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

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Abstract: 5 *new variable stars (UCAC3 238-155729, 2MASS J19042957+2926268, GSC 02134-00688, UCAC3 283-169273, 2MASS J19070964+2941427) 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 ninth part of a series dealing with numerous discoveries.

All new variables were discovered on images taken with a 102mm-TeleVue-Refractor 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 2018 and earlier, which are discussed subsequently in detail:

Fr278 Lyr	=	UCAC3 238-155729	= Gaia DR2 2037706418524883968
Fr279 Lyr	=	2MASS J19042957+2926268	= Gaia DR2 2040838892789428096
Fr282 Lyr	=	GSC 02134-00688	= Gaia DR2 2037815407615040384
Fr268 Cyg	=	UCAC3 283-169273	= Gaia DR2 2180676705760867712
Fr284 Lyr	=	2MASS J19070964+2941427	= Gaia DR2 2037865194876660224

Observations

All discovery observations 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.

Further observations for all new variables were carried out between June 2016 and September 2019 with the discoverer telescope in Velden and with a robotic telescope 400 mm f/3.7 ASA Astrograph (Nerpio, Spain) equipped with a cooled FLI Proline 16803 CCD-Camera and partly a V-filter or an IR & UV cut-off filter. The exposure times were 120 seconds. The telescope was controlled from Lennestadt via internet.

Data analysis

Muniwin [1] and self-written programs by Franz Agerer and Lienhard Pagel were used for the analysis of the frames, after bias, dark and flatfield correction of the exposures. The weighted average of 5 comparison stars was used.
The period analysis was performed with Peranso [2], and the magnitudes of the variable stars (at maximum brightness) were obtained from the XPM Catalog (Fedorov et. Al. 2009) [3] and the Gaia DR2 Catalog [5].
The elements which we present were first calculated with the method of Peranso and then refined with the method of least squares, by taking all O-C values into account (see tables below).The given amplitudes are uncorrected instrumental values.

Explanations:
HJD = heliocentric UTC timings (JD) of the observed minima
mag = (raw instrumental) magnitude

All coordinates are taken from the Gaia DR2 catalogue [5].

G-band mean magnitude (Vega) = 350-1000 nm
Integrated BP mean magnitude (Vega) = 330- 680 nm
Integrated RP mean magnitude (Vega) = 640-1000 nm

Explanations to the lightcurves:
The colors of the symbols denote different nights.

C1, C2, C3, C4, C5 = comparison stars
K1 = check star

Fr278 Lyr

= UCAC3 238-155729

= Gaia DR2 2037706418524883968

Right ascension: 19h04m54.4793s (ICRS, J2015.5)
Declination: +28° 48' 21.733"

XPM Catalog:
Vmag: 15.860 Bmag: 16.5 Bmag-Vmag = 0.640

Gaia DR2 Catalog:

15.6255	mag	(i) G-band mean magnitude (Vega)
15.9879	mag	(i) Integrated BP mean magnitude (Vega)
15.0836	mag	(i) Integrated RP mean magnitude (Vega)

C1 = GSC 02134-00116 C2 = UCAC3 239-157262 C3 = UCAC3 239-156677
C4 = UCAC3 239-157384 C5 = UCAC3 240-156465 K1 = UCAC3 239-156822

Amplitude: Min I: 0.30 mag (instr.) Min II: 0.17 mag (instr.)
Type: EW type eclipsing binary

Min I = HJD 2458043.4029 + 0.4556852*E
+-0.0008 +-0.0000037

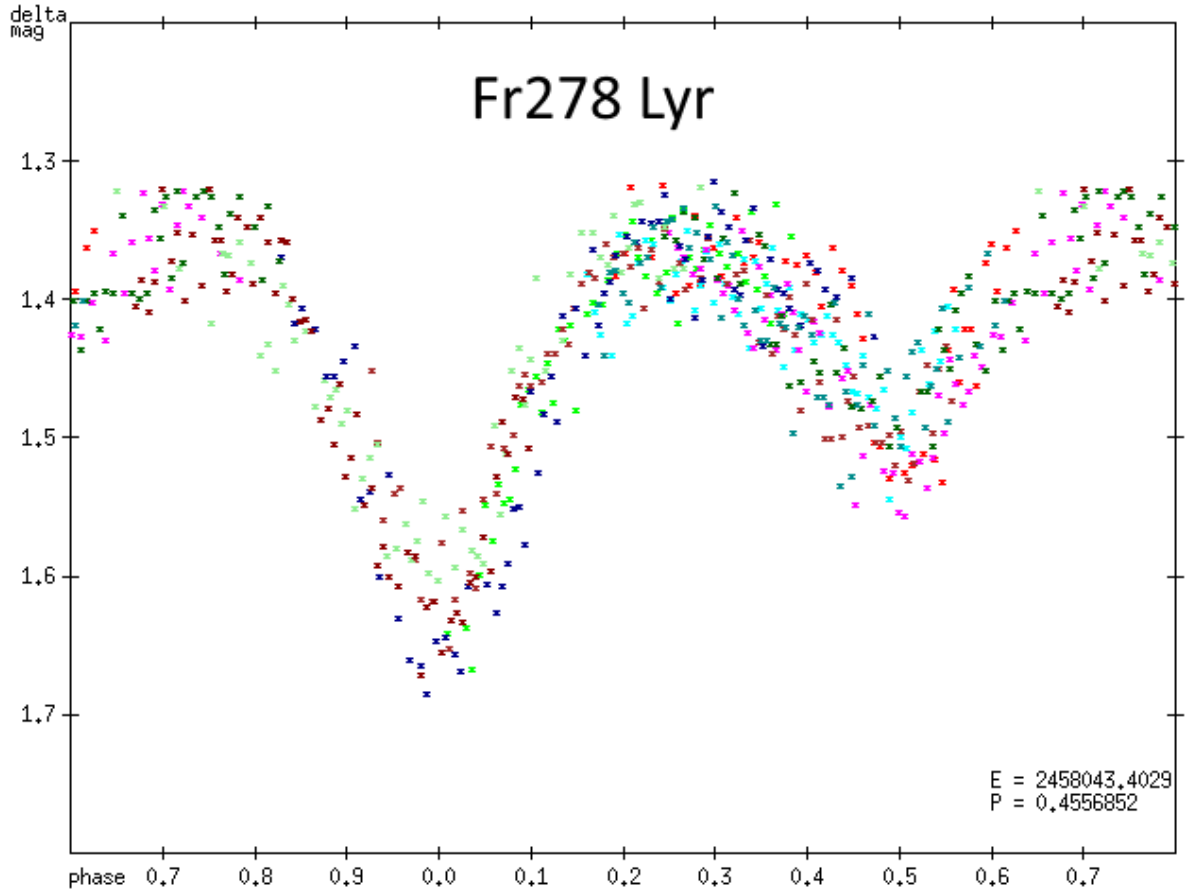


Fig 1: Phased lightcurve of Fr278 Lyr = UCAC3 238-155729 using the ephemeris given above. The vertical axis shows differential magnitudes. A FLI Proline 16803+V-filter (2016-2019) was used. Presented elements were calculated by taking into account all minima (see tables below) with the method of least squares.

