



**First elements for six new Eclipsing Binaries in several fields**

Moschner, Wolfgang  
Lennestadt, Germany  
email: [wolfgang.moschner@t-online.de](mailto:wolfgang.moschner@t-online.de)

Frank, Peter  
Velden, Germany  
email: [frank.velden@t-online.de](mailto:frank.velden@t-online.de)

Bernhard, Klaus  
Linz, Austria  
email: [klaus.bernhard@liwest.at](mailto:klaus.bernhard@liwest.at)

Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V.

October 2016

**Abstract:** *6 new eclipsing binaries (3UCAC 275-153185, 3UCAC 205-282753, 3UCAC246-056307, 3UCAC 286-155544, GSC 3937-02349, 3UCAC 273-264245) are presented, which were found in a search for new variables in several fields of 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). These new variables were discovered at images of the 320mm-RC-Telescope (Lennestadt) of Wolfgang Moschner by Peter Frank. Further detailed observations were made using an 400mm-ASA-Astrograf in 2016, which are discussed subsequently in detail:

MoFr13 Cyg = 3UCAC 275-153185  
MoFr16 Del = 3UCAC 205-282753  
MoFr17 Aur = 3UCAC 246-056307  
MoFr21 Cyg = 3UCAC 286-155544  
MoFr22 Cyg = GSC 3937-02349  
MoFr24 Lac = 3UCAC 273-264245

**Observations**

The discovery observations were carried out with a 0.32 m f/5.9 Ritchey-Chretien-Telescope (Lennestadt) equipped with a cooled SBIG ST-9XE CCD-Camera without filter between 2010 and 2011. The exposure times were between 20 and 30 seconds.

Further observations were carried out with a robotic telescope a 0.40 m f/3.7 ASA-Astrograph (Nerpio, Spain) equipped with a cooled FLI Proline 16803 CCD-Camera and V-Filter between June 2015 and September 2016. 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. Period analysis was performed with Peranso [2], the magnitudes of the variable (Max) and of the comparison stars were obtained from GUIDE 9 [3].

Presented elements were calculated 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

#### Explanations to the lightcurves

The colored measuring-points mark different nights.

### **MoFr13 Cyg = 3UCAC 275-153185 (14.64 mag)**

Right ascension: 19h 25m 47.3584s (2000)

Declination: +47° 09' 07.233"

2MASS J-K = 0.38 mag

Comparison star = GSC 3547-02939 (13.0 mag) J-K=0.36 mag

Check Star = GSC 3547-02886 (13.5 mag) J-K=0.38 mag

Amplitude Min I: 0.75 mag (instr.) Min II: 0.70 mag (instr.)

Type: Algol type eclipsing binary

Min I = HJD 2455340.4516 + 5.3460140\*E  
          + -0.0006    + -0.000002

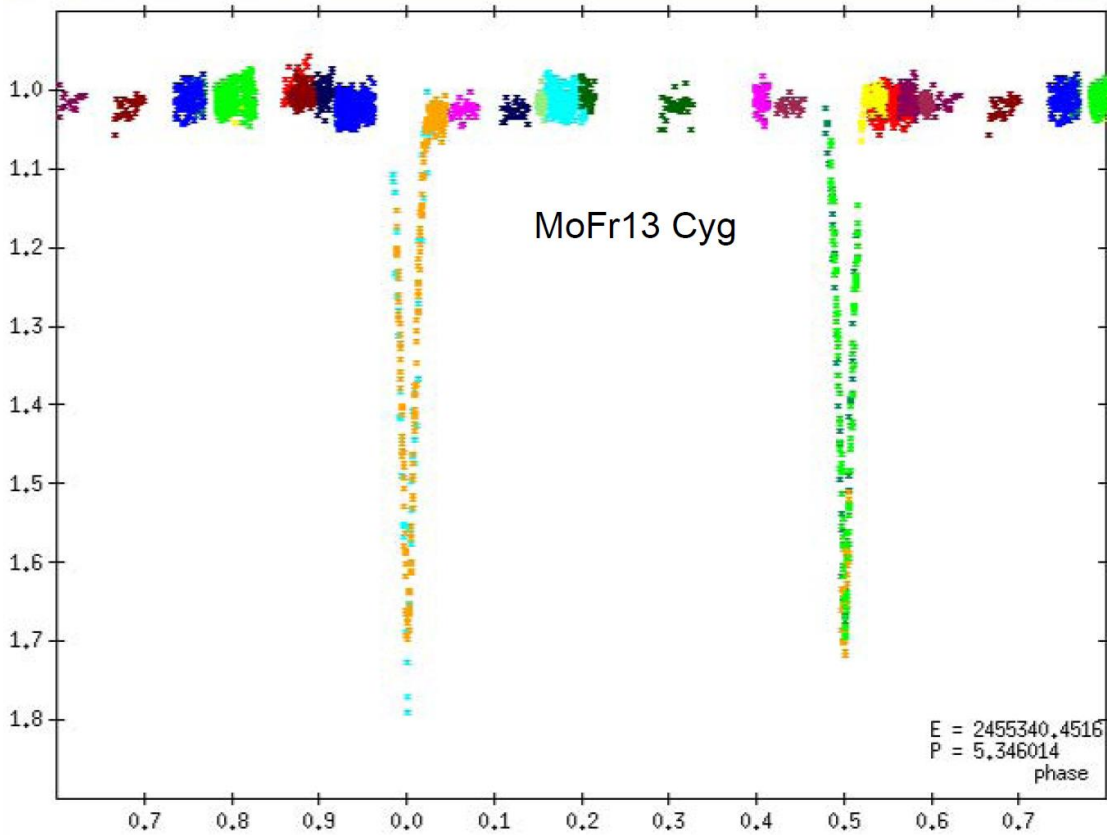


Fig 1: Phased lightcurve of MoFr13 Cyg = 3UCAC 275-153185 using the ephemeris given above.

