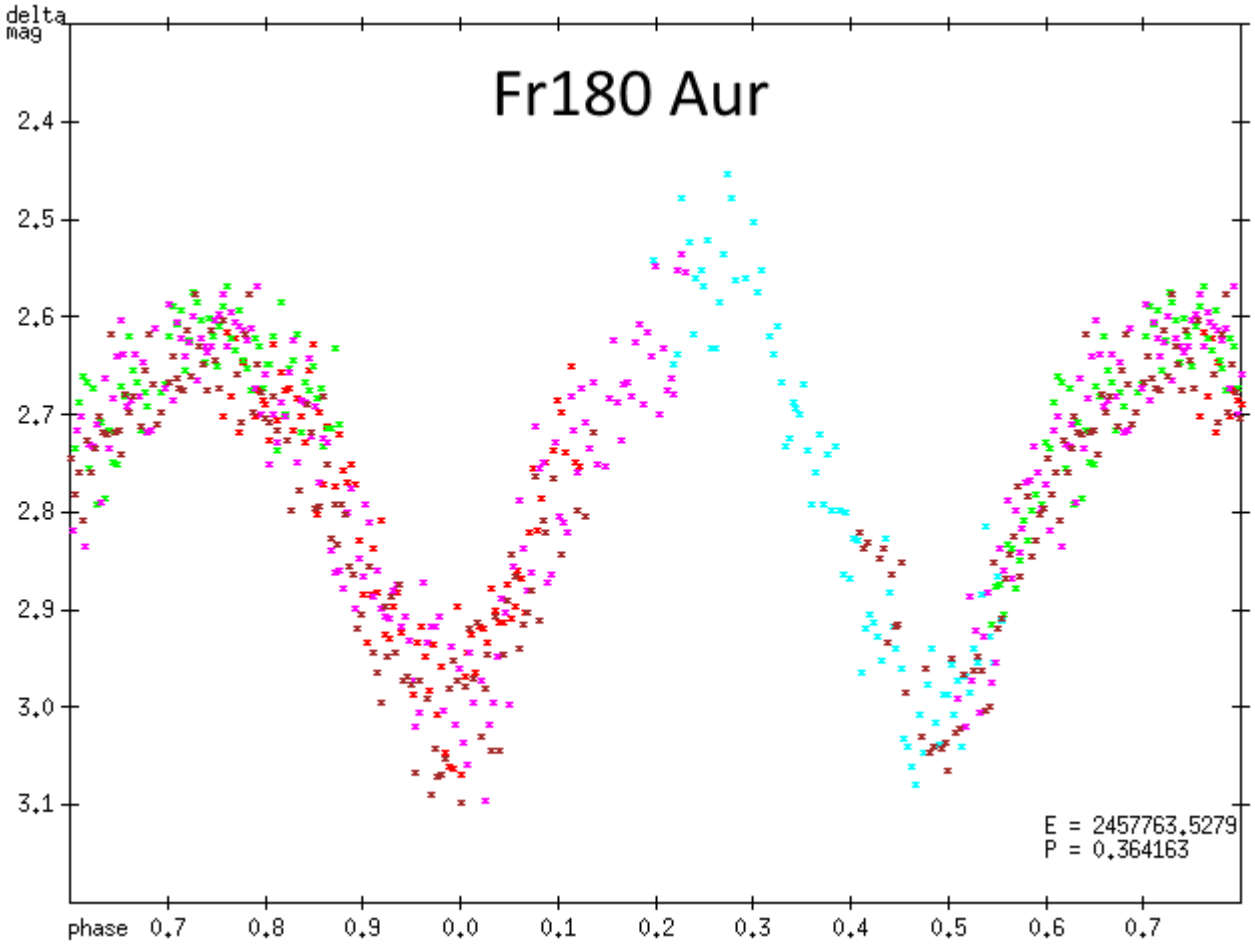

Fig 9: Phased lightcurve of Fr180 Aur = UCAC3 284-091086 using the ephemeris given above. FLI Proline 16803+V-filter. Presented elements were calculated by taking into account all minima (see tables below) with the method of least squares.