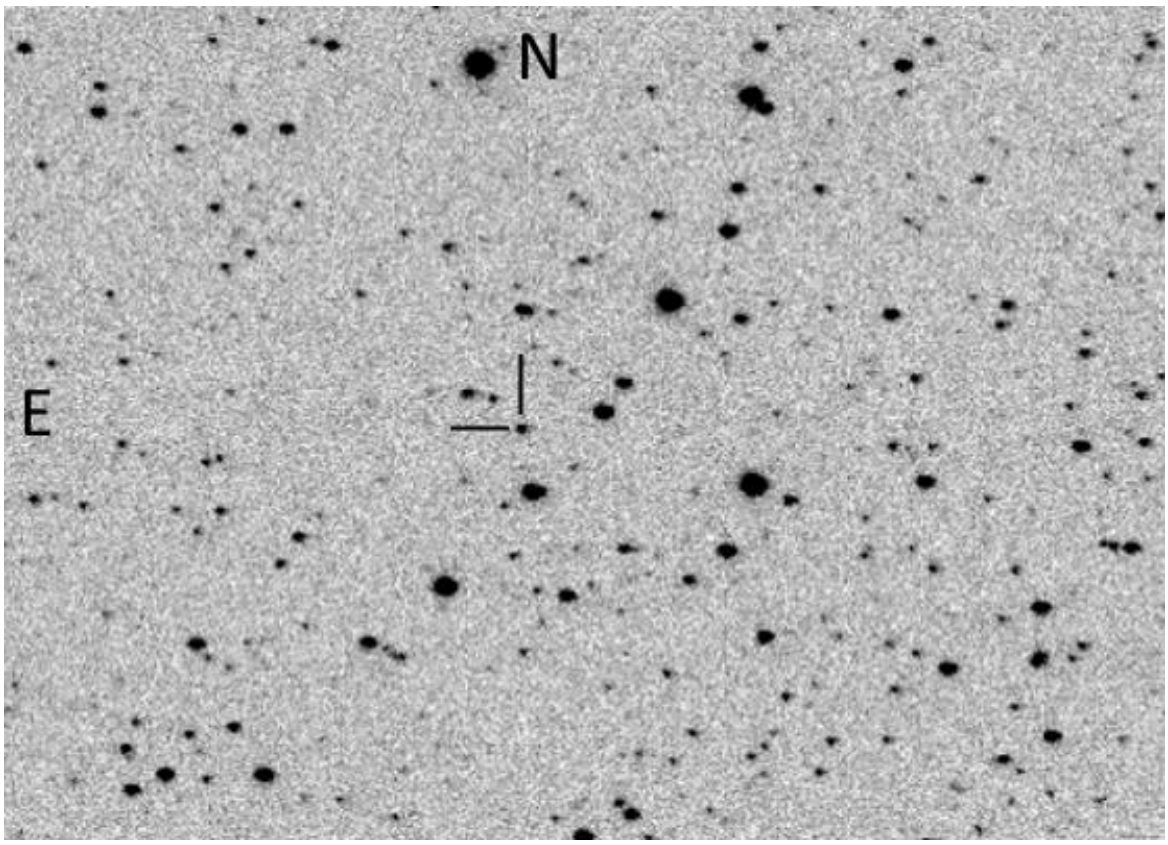


Fig 2: Fr278 Lyr = UCAC3 238-155729 in the field of AA Lyr; image size: 10.0' x 6.7'.

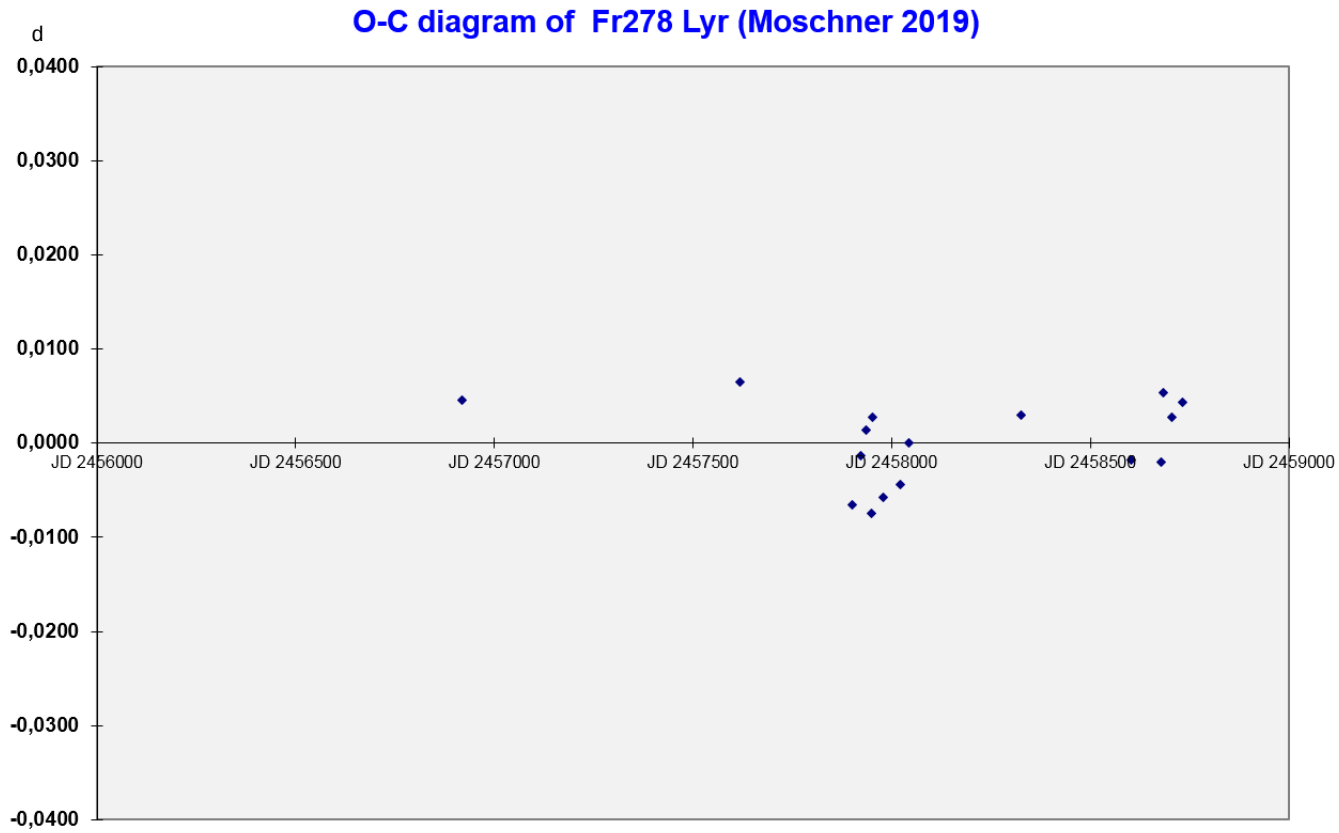


Fig 3: O-C-diagram from Fr278 Lyr = UCAC3 238-155729

Table 1: Fr278 Lyr = UCAC3 238-155729

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
P. Frank	2456918.3207	I	-2469	0.0046	
Moschner/Frank	2457618.4830	II	-932.5	0.0065	
Moschner/Frank	2457899.6277	II	-315.5	-0.0065	
Moschner/Frank	2457921.5058	II	-267.5	-0.0013	
Moschner/Frank	2457935.4069	I	-237	0.0014	
Moschner/Frank	2457949.5243	I	-206	-0.0074	
Moschner/Frank	2457950.4459	I	-204	0.0028	
Moschner/Frank	2457978.4620	II	-142.5	-0.0058	
Moschner/Frank	2458022.4370	I	-46	-0.0044	
P. Frank	2458043.4029	I	0	0.0000	
W. Moschner	2458324.5637	I	617	0.0030	
W. Moschner	2458601.6155	I	1225	-0.0018	
W. Moschner	2458678.6261	I	1394	-0.0020	
W. Moschner	2458682.5068	II	1402.5	0.0054	
W. Moschner	2458705.5162	I	1453	0.0027	
W. Moschner	2458731.4919	I	1510	0.0043	

Fr279 Lyr

= 2MASS 19042957+2926268 = XPM 238-0474951
= Gaia DR2 2040838892789428096
Right ascension: 19h04m29.5865s (ICRS, J2015.5)
Declination: +29° 26' 26.898"

XPM Catalog:
Vmag: 16.213 Bmag: 16.5 Bmag-Vmag = 0.287

Gaia DR2 Catalog:
16.5374 mag (i) G-band mean magnitude (Vega)
16.8821 mag (i) Integrated BP mean magnitude (Vega)
15.9156 mag (i) Integrated RP mean magnitude (Vega)

C1 = GSC 02134-00116 C2 = UCAC3 239-157262 C3 = UCAC3 239-156677
C4 = UCAC3 239-157384 C5 = UCAC3 240-156465 K1 = UCAC3 239-156822

Amplitude: Min I: 0.50 mag (instr.) Min II: 0.45 mag (instr.)
Type: EW type eclipsing binary