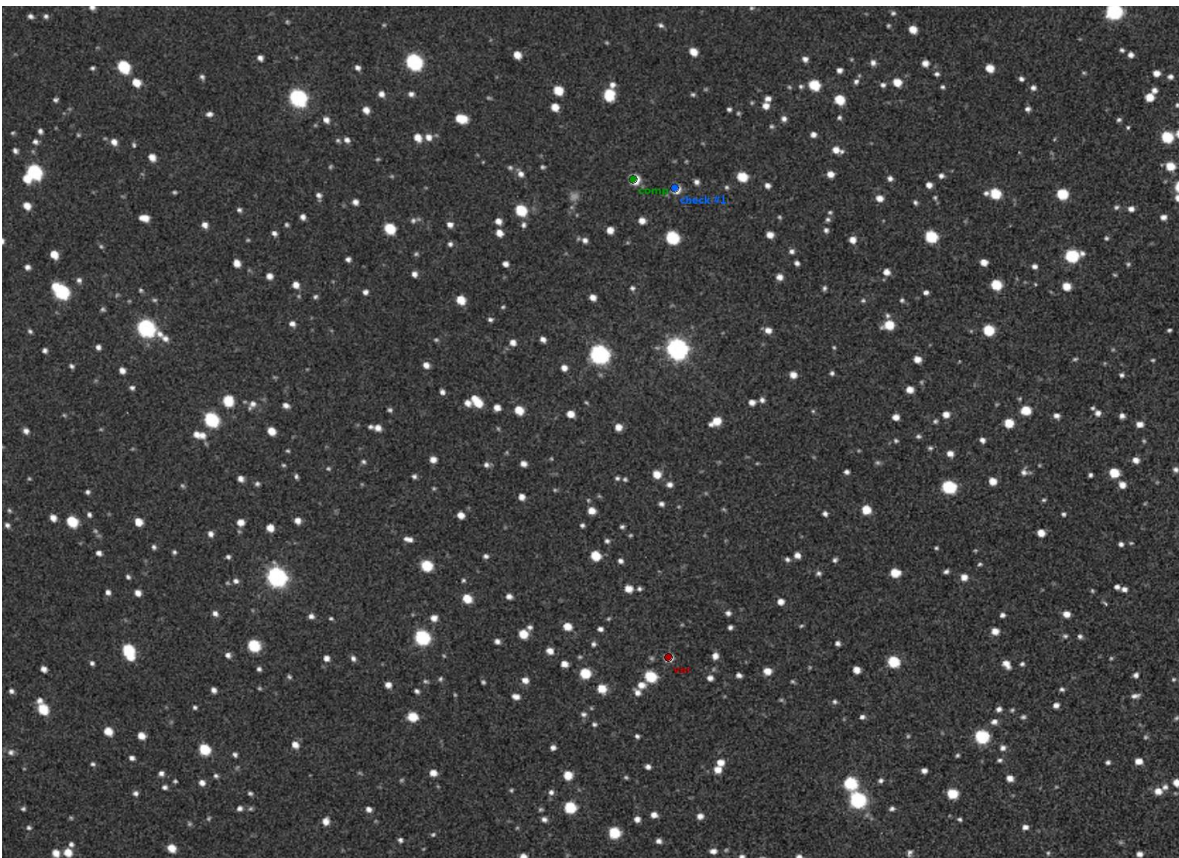


Fig 2: MoFr13 Cyg = 3UCAC 275-153185 (var) in the field of V850 Cyg. (comp) is the comparison star and (check#1) is the check star. North is right and East is up.

Table 1: Minima of MoFr13 Cyg = 3UCAC 275-153185

Observer	HJD-Date	Type	Epoch	O-C (d)	Source
	Minimum				
Moschner/Frank	2455340,4516	I	0	0,0000	BAVM
Moschner/Frank	2455364,5065	II	4,5	-0,0022	
F. Agerer	2456933,5527	I	298	-0,0111	
W. Moschner	2457580,4354	I	419	0,0039	
W. Moschner	2457588,4549	II	420,5	0,0044	

Remarks: Primary and secondary minima exhibit very similar depths and the secondary minimum is situated exactly at phase 0.5. Therefore the halved period with not detectable secondary minimum cannot be excluded.

**MoFr16 Del = 3UCAC 205-282753 (14.45 mag)**

Right ascension: 20h 39m 46.3351s

Declination: +12° 21' 04.973"

2MASS J-K = 0.36 mag

Comparison star = 3UCAC 205-282824 (13.62 mag) J-K = 0.70 mag

Check Star = 3UCAC 205-282802 (13.09 mag) J-K = 0.68 mag

Amplitude Min I: 0.45 mag (instr.) Min II: 0.40 mag (instr.)