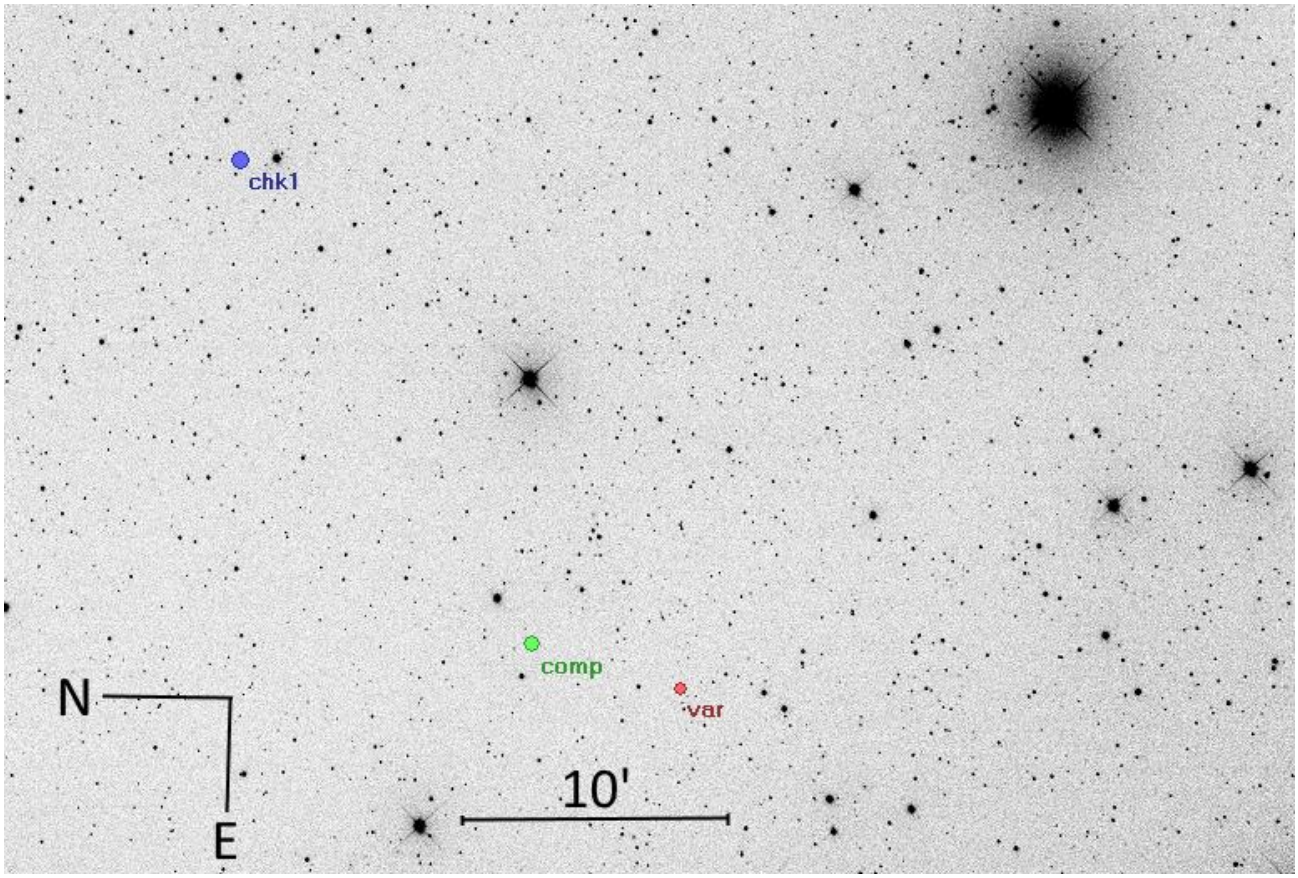

Fig 10: Fr180 Aur = UCAC3 284-091086 (var) in the field of KL Aur; (comp) is the comparison star and (chk1) is the check star.

Table 5: Minima of Fr180 Aur = UCAC3 284-091086

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
P. Frank	2456013,3633	I	-4806	0,0028	
P. Frank	2456013,5368	II	-4805,5	-0,0058	
P. Frank	2456747,3288	II	-2790,5	-0,0022	
W. Moschner	2457690,6895	I	-200	-0,0058	
W. Moschner	2457704,7045	II	-161,5	-0,0111	
W. Moschner	2457756,6040	I	-19	-0,0048	
W. Moschner	2457763,5279	I	0	0,0000	
W. Moschner	2457814,3284	II	139,5	-0,0002	
W. Moschner	2457814,5020	I	140	-0,0087	

Remarks: none

Fr181 Aur = UCAC3 284-090934
Right ascension: 06h 05m 52.98s (2000)
Declination: +51° 40' 07.1"
NOMAD 1 Catalog:
Vmag: 15.970 /Bmag: 16.740 /Bmag-Vmag = 0.770

Comparison star = UCAC3 284-091060
Check Star = UCAC3 285-090478

Amplitude Min I: 1.12 mag (instr.) Min II: 1.00 mag (instr.)
Type: WUMa type eclipsing binary