Min I = HJD 2455387.5370 + 0.3692962*E
+-0.0011 +-0.0000029

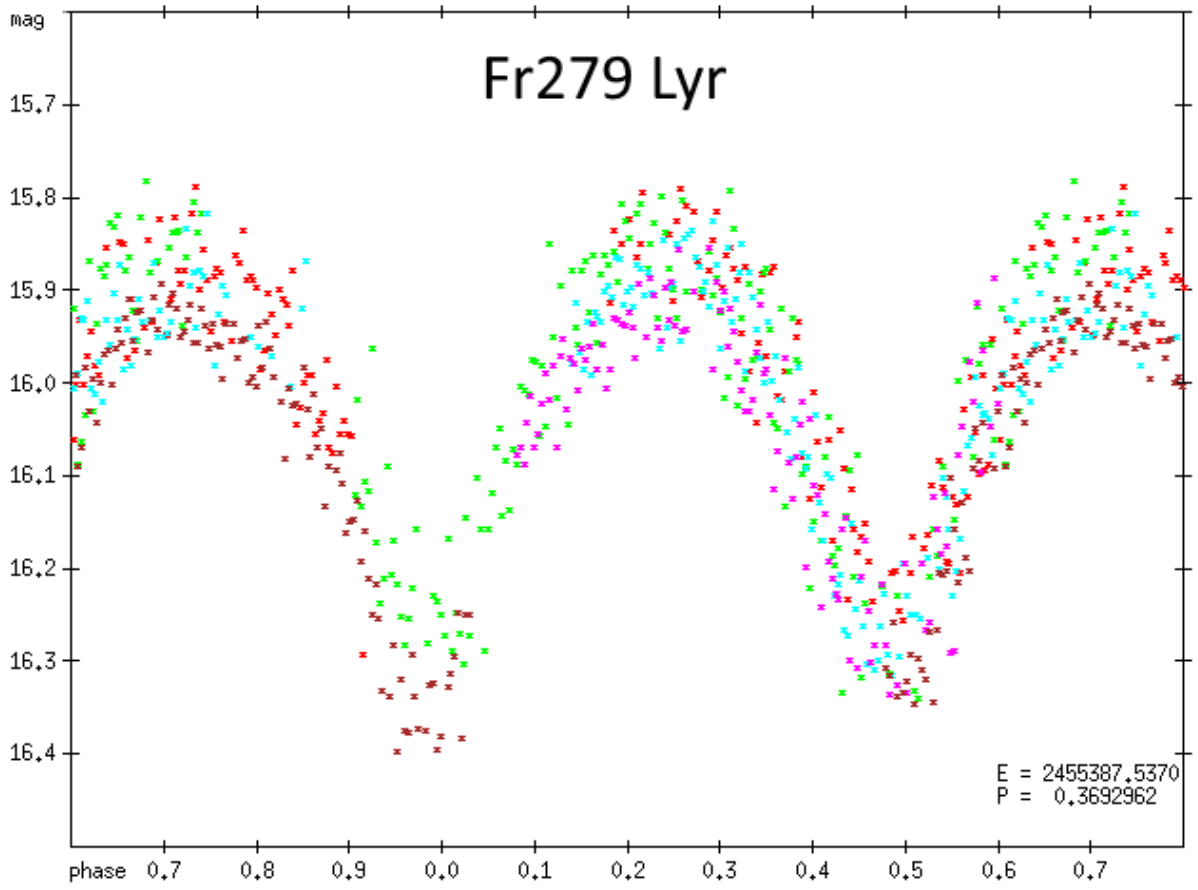


Fig 4: Phased lightcurve of Fr279 Lyr = 2MASS 19042957+2926268 using the ephemeris given above. The vertical axis shows raw instrumental magnitudes. A FLI Proline 16803+V-filter (2016-2019) was used. Presented elements were calculated by taking into account all minima (see tables below) with the method of least squares.

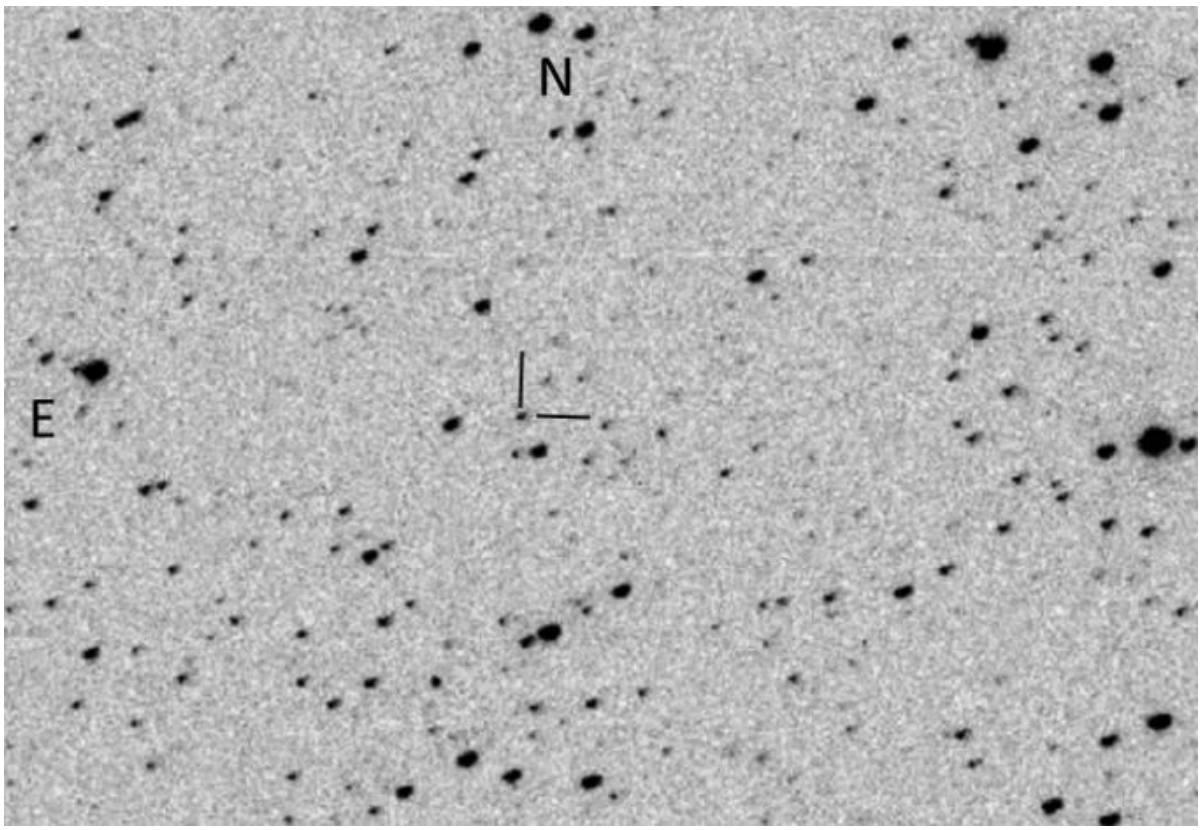


Fig 5: Fr279 Lyr = 2MASS 19042957+2926268 in the field of AA Lyr; image size: 10.0' x 6.7'.

