GEOS **GEOS CIRCULAR ON NEW VARIABLES** **GEOS**
NV02 **Parc de Levesville, 23**
January 2018 **F-28300 BAILLEAU L'EVÊQUE**

New Variable Stars in Perseus

Francesco Fumagalli *, Marco Nobile**

* Calina Observatory, GEOS
**Private Observatory, GEOS

Riassunto
9 nuove stelle variabili sono state scoperte dagli autori nel campo di due stelle variabili RR Lyr: TU Per e V375 Per. In quattro stagioni osservative, dal 2013 al 2016, sono state condotte complessivamente 58 notti d'osservazione totalizzando circa 20.000 immagini, presso l'osservatorio Calina di Carona e presso l'Osservatorio privato di Marco Nobile sito a Savosa. Le 9 stelle appartengono a diverse classi: 3 δ Sct, 5 Binarie ad Eclisse, 1 RR Lyr. Per alcune di queste si rendono necessarie ulteriori osservazioni.

Summary
9 new variable stars have been discovered from the authors in the field of two RR Lyr type variable stars : TU Per, V375 Per. In four observational seasons, carried out from 2013 to 2016, about 20.000 images have been carried out at Calina observatory, and at Marco Nobile private observatory. The 9 new variable stars belong to various classes : 3 are δ Sct pulsating stars, 5 are Eclipsing Binaries, and 1 an RR Lyr pulsating star. Some of those new variable stars need further observations.

Résumé :
9 nouvelles étoiles variables ont été découvertes par les auteurs dans le champ de deux variables de type RR Lyr : TU Per et V375 Per.
En quatre saisons, entre 2013 et 2016, un total de 58 nuits d'observation a été réalisé, permettant d'obtenir environ 20 000 images, à l'observatoire Calina de Carona et à l'observatoire privé de Marco Nobile situé à Savosa.
Les 9 étoiles appartiennent à différentes classes: 3 δ Sct, 5 binaires à éclipses, 1 RR Lyr. La poursuite des observations est nécessaire pour certaines.

Resumen:
9 estrellas variables nuevas fueron descubiertas por los autores en el campo de dos estrellas variables de tipo RR Lyr: TU Per y V375 Per.
En cuatro temporadas, entre 2013 y 2016, se realizo un total de 58 noches de observación, sumando cerca de 20,000 imágenes, en el observatorio Calina en Carona y en el observatorio privado de Marco Nobile ubicado en Savosa.
Las 9 estrellas pertenecen a diferentes clases: 3 δ Sct, 5 binarias a eclipse, 1 RR Lyr. Para algunas de estas observaciones adicionales son necesarias.

Introduction

The authors worked at Calina Observatory in Carona, and at M.Nobile private observatory near Lugano (Switzerland). They carried out systematic observations in the GEOS RR Lyr campaign from 2013 until 2016.
The instruments used were :

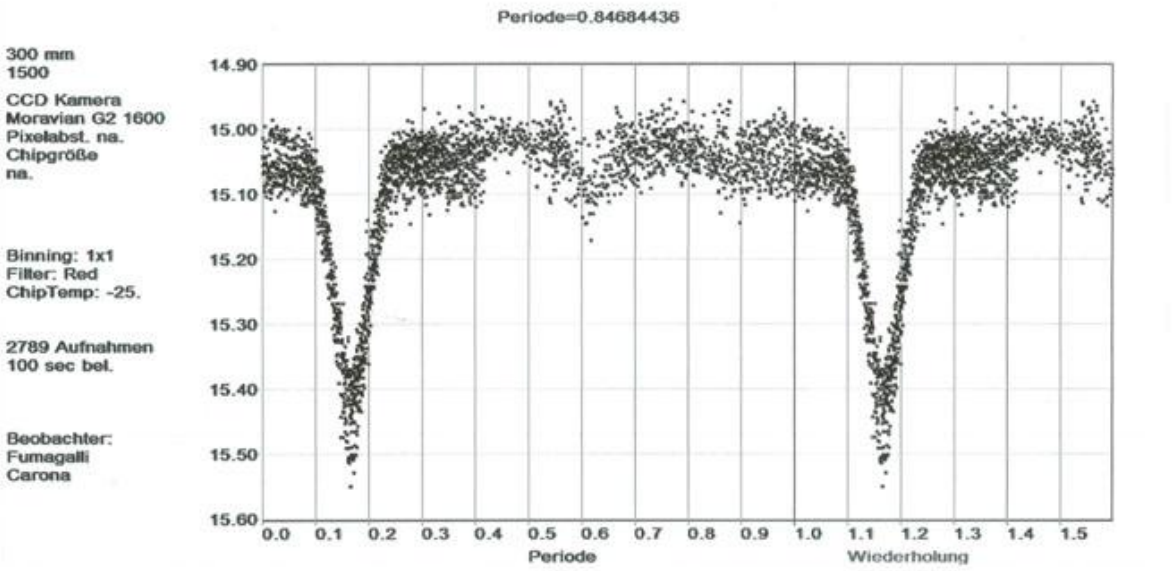
- A Ø 300 mm F :5 Newton telescope FOV 20'x30' at Calina Observatory.
- A Ø 250 mm F :3 Baker Schmidt telescope FOV 40'x60' at Savosa observatory.