Min = HJD 2456013.3945 + 0.2643665*E
+-0.0005 +-0.0000011

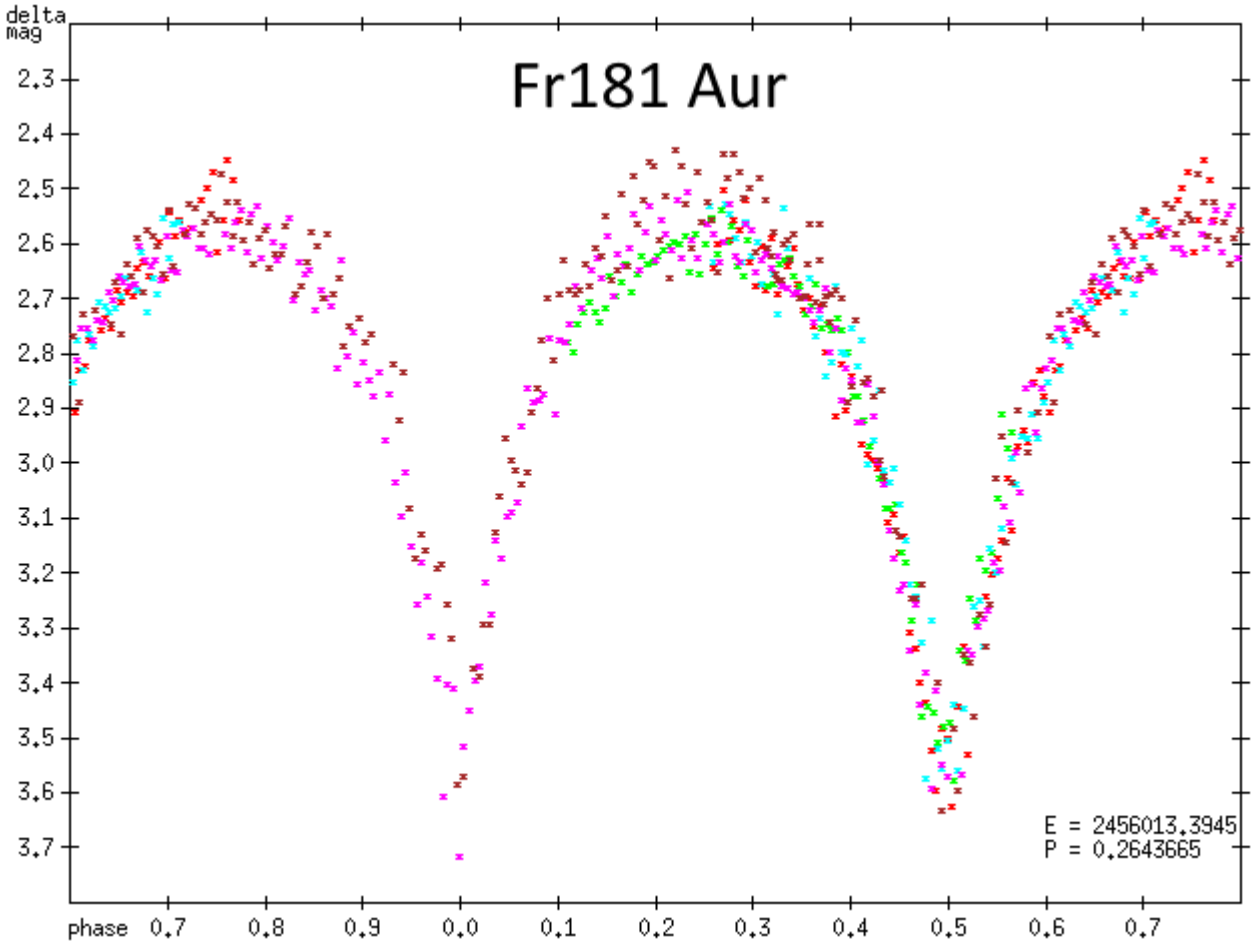

Fig 11: Phased lightcurve of Fr181 Aur = UCAC3 284-090934 using the ephemeris given above. FLI Proline 16803+V-filter. Presented elements were calculated by taking into account all minima (see tables below) with the method of least squares.