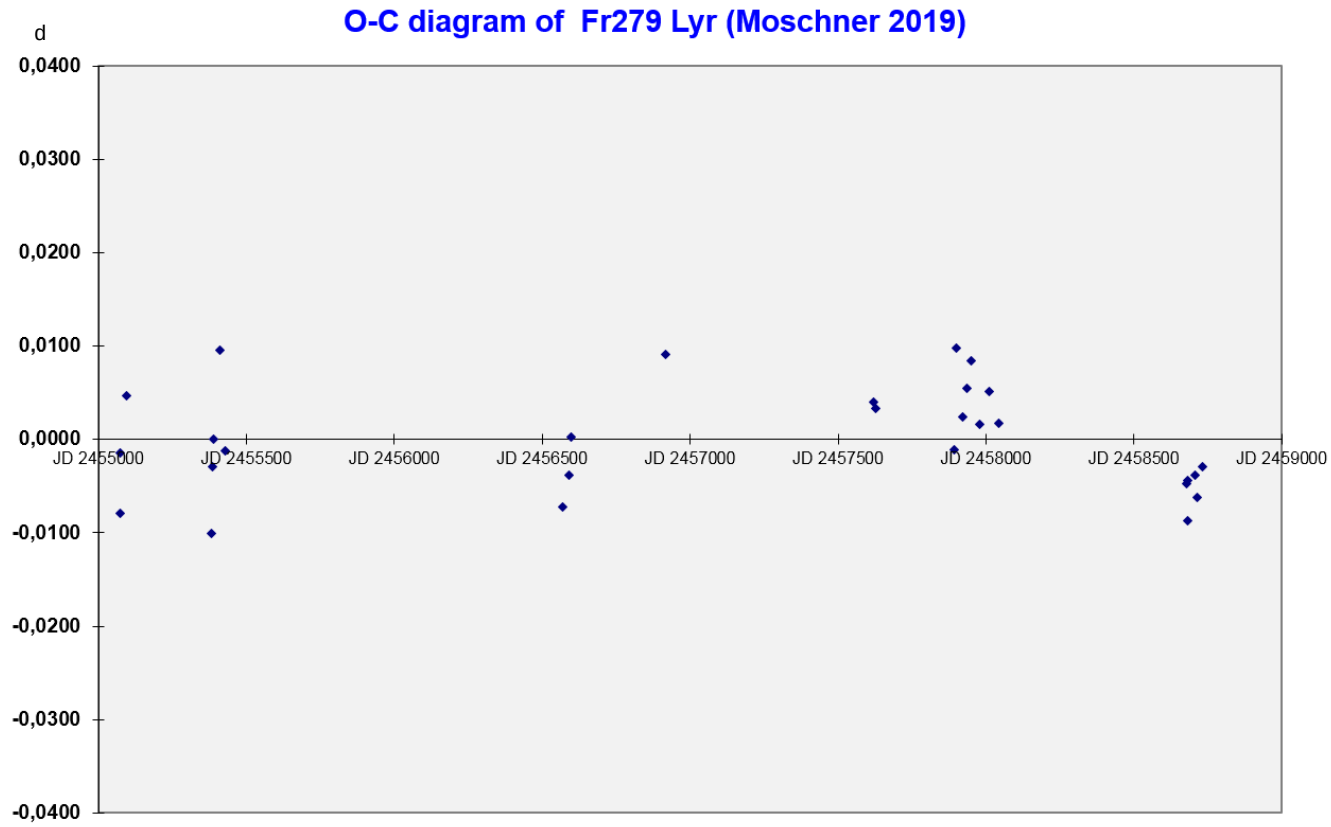


Fig 6: O-C-diagram from Fr279 Lyr = 2MASS 19042957+2926268

Table 2: Fr279 Lyr = 2MASS 19042957+2926268

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
P. Frank	2455074.3659	I	-848	-0.0079	
P. Frank	2455074.5570	II	-847.5	-0.0015	
P. Frank	2455096.3516	II	-788.5	0.0047	
P. Frank	2455380.5103	I	-19	-0.0101	
P. Frank	2455385.5029	II	-5.5	-0.0030	
P. Frank	2455387.5370	I	0	0.0000	
P. Frank	2455409.5197	II	59.5	0.0096	
P. Frank	2455429.4509	II	113.5	-0.0012	
P. Frank	2456568.3544	II	3197.5	-0.0072	
P. Frank	2456590.3309	I	3257	-0.0038	
P. Frank	2456596.2437	I	3273	0.0002	
P. Frank	2456918.4635	II	4145.5	0.0091	
Moschner/Frank	2457618.4594	I	6041	0.0041	
Moschner/Frank	2457626.3985	II	6062.5	0.0033	
Moschner/Frank	2457893.5799	I	6786	-0.0011	
Moschner/Frank	2457899.4995	I	6802	0.0097	
Moschner/Frank	2457921.4653	II	6861.5	0.0024	
Moschner/Frank	2457935.5016	II	6899.5	0.0055	
Moschner/Frank	2457949.5378	II	6937.5	0.0084	
Moschner/Frank	2457978.5208	I	7016	0.0017	
Moschner/Frank	2458009.3605	II	7099.5	0.0051	
P. Frank	2458043.3324	II	7191.5	0.0018	
W. Moschner	2458678.5153	II	8911.5	-0.0048	
W. Moschner	2458682.3933	I	8922	-0.0044	
W. Moschner	2458682.5736	II	8922.5	-0.0087	
W. Moschner	2458705.4749	II	8984.5	-0.0038	
W. Moschner	2458712.4891	II	9003.5	-0.0062	
W. Moschner	2458731.5112	I	9055	-0.0029	

Remarks:
The period does not seem to be constant. Further observations are useful to prove a possible change in period.

Fr282 Lyr

= GSC 02134-00688

= Gaia DR2 2037815407615040384

Right ascension: 19h05m57.913s (ICRS, J2015.5)
Declination: +29° 11' 01.649"

XPM Catalog:
Vmag: 13.017 Bmag: 15.6 Bmag-Vmag = 2.583

Gaia DR2 Catalog:

13.6481	mag	(i) G-band mean magnitude (Vega)
14.7677	mag	(i) Integrated BP mean magnitude (Vega)
12.6026	mag	(i) Integrated RP mean magnitude (Vega)

C1 = GSC 02134-00116 C2 = UCAC3 239-157262 C3 = UCAC3 239-156677
C4 = UCAC3 239-157384 C5 = UCAC3 240-156465 K1 = UCAC3 239-156822

Amplitude: Min I: 0.52 mag (instr.)
Type: EA type eclipsing binary

Min I = HJD 2455096.3561 + 1.9249814*E
+-0.0011 +-0.0000019

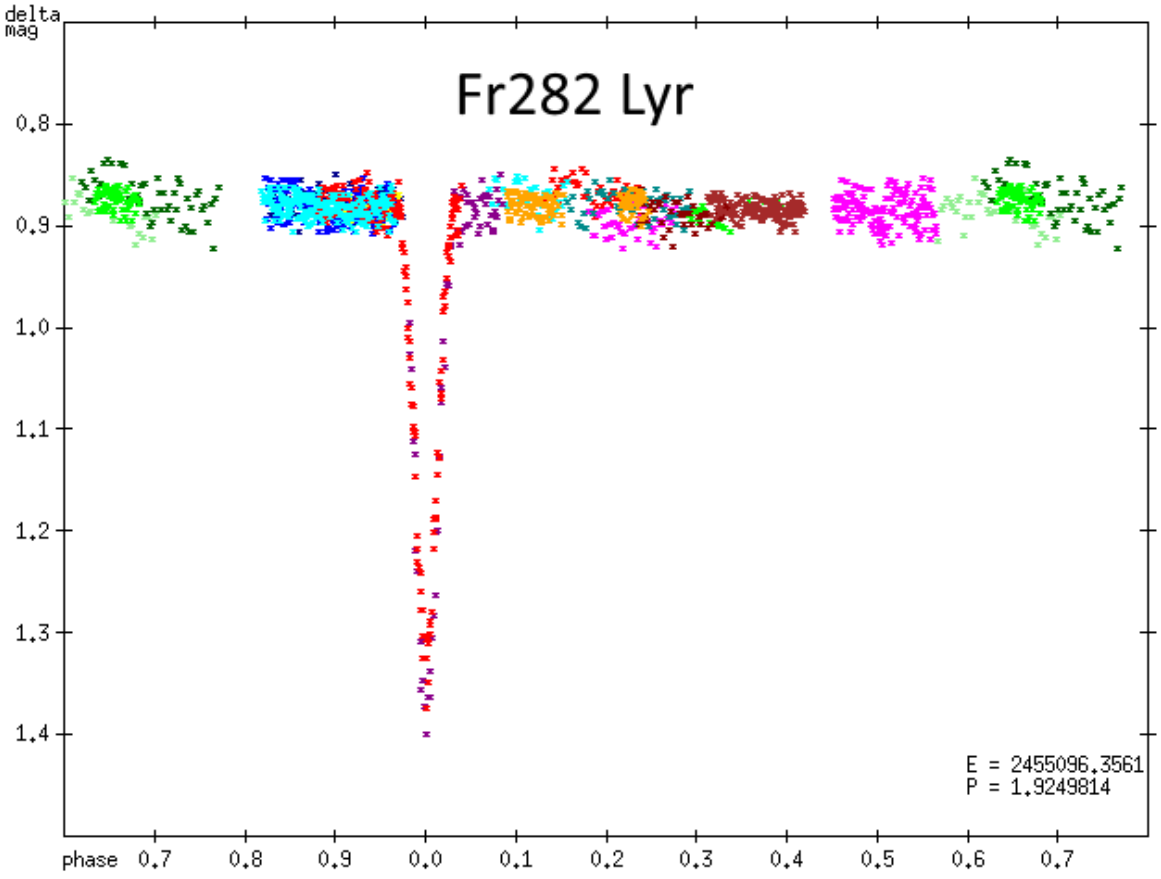


Fig 7: Phased lightcurve of Fr282 Lyr = GSC 02134-00688 using the ephemeris given above. The vertical axis shows differential magnitudes. A FLI Proline 16803+V-filter (2016-2019) was used. Presented elements were calculated by taking into account all minima (see tables below) with the method of least squares.