Type: WUMa type eclipsing binary

Min I = HJD 2457612.4245 +0.3284086\*E  
 +-0.0007 +-0.0000003

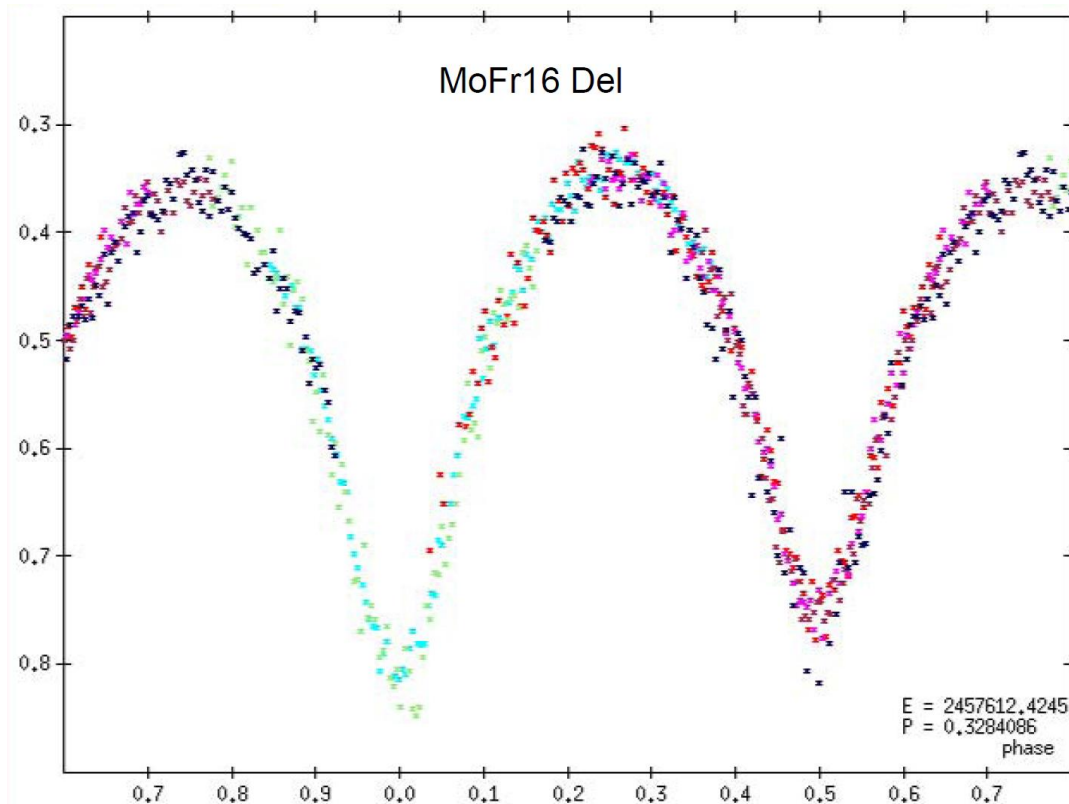


Fig 3: Phased lightcurve of MoFr16 Del = 3UCAC 205-282753 using the ephemeris given above.



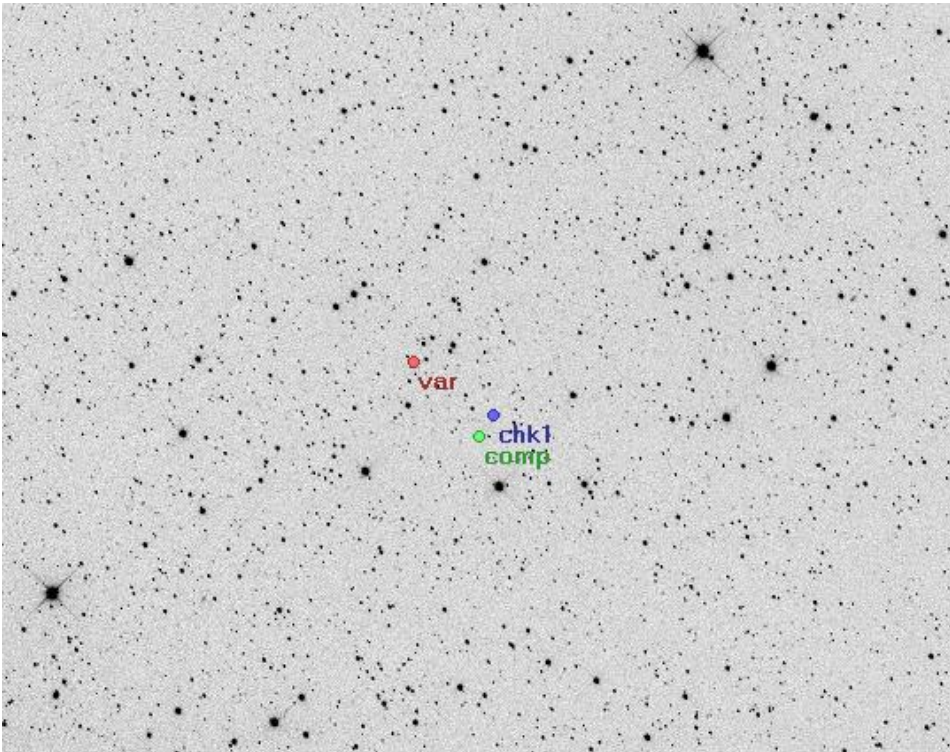


Fig 4: MoFr16 Del = 3UCAC 205-282753 (**var**) in the field of EQ Del. (**comp**) is the comparison star and (**chk1**) is the check star. North is left and East is down.

Table 2: Minima of MoFr16 Del = 3UCAC 205-282753

Observer	HJD-Date		Epoch	O-C (d)	Source
	Minimum	Type			
Moschner/Frank	2455739,5101	I	-5703	-0,0002	BAVM
W. Moschner	2457587,6291	II	-75,5	-0,0006	
W. Moschner	2457598,4667	II	-42,5	-0,0004	
W. Moschner	2457600,4367	II	-36,5	-0,0009	
W. Moschner	2457612,4245	I	0	0,0000	
W. Moschner	2457622,4405	II	30,5	-0,0005	

Remarks: none

**MoFr17 Aur = 3UCAC 246-056307 (15.27 mag)**

Right ascension: 05h 46m 24.7404s  
 Declination: +32° 41' 20.794"  
 2MASS J-K = 0.48 mag

Comparison star = 3UCAC 246-056347 (13.85 mag) J-K = 0.78 mag  
 Check Star = GSC 2409-01061 (12.90 mag) J-K = 0.40 mag

Amplitude Min I: 0.60 mag (instr.) Min II: 0.60 mag (instr.)  
 Type: WUMa type eclipsing binary  
 Min I = HJD 2455858.4815 +0.4191993\*E  
 +0.0010 +0.0000002