Both telescopes are remote controlled, and all the images and the data obtained have been analysed with the "Muniwin" and "Starmeter" softwares.
Both telescopes are equipped with a Moravian G 1600 CCD camera and the images have been taken in white light, i.e., without filters.

The light curves have been folded using arbitrary epochs, not the respective ephemerides.

Field of TU Per
This field has been observed for 24 nights in the seasons 2013-2014 and 2014-2015. 8903 images/measurements have been carried out. Finally five stars have been recognized as suspected variables.
The following stars have been used as comparison and check stars :
GSC 03702 :00661 mag.11,75 [α 03.09.07,16 δ + 53.17.24,91] comparison
GSC 03702 :00706 mag.12,11 [α 03.09.16,52 δ +53.18.06,87] check

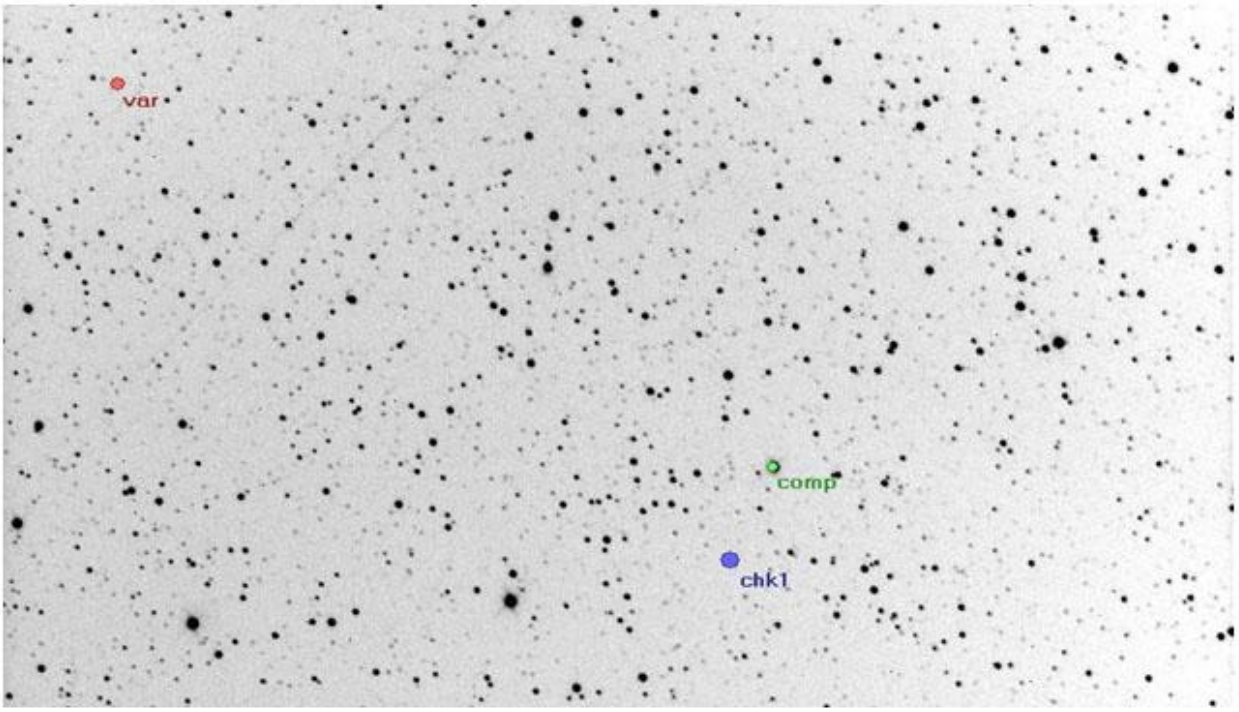
Suspected 1: USNO-B1.0 1434-0100309
Variation M. instr 15.00-15.51 Type EA HJD 2456634.283440 + 0.84684436 x E
α 03h 08m 58.7s δ +53° 29' 57.