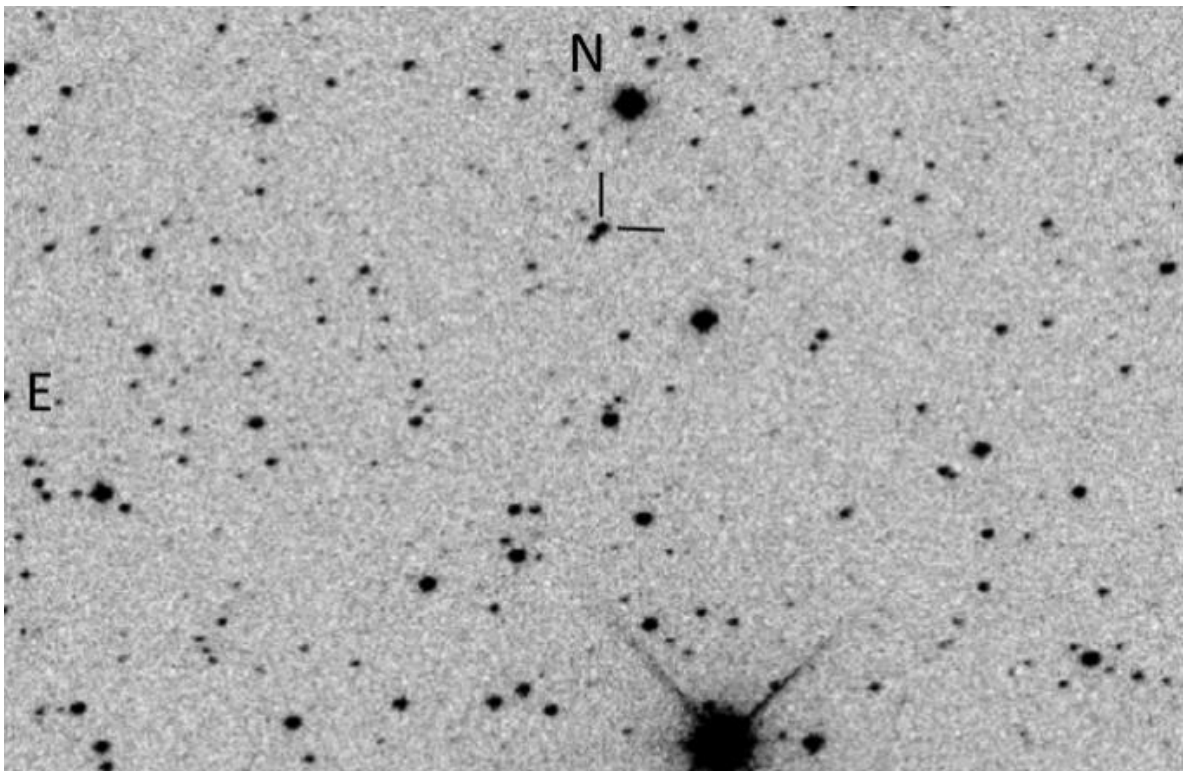


Fig 8: Fr282 Lyr = GSC 02134-00688 in the field of AA Lyr; image size: 10.0' x 6.7'.

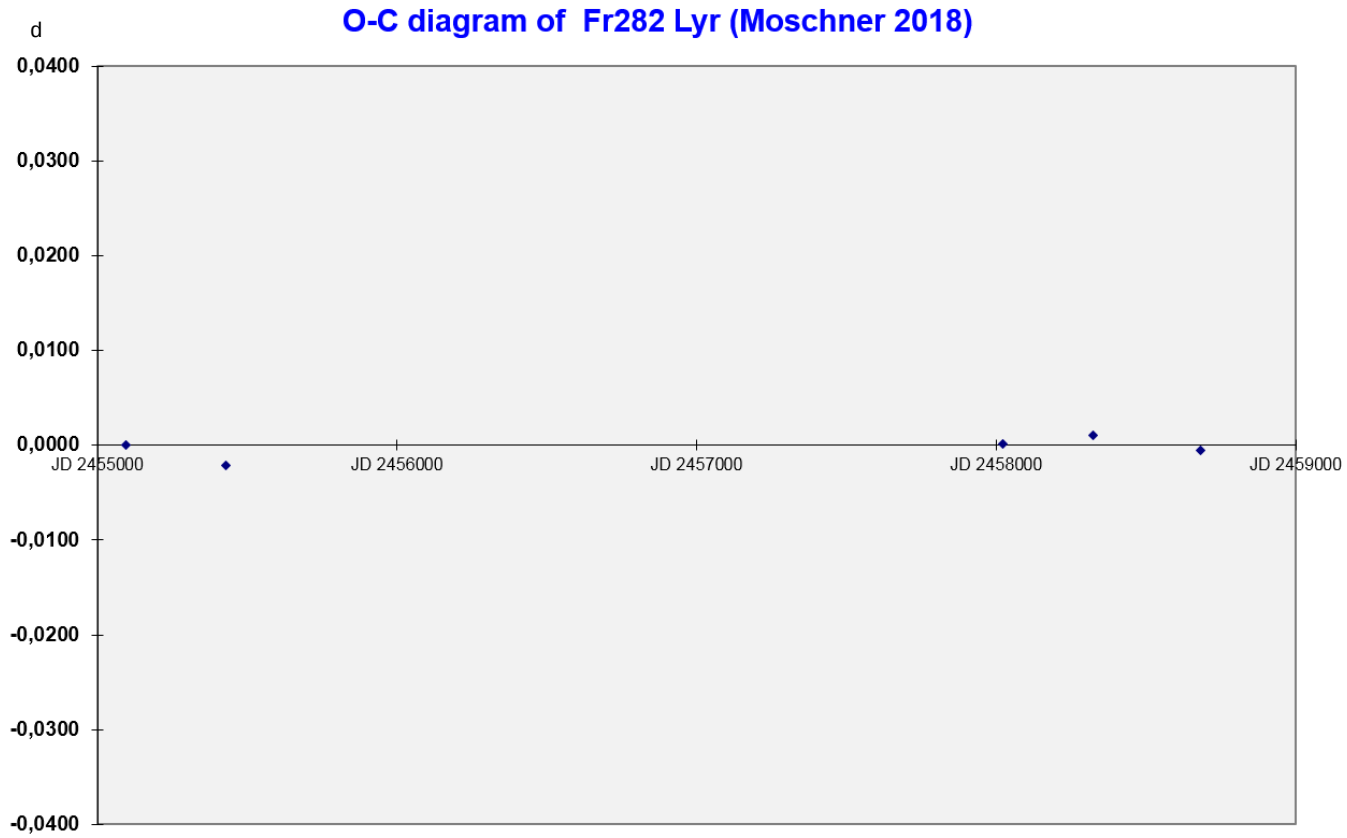


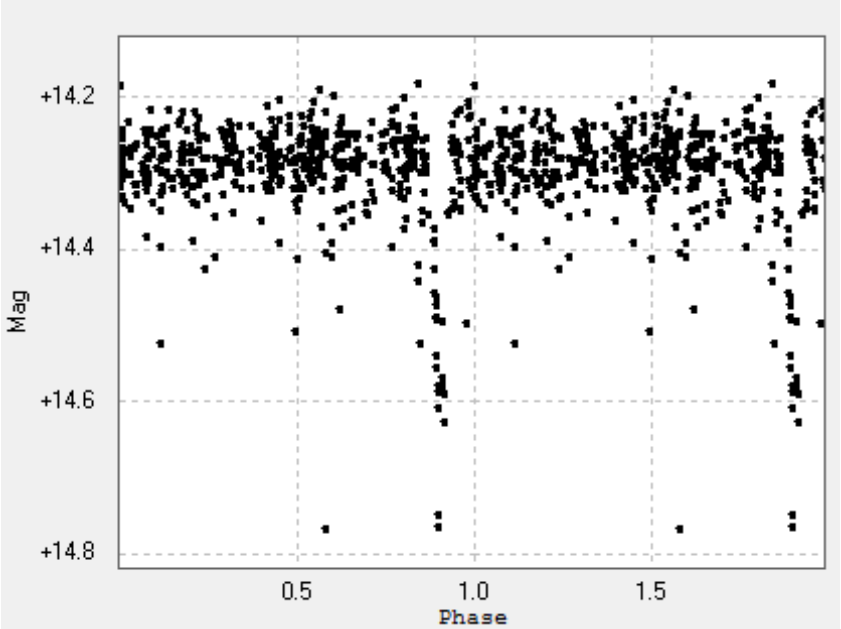
Fig 9: O-C-diagram from Fr282 Lyr = GSC 02134-00688

Table 3: Fr282 Lyr = GSC 02134-00688

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
P. Frank	2455096.3561	I	0	0.0000	
P. Frank	2455429.3758	I	173	-0.0021	
Moschner/Frank	2458022.3280	I	1520	0.0002	
W. Moschner	2458324.5510	I	1677	0.0011	
W. Moschner	2458682.5959	I	1863	-0.0005	

Remarks:
A period determination using the ASAS-SN data resulted in a period of 1.924990 d.
We only use our dates and minima to determine the final period.
All used data show no minimum II.

Fig 10: ASAS-SN data with a period of 1.924990 d.