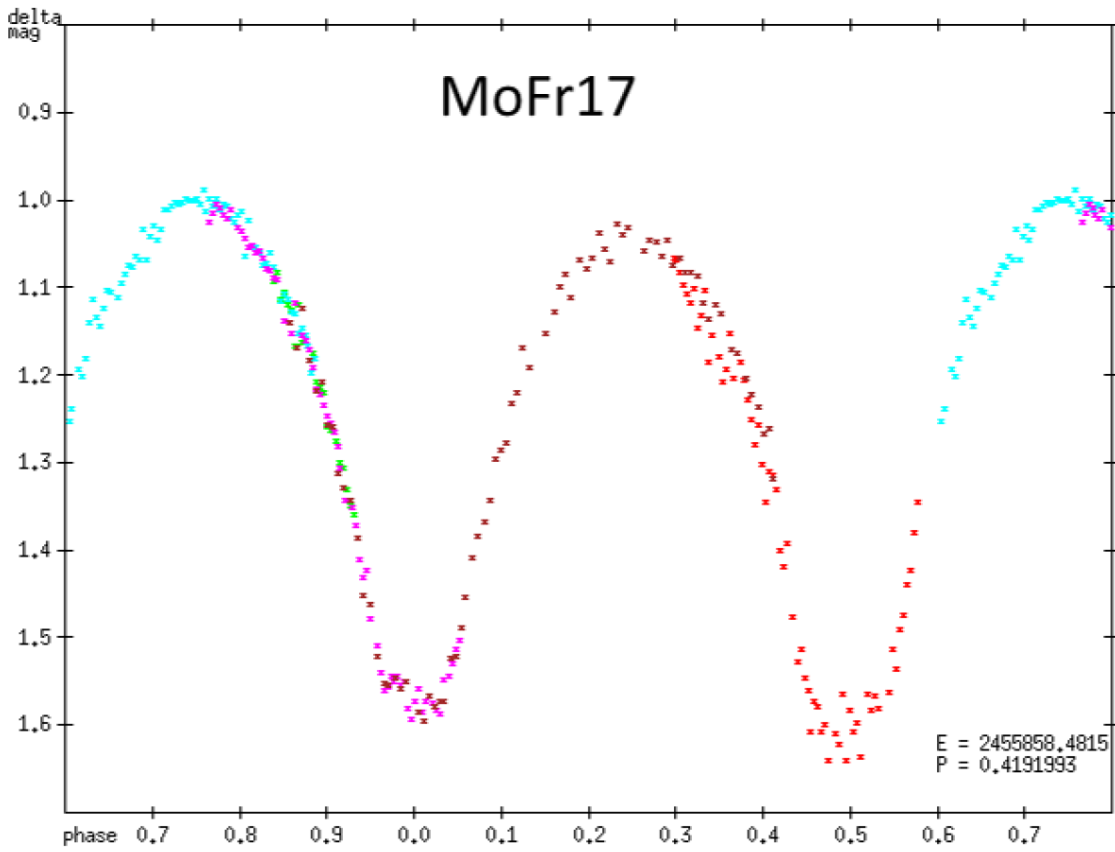


Fig 5: Phased lightcurve of MoFr17 Aur = 3UCAC 246-056307 using the ephemeris given above.

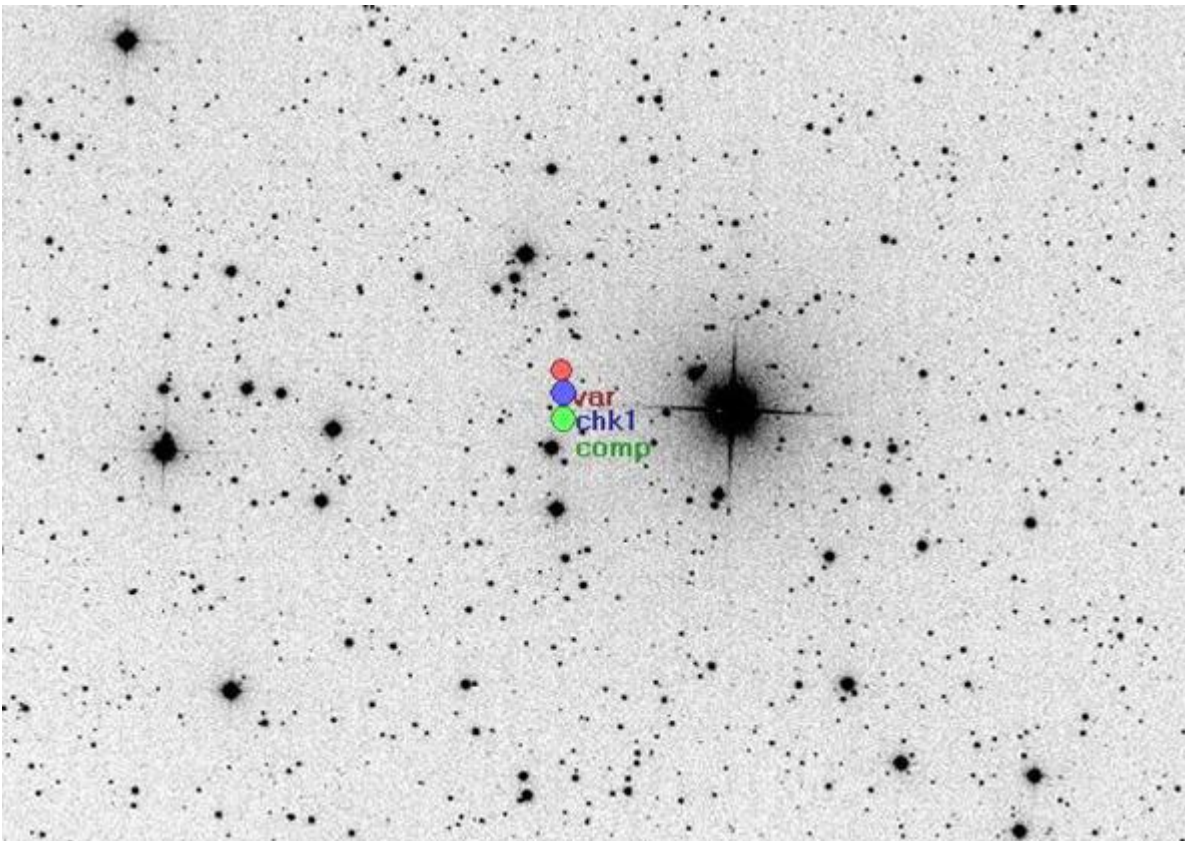


Fig 6: MoFr17 Aur = 3UCAC 246-056307 (var) in the field of BC Aur. (comp) is the comparison star and (chk1) is the check star. North is left and East is down.

Table 3: Minima of MoFr17 Aur = 3UCAC 246-056307

Observer	HJD-Datum		Epoch	O-C (d)	Source
	Minimum	Type			
Moschner/Frank	2455858,4815	I	0	0,0000	
W. Moschner	2457373,6755	II	3614,5	-0,0019	
W. Moschner	2457376,4035	I	3621	0,0013	
W. Moschner	2457402,8121	I	3684	0,0004	
W. Moschner	2457664,6018	II	4308,5	0,0001	

Remarks: A sure differentiation between primary and secondary minima was not possible.

**MoFr21 Cyg = 3UCAC 286-155544 (14.68 mag)**

Right ascension: 20h 17m 02.8203s

Declination: +52° 52' 08.848"

2MASS J-K = 0.62 mag

Comparison star = 3UCAC 286-155711 (13.81 mag) J-K = 0.66 mag

Check Star = 3UCAC 286-155536 (14.72 mag) J-K = 0.36 mag

Amplitude Min I: 0.40 mag (instr.) Min II: 0.35 mag (instr.)