We obtained 2789 measurements:

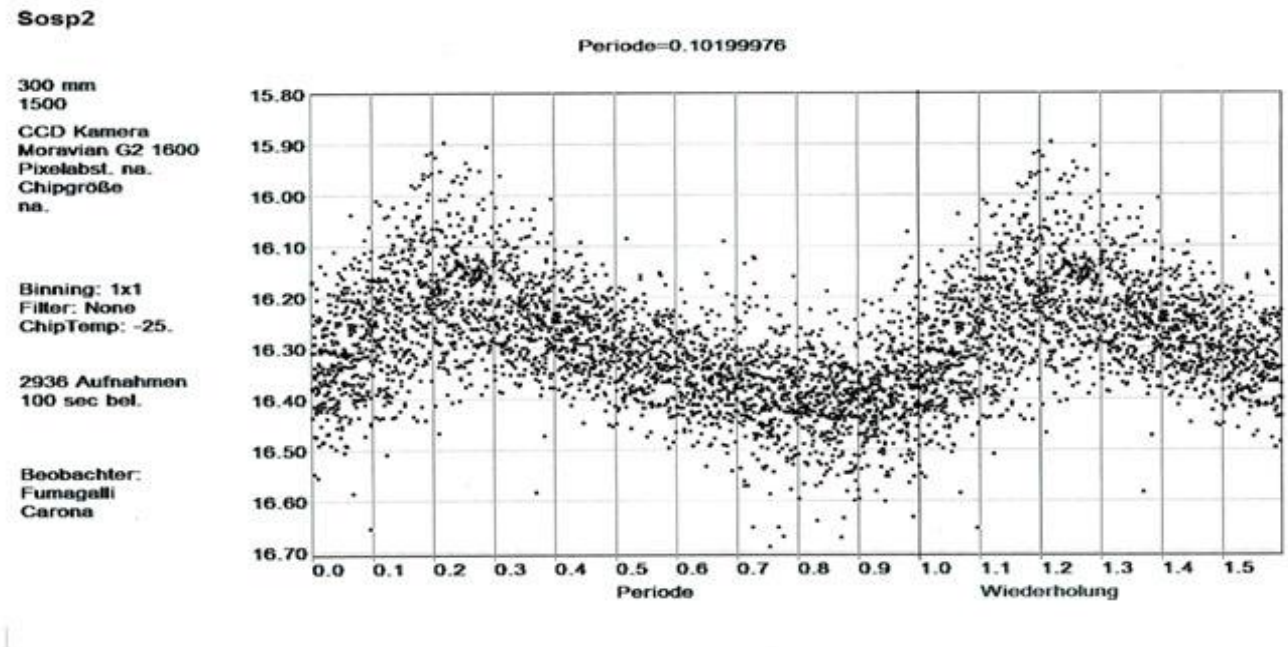
6 minima observed: HJD 2456000 +	635.28038	948.59971
(HJD = Heliocentric Julian Day)	639.48487	981.56032
	657.28153	983.32744

To note as important feature : the secondary minimum is eccentric.