Fr268 Cyg

= UCAC3 283-169273

= Gaia DR2 2180676705760867712

Right ascension: 20h33m15.0691s (ICRS, J2015.5)
Declination: +51° 13' 26.640"

XPM Catalog:
Vmag: 16.467 Bmag: 17.124 V-B = 0.657

C1 = UCAC3 283-169249 C2 = UCAC3 283-169233 C3 = UCAC3 283-169238
C4 = UCAC3 283-169127 C5 = UCAC3 283-169291 K1 = UCAC3 283-169177

Gaia DR2 Catalog:

16.3201	mag	(i) G-band mean magnitude (Vega)
16.8228	mag	(i) Integrated BP mean magnitude (Vega)
15.5892	mag	(i) Integrated RP mean magnitude (Vega)

Amplitude: Min I: 0.70 mag (instr.) Min II: 0.65 mag (instr.)
Type: EW type eclipsing binary

Min I = HJD 2458694.5637 + 0.29913030*E
+-0.0017 +-0.00000168

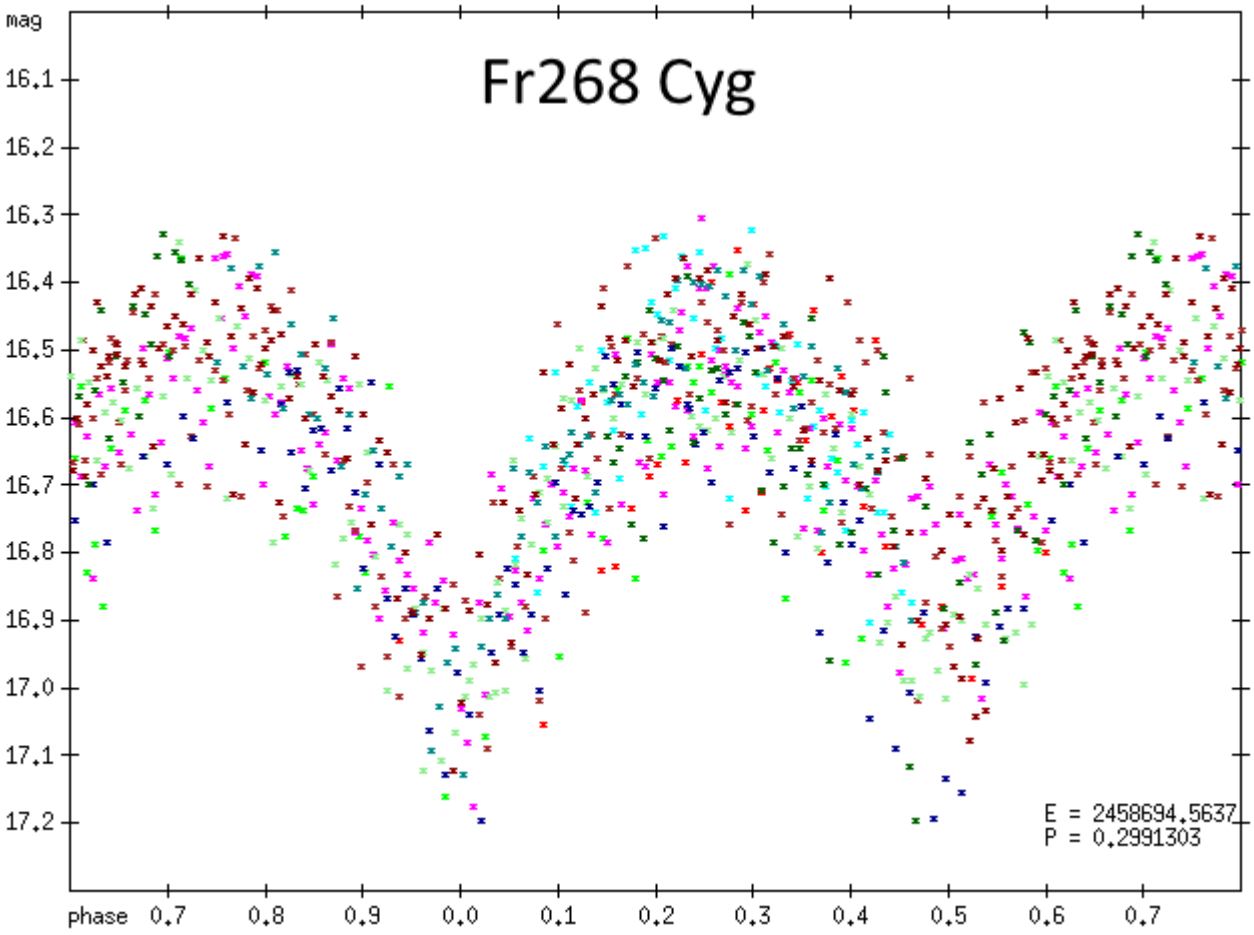


Fig 11: Phased lightcurve of Fr268 Cyg = UCAC3 283-169273 using the ephemeris given above. The vertical axis shows raw instrumental magnitudes. A SIGMA 1603 CCD-Camera and IR & UV cut-off filter (102mm/f5.0 TeleVue Refractor) was used. Presented elements were calculated by taking into account all minima (see tables below) with the method of least squares.

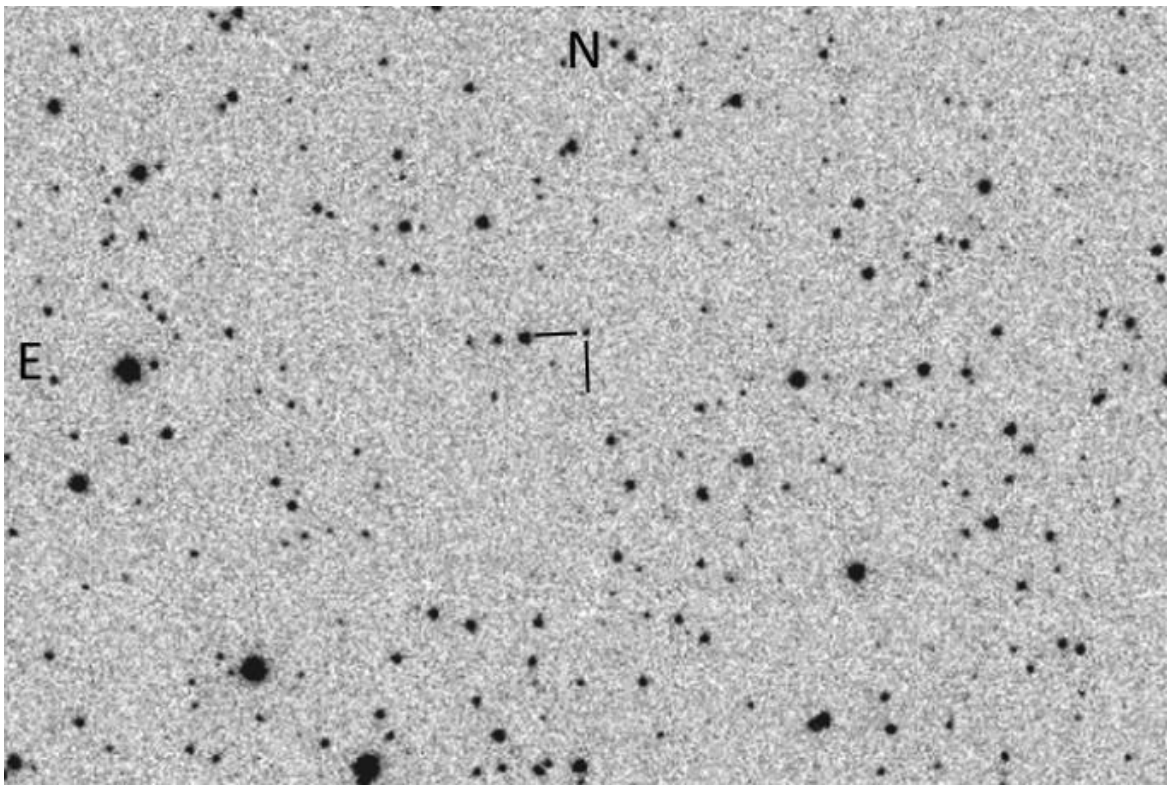


Fig 12: Fr268 Cyg = UCAC3 283-169273 in the field of V745 Cyg; image size: 10.0' x 6.7'.