Type: WUMa type eclipsing binary

Min I = HJD 2457574.6134 +0.2543125\*E  
 +-0.0012 +-0.0000004

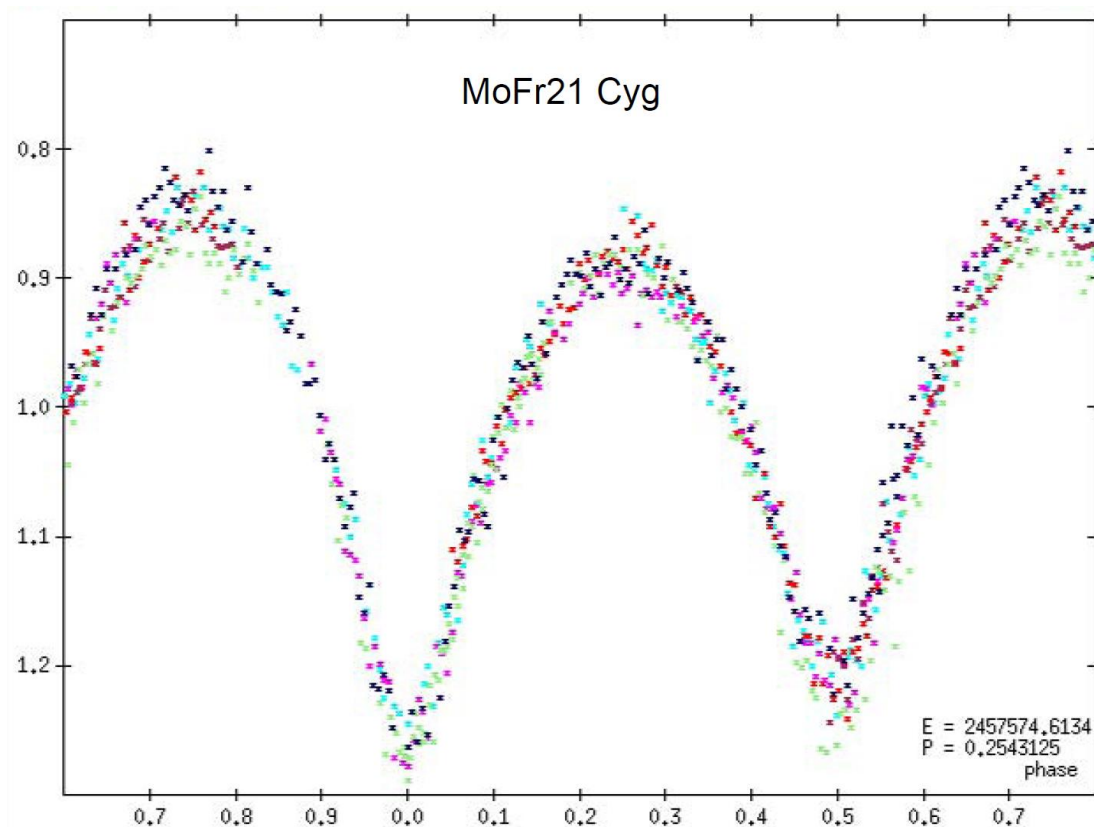


Fig 7: Phased lightcurve of MoFr21 Cyg = 3UCAC 286-155544 using the ephemeris given above.



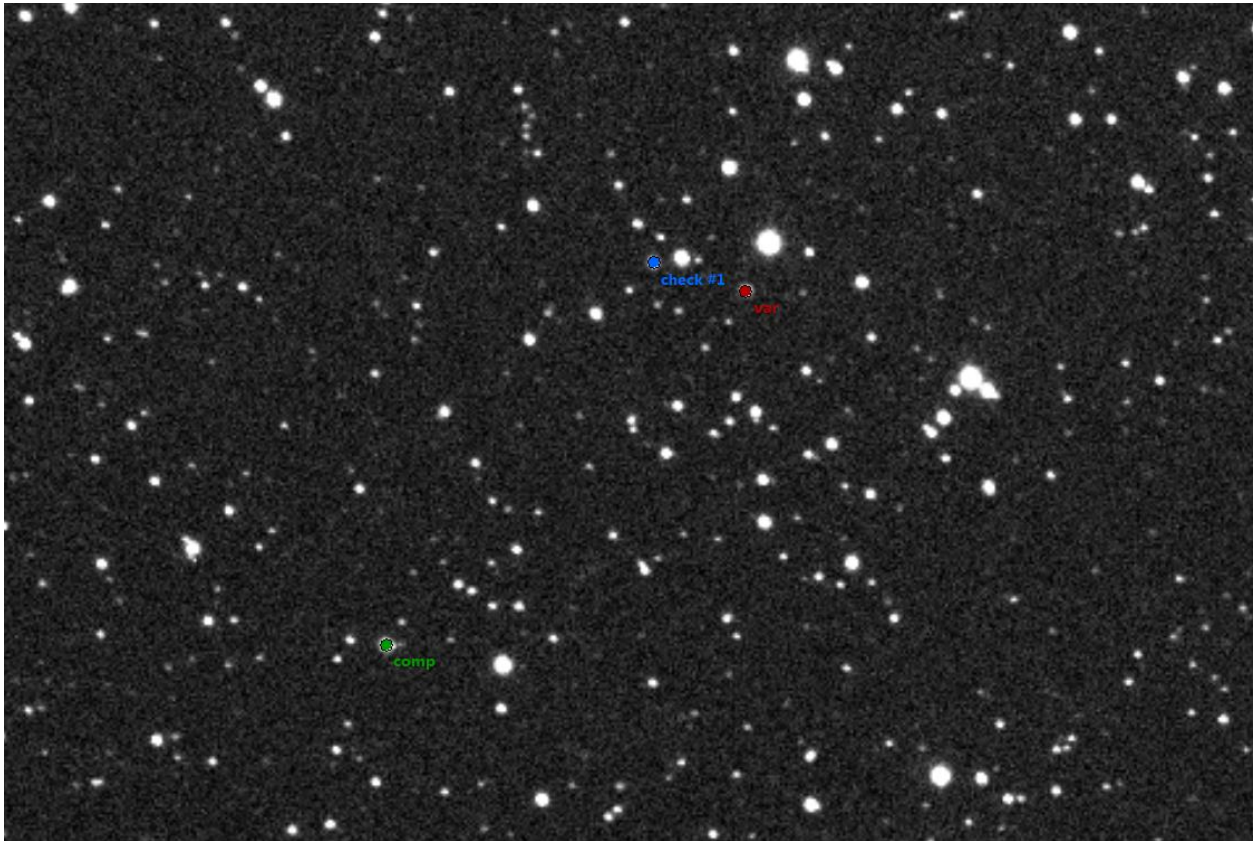


Fig 8: MoFr21 Cyg = 3UCAC 286-155544 (**var**) in the field of V1047 Cyg. (**comp**) is the comparison star and (**check#1**) is the check star. North is left and East is down.