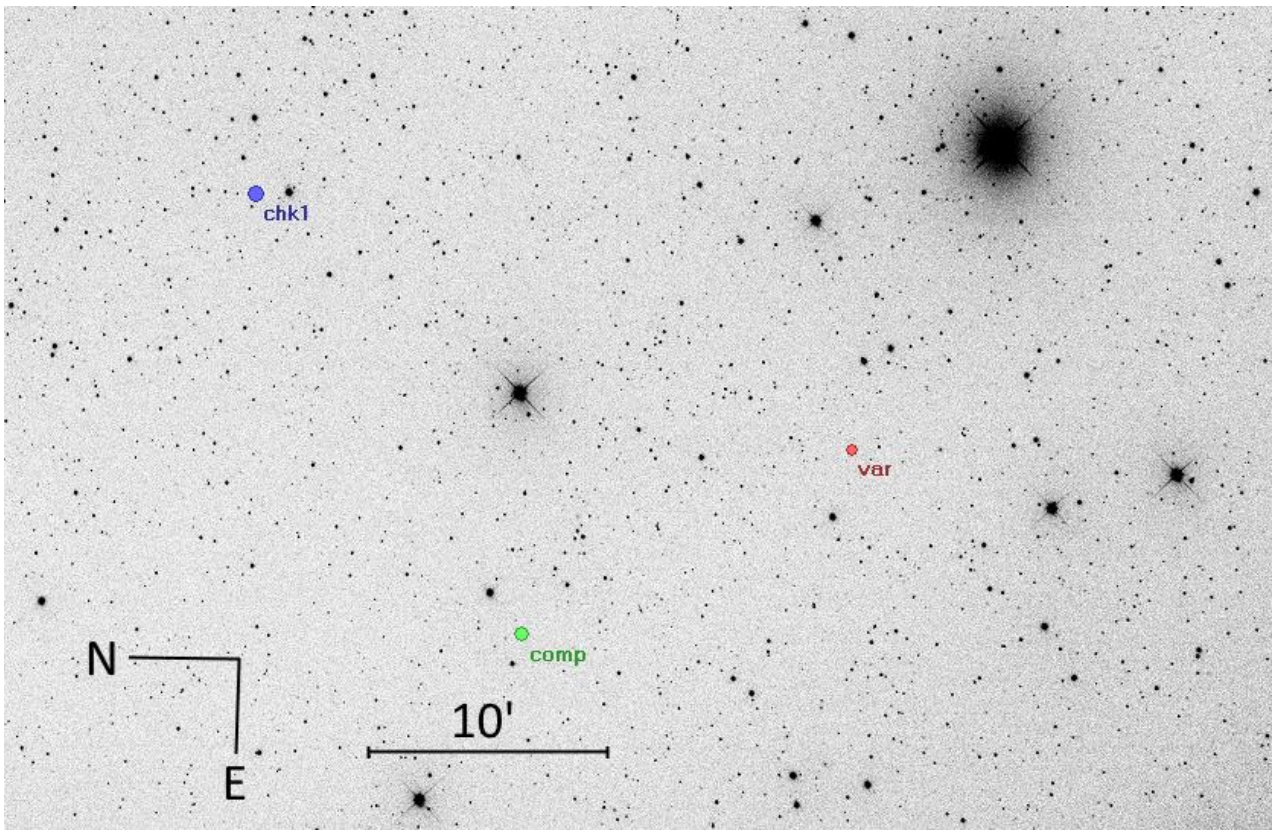

Fig 12: Fr181 Aur = UCAC3 284-090934 (var) in the field of KL Aur; (comp) is the comparison star and (chk1) is the check star.

Table 6: Minima of Fr181 Aur = UCAC3 284-090934

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
P. Frank	2456013,3945	I	0	0,0000	
P. Frank	2456013,5234	II	0,5	-0,0033	
P. Frank	2456747,4127	II	2776,5	0,0046	
W. Moschner	2457690,6672	II	6344,5	-0,0006	
W. Moschner	2457691,7230	II	6348,5	-0,0022	
W. Moschner	2457704,6796	II	6397,5	0,0004	
W. Moschner	2457756,4943	II	6593,5	-0,0007	
W. Moschner	2457756,6261	I	6594	-0,0011	
W. Moschner	2457763,3685	II	6619,5	0,0000	
W. Moschner	2457763,5022	I	6620	0,0015	
W. Moschner	2457814,3915	II	6812,5	0,0002	
W. Moschner	2457814,5251	I	6813	0,0016	

Remarks: none

Acknowledgements

This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France and of the International Variable Star Index (VSX) database, operated at AAVSO, Cambridge, Massachusetts, USA.

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

References

[1] Motl, David: MuniWin, http://c-munipack.sourceforge.net

[2] Vanmunster, Tony: Peranso, http://www.peranso.com/

[3] NOMAD 1 Catalog (Zacharias et al. 2015), http://cdsportal.u-strasbg.fr

[4] APASS DR9 Catalog (Henden et al. 2016) http://cdsportal.u-strasbg.fr

[5] IBVS 6084, J. Hübscher et al. 2013