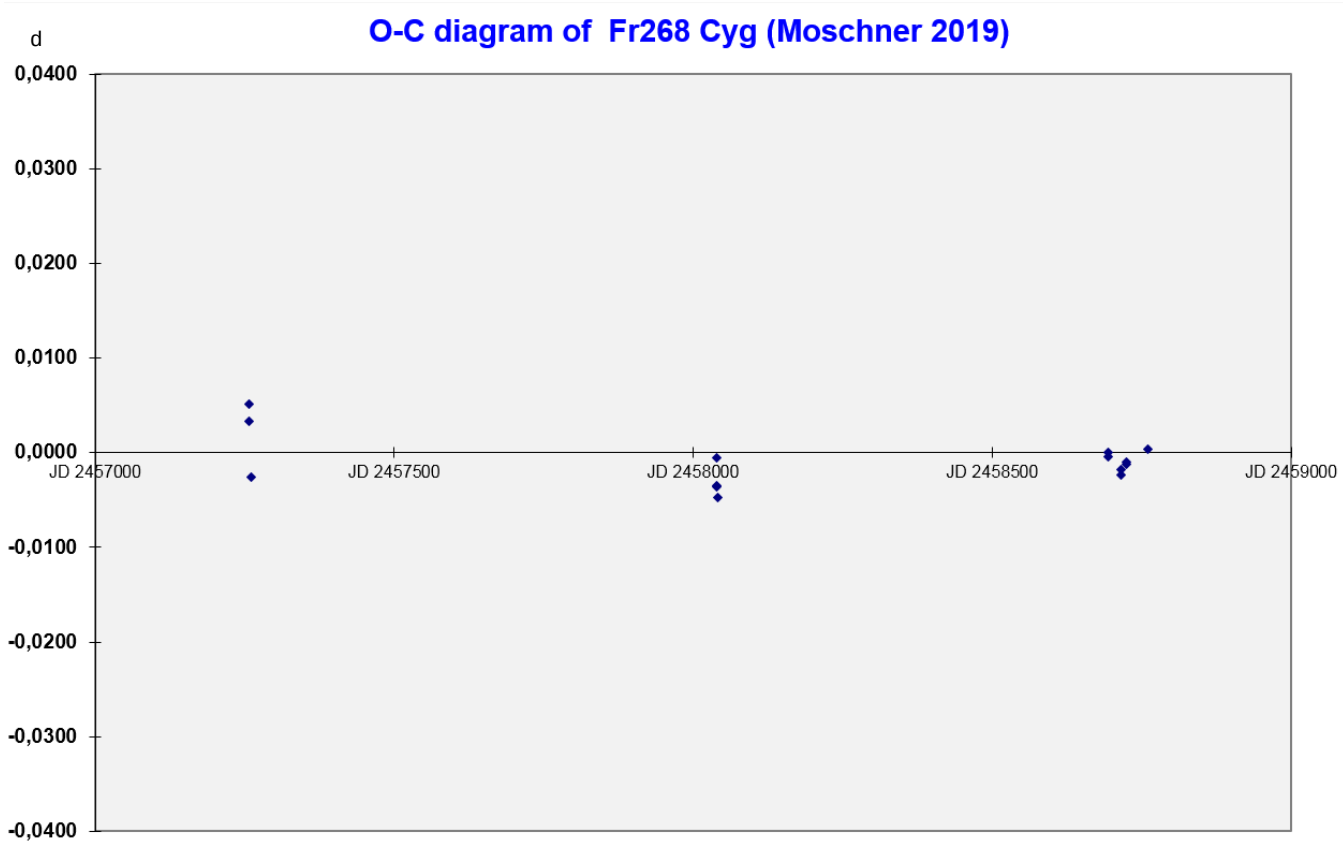


Fig 13: O-C-diagram from Fr268 Cyg = UCAC3 283-169273

Table 4: Fr268 Cyg = UCAC3 283-169273

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
P. Frank	2457257.3973	II	-4804.5	0.0051	
P. Frank	2457257.5451	I	-4804	0.0034	
P. Frank	2457261.4278	I	-4791	-0.0026	
P. Frank	2458038.2713	I	-2194	-0.0005	
P. Frank	2458038.4179	II	-2193.5	-0.0035	
P. Frank	2458038.5674	I	-2193	-0.0036	
W.Moschner	2458040.3610	I	-2187	-0.0047	
W.Moschner	2458694.4137	II	-0.5	-0.0004	
W.Moschner	2458694.5637	I	0	0.0000	
W.Moschner	2458714.4535	II	66.5	-0.0024	
W.Moschner	2458714.6037	I	67	-0.0017	
W.Moschner	2458724.4755	I	100	-0.0012	
W.Moschner	2458724.6253	II	100.5	-0.0010	
W.Moschner	2458760.3727	I	220	0.0003	

Fr284 Lyr

= 2MASS J19070964+2941427 = XPM 239-0480587
= Gaia DR2 2037865194876660224
Right ascension: 19h07m09.6490s (ICRS, J2015.5)
Declination: +29° 41' 42.924"

XPM Catalog:
Vmag: 16.42 Bmag: 16.8 Bmag-Vmag = 0.38

Gaia DR2 Catalog:
16.9440 mag (i) G-band mean magnitude (Vega)
17.4206 mag (i) Integrated BP mean magnitude (Vega)
16.2089 mag (i) Integrated RP mean magnitude (Vega)

C1 = GSC 02134-00116 C2 = UCAC3 239-157262 C3 = UCAC3 239-156677
C4 = UCAC3 239-157384 C5 = UCAC3 240-156465 K1 = UCAC3 239-156822

Amplitude: Min I: 0.68 mag (instr.) Min II: 0.63 mag (instr.)
Type: EW type eclipsing binary

Min I = HJD 2458678.5460 + 0.3804588*E
+-0.0011 +-0.0000022

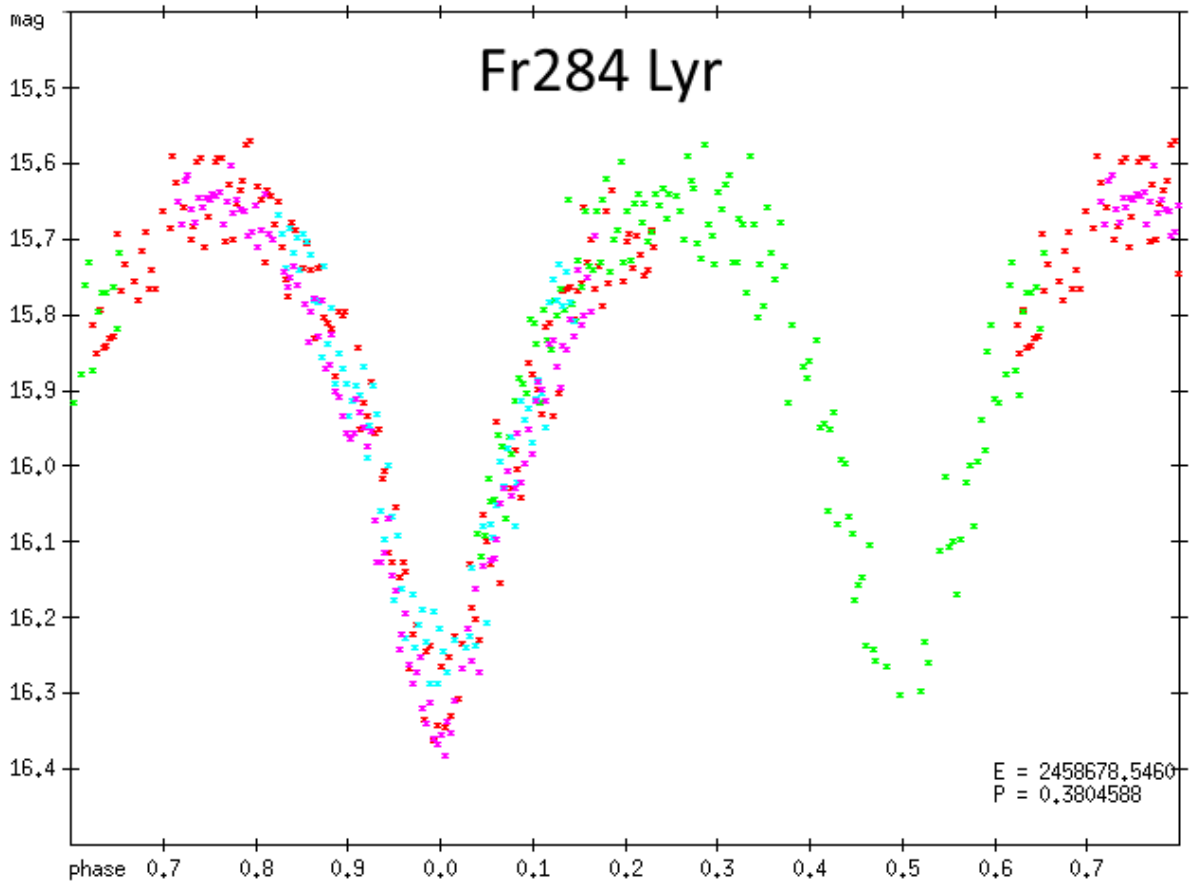


Fig 14: Phased lightcurve of Fr284 Lyr = 2MASS J19070964+2941427 using the ephemeris given above. The vertical axis shows raw instrumental magnitudes. A FLI Proline 16803+V-filter (2016-2018) was used. Presented elements were calculated by taking into account all minima (see tables below) with the method of least squares.