Table 4: Minima of MoFr21 Cyg = 3UCAC 286-155544

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
W. Moschner	2457574,4846	II	-0,5	-0,0016	
W. Moschner	2457574,6134	I	0	0,0000	
W. Moschner	2457576,5194	II	7,5	-0,0013	
W. Moschner	2457581,4799	I	27	0,0001	
W. Moschner	2457581,6060	II	27,5	-0,0010	
W. Moschner	2457605,3843	I	121	-0,0008	
W. Moschner	2457605,5117	II	121,5	-0,0005	
W. Moschner	2457623,4416	I	192	0,0004	
W. Moschner	2457623,5660	II	192,5	-0,0023	

Remarks: possibly O'Connell-Effect.



**MoFr22 Cyg = GSC 3937-02349 (12.90 mag)**

Right ascension: 20h 17m 01.23s

Declination: +52° 52' 41.0"

2MASS J-K = 0.46 mag

Comparison star = 3UC286-155711 (13.81 mag) J-K = 0.66 mag

Check Star = 3UC286-155536 (14.72 mag) J-K = -0.36 mag

Amplitude Min I: 0.15 mag (instr.) Min II: 0.13 mag (instr.)

Type: WUMa type eclipsing binary

Min I = HJD 2457605.4016 +0.2875006\*E  
          +-0.0008 +-0.000003

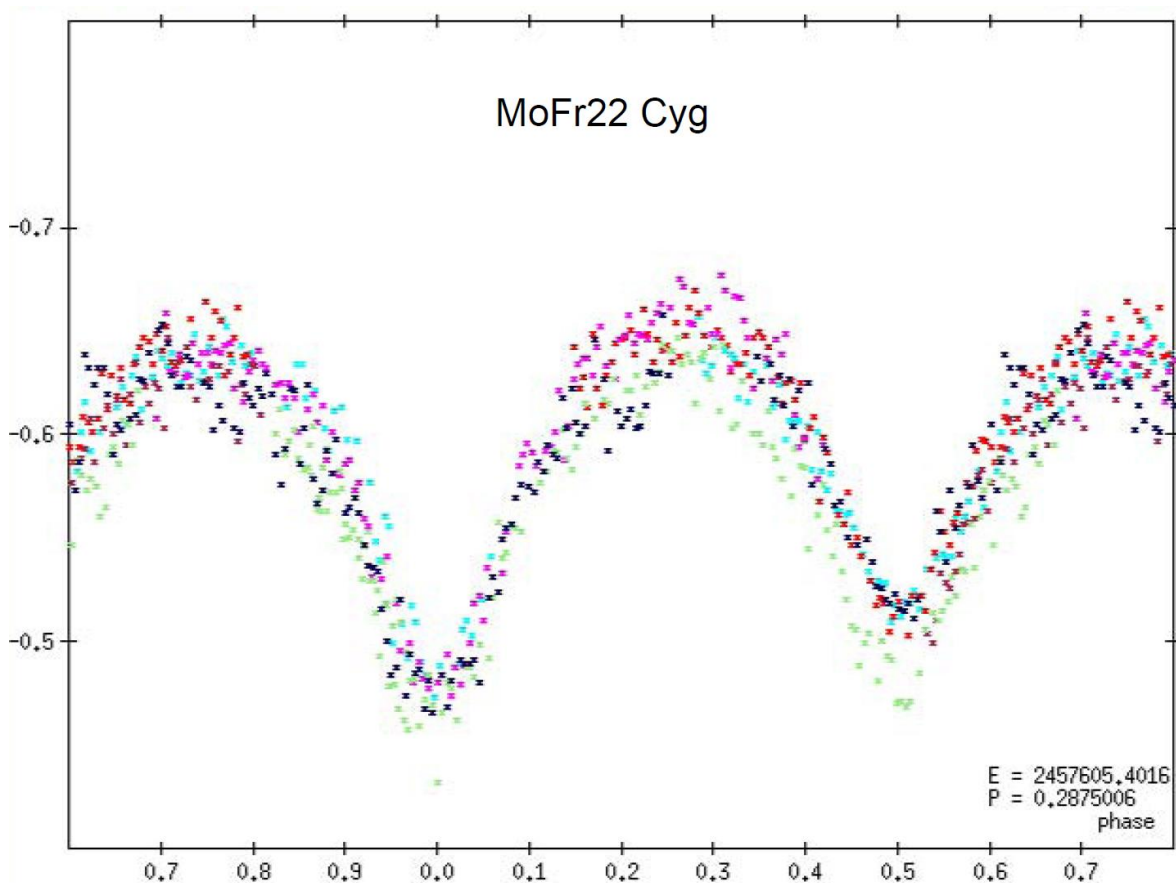


Fig 9: Phased lightcurve of MoFr22 Cyg = GSC 3937-02349 using the ephemeris given above.