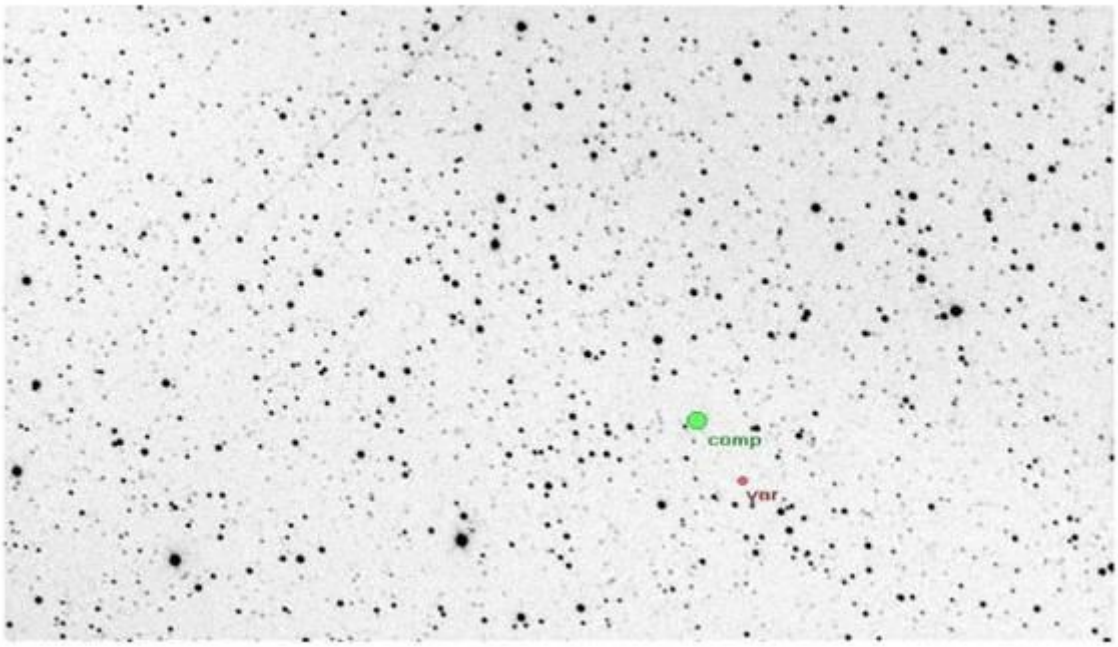
TU Per : field of Suspected 1

Suspected 2: USNO-B1.0 1431- 0113964
Variation M. instr 15.95-16.55 Type δ Sct Max I : 2456634.27661 + 0.10199976 x E
α 03h 08m 46.211s δ +53° 06' 56.01''



We obtained 2936 measurements:

15 maxima observed: HJD 2456000 +	634.27661	638.30315	682.36644
	634.36245	638.49641	984.37557
	634.52642	639.30315	984.48212
	637.47237	639.44461	984.77344
	637.56536	641.34597	984.66743