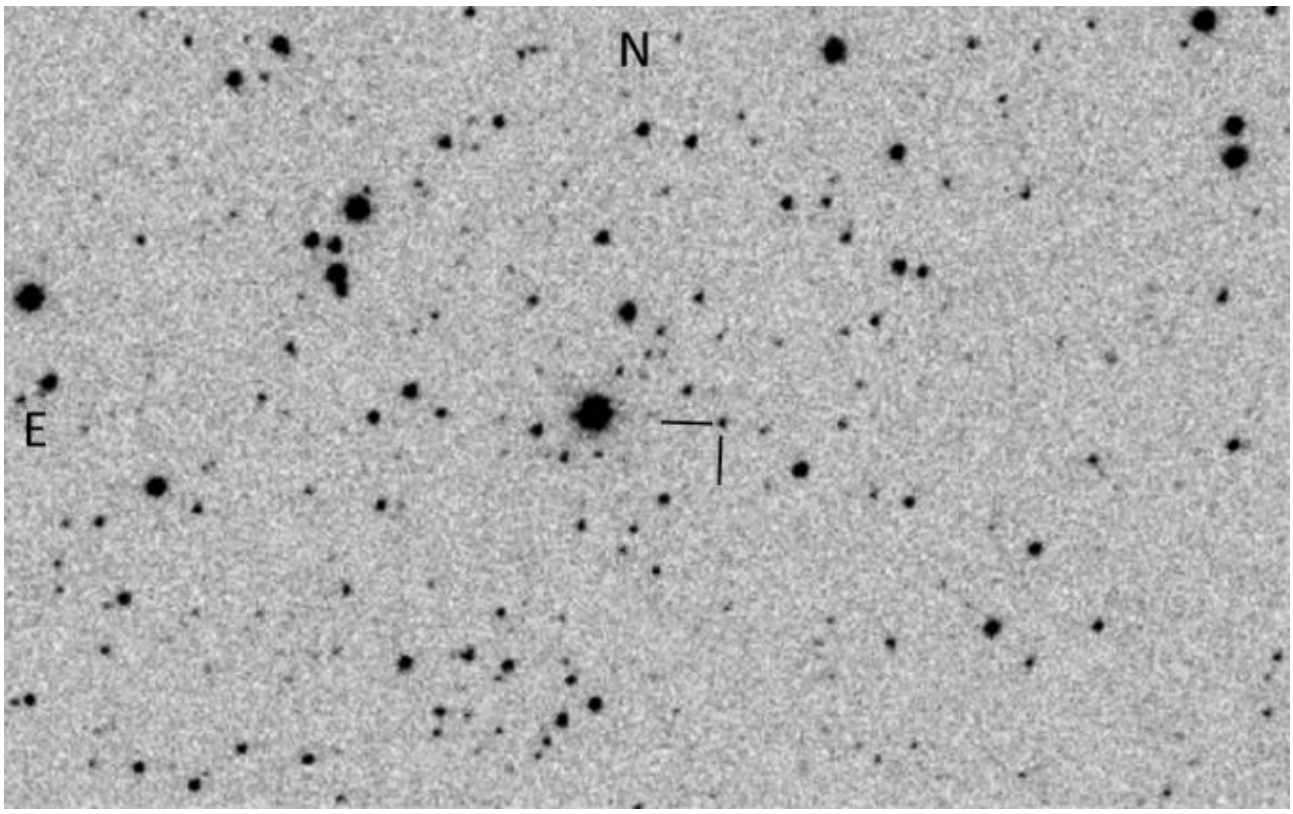


Fig 15: Fr284 Lyr = 2MASS J19070964+2941427 in the field of AA Lyr; image size: 10.0' x 6.7'.

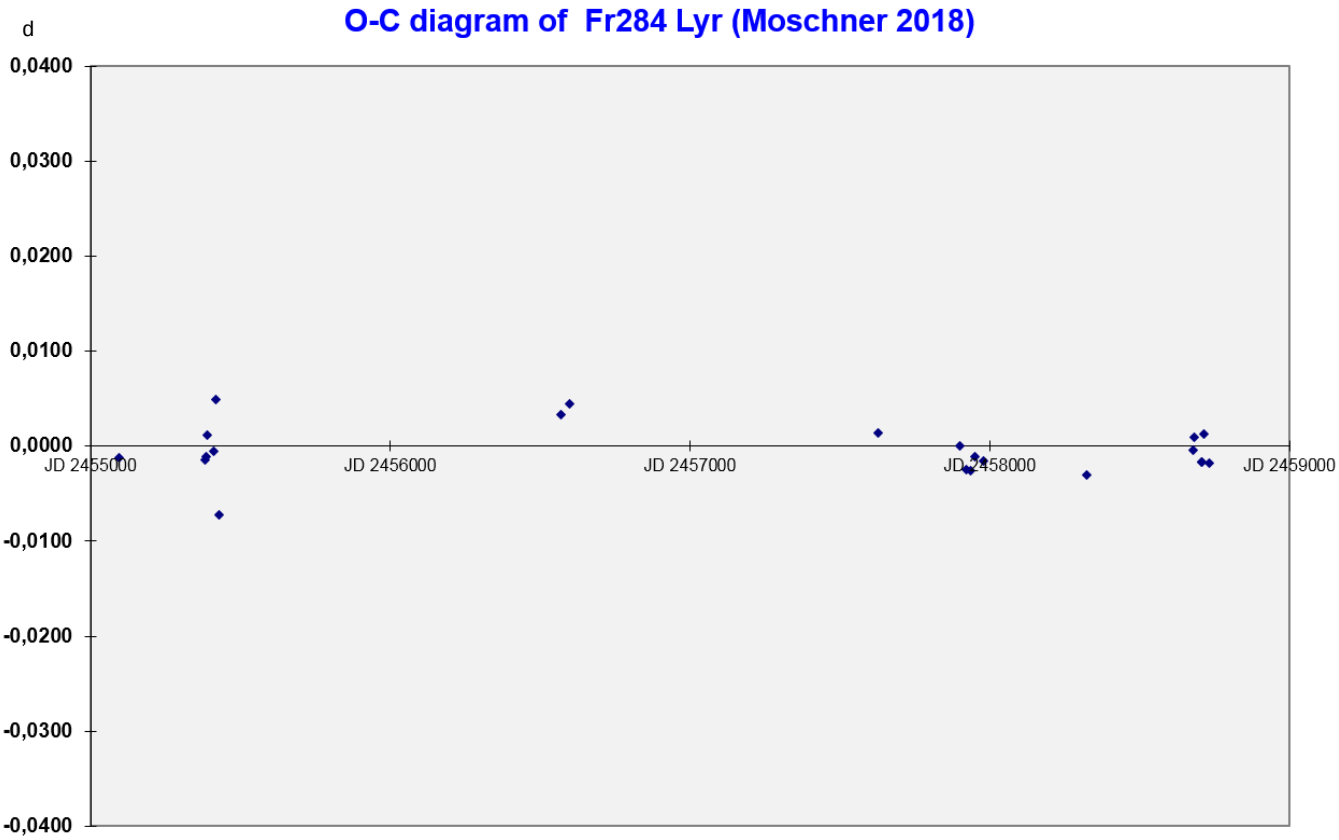


Fig 16: O-C-diagram from Fr284 Lyr = 2MASS J19070964+2941427

Table 5: Minima of Fr284 Lyr = 2MASS J19070964+2941427

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
P. Frank	2455096.3353	II	-9415.5	-0.0009	
P. Frank	2455380.5379	II	-8668.5	-0.0010	
P. Frank	2455385.4842	II	-8655.5	-0.0007	
P. Frank	2455387.3887	II	-8650.5	0.0015	
P. Frank	2455409.4536	II	-8592.5	-0.0002	
P. Frank	2455418.3998	I	-8569	0.0053	
P. Frank	2455429.4210	I	-8540	-0.0068	
P. Frank	2456568.3350	II	-5546.5	0.0037	
P. Frank	2456596.2998	I	-5473	0.0048	
Moschner/Frank	2457626.3890	II	-2765.5	0.0018	
Moschner/Frank	2457899.5570	II	-2047.5	0.0004	
Moschner/Frank	2457921.4309	I	-1990	-0.0021	
Moschner/Frank	2457935.5078	I	-1953	-0.0022	
Moschner/Frank	2457935.5078	I	-1953	-0.0022	
Moschner/Frank	2457950.5374	II	-1913.5	-0.0007	
Moschner/Frank	2457978.5007	I	-1840	-0.0011	
W. Moschner	2458324.5265	II	-930.5	-0.0026	
W. Moschner	2458678.5460	I	0	0.0000	
W. Moschner	2458682.5422	II	10.5	0.0014	
W. Moschner	2458705.3671	II	70.5	-0.0012	
W. Moschner	2458705.5573	I	71	-0.0013	
W. Moschner	2458712.4085	I	89	0.0017	
W. Moschner	2458731.4284	I	139	-0.0014	

Acknowledgements

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