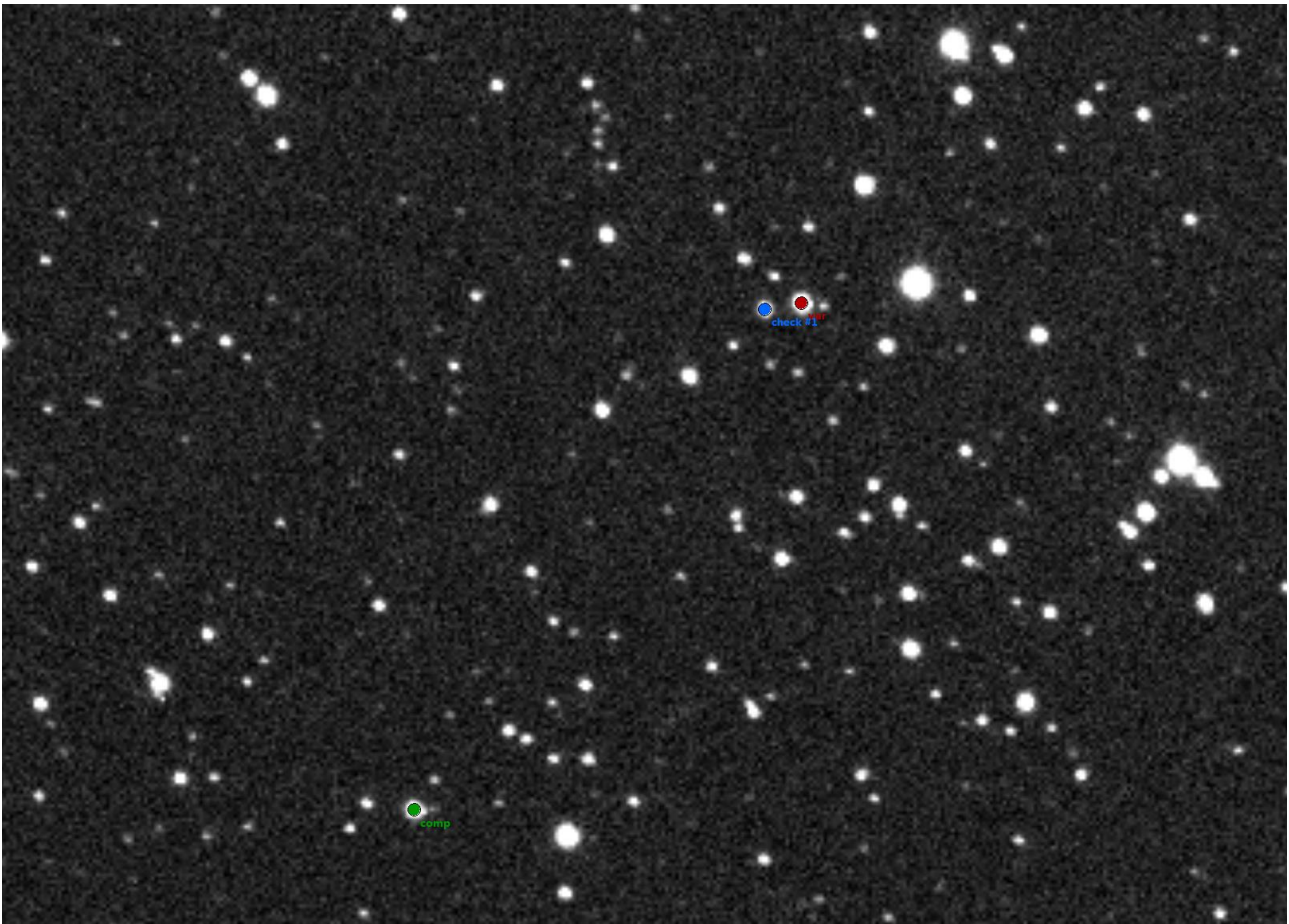


Fig 10: MoFr22 Cyg = GSC 3937-02349 (**var**) in the field of V1047 Cyg. (**comp**) is the comparison star and (**check#1**) is the check star. North is left and East is down.

Table 5: Minima of MoFr22 Cyg = GSC 3937-02349

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
Moschner/Frank	2455333,4280	II	-7902,5	-0,0001	
W. Moschner	2457574,4973	II	-107,5	0,0020	
W. Moschner	2457574,6398	I	-107	0,0008	
W. Moschner	2457576,5085	II	-100,5	0,0007	
W. Moschner	2457581,5385	I	-83	-0,0006	
W. Moschner	2457605,4016	I	0	0,0000	
W. Moschner	2457605,5462	II	0,5	0,0008	
W. Moschner	2457623,3711	II	62,5	0,0007	
W. Moschner	2457623,5131	I	63	-0,0010	

Remarks: none

**MoFr24 Lac = 3UCAC 273-264245 (15.30 mag)**

Right ascension: 22h 05m 18.40s  
Declination: +46° 10' 41.0"  
2MASS J-K = 0.62 mag

Comparison star = 3UCAC 273-264251 (14.19 mag) J-K = 0.30 mag  
Check Star = 3UCAC 273-264255 (14.46 mag) J-K = 0.30 mag

Amplitude Min I: 0.45 mag (instr.) Min II: 0.40 mag (instr.)

Type: WUMa type eclipsing binary

Min I = HJD 2457604.6518 +0.3416220\*E  
          +-0.0010 +-0.000005

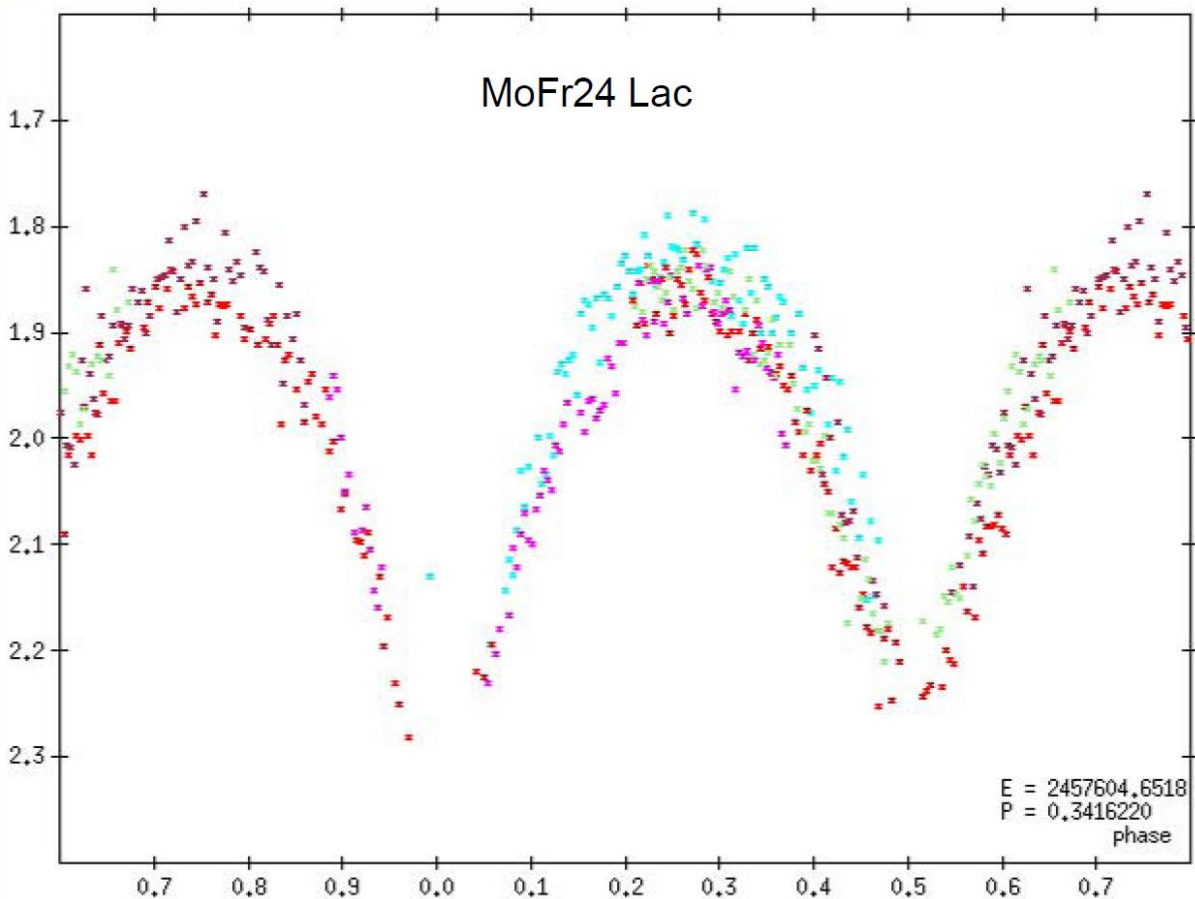


Fig 11: Phased lightcurve of MoFr24 Lac = 3UCAC 273-264245 using the ephemeris given above.

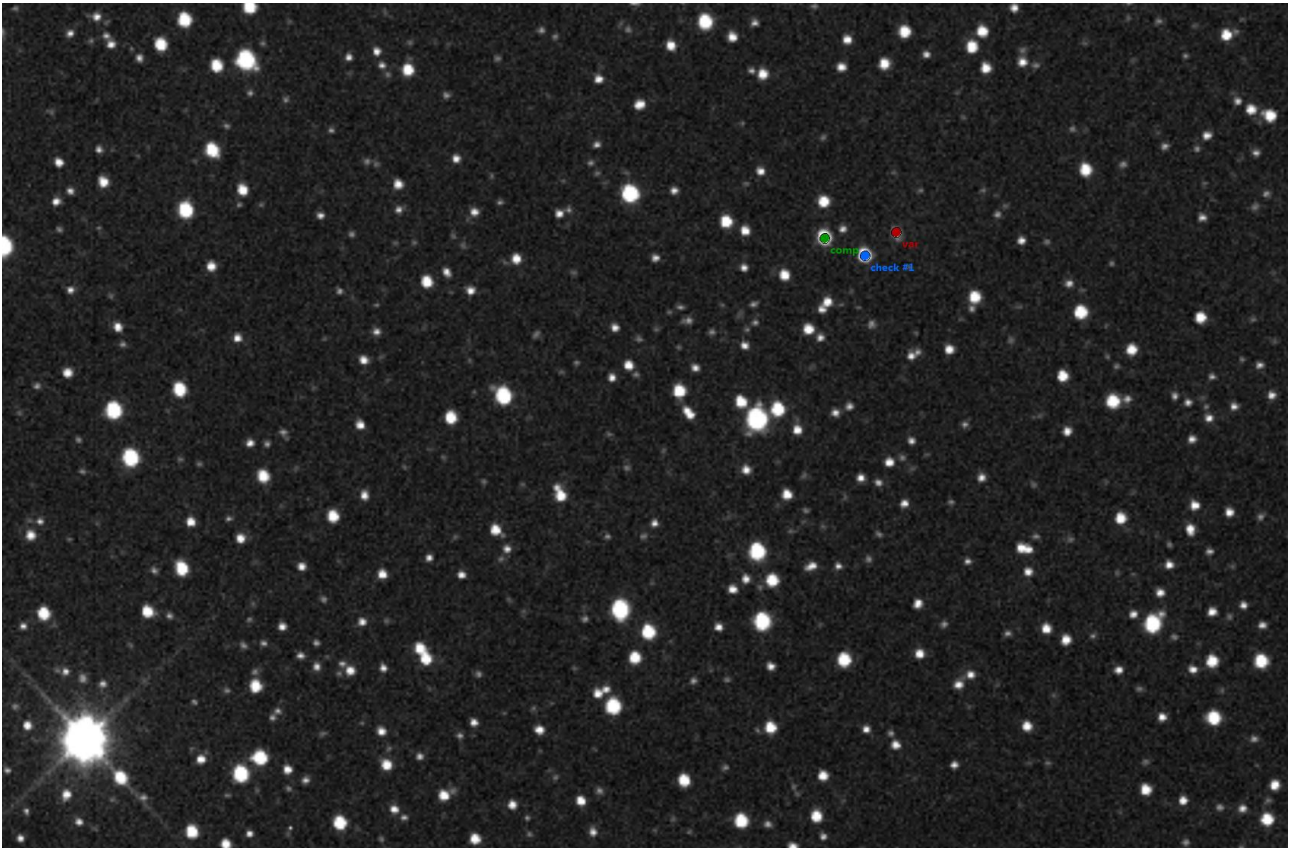


Fig 12: MoFr24 Lac = 3UCAC 273-264245 (**var**) in the field of CN Lac. (**comp**) is the comparison star and (**check#1**) is the check star. North is left and East is down.

Table 6: Minima of MoFr24 Lac = 3UCAC 273-264245

Observer	HJD-Date Minimum	Type	Epoch	O-C (d)	Source
W. Moschner	2457604,4828	II	-0,5	0,0018	
W. Moschner	2457604,6518	I	0	0,0000	
W. Moschner	2457609,4377	I	14	0,0032	
W. Moschner	2457614,3895	II	28,5	0,0015	
W. Moschner	2457624,6352	II	58,5	-0,0015	

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] Guide 9: <http://www.projectpluto.com>