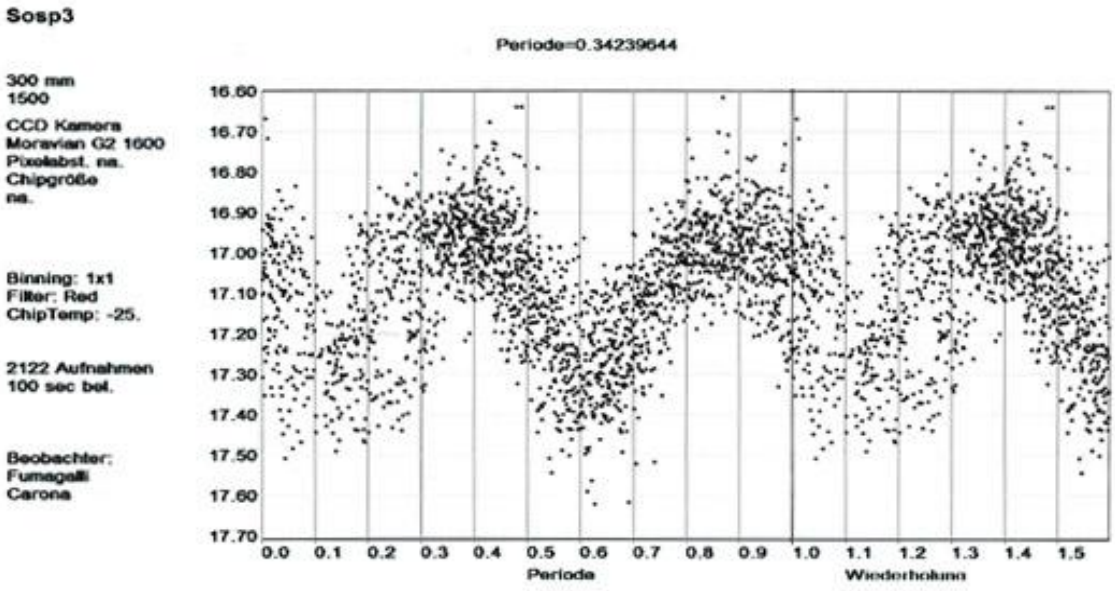


TU Per : field of Suspected 2

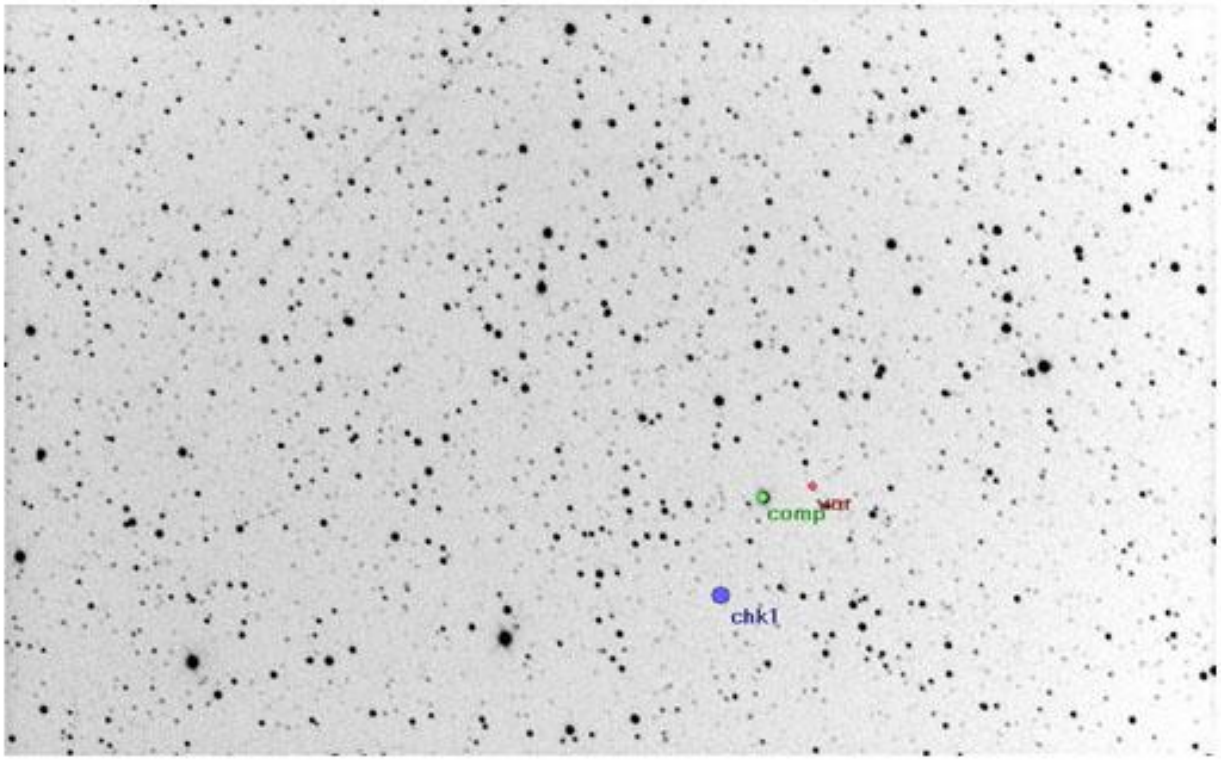
Suspected 3: USNO-B1.0 1431-0114143

Variation M. instr 16.8-17.5 Type EW Min I :2456634.33080 + 0.34239644 x E

α 03h 08m 59.516s δ +53° 08' 06.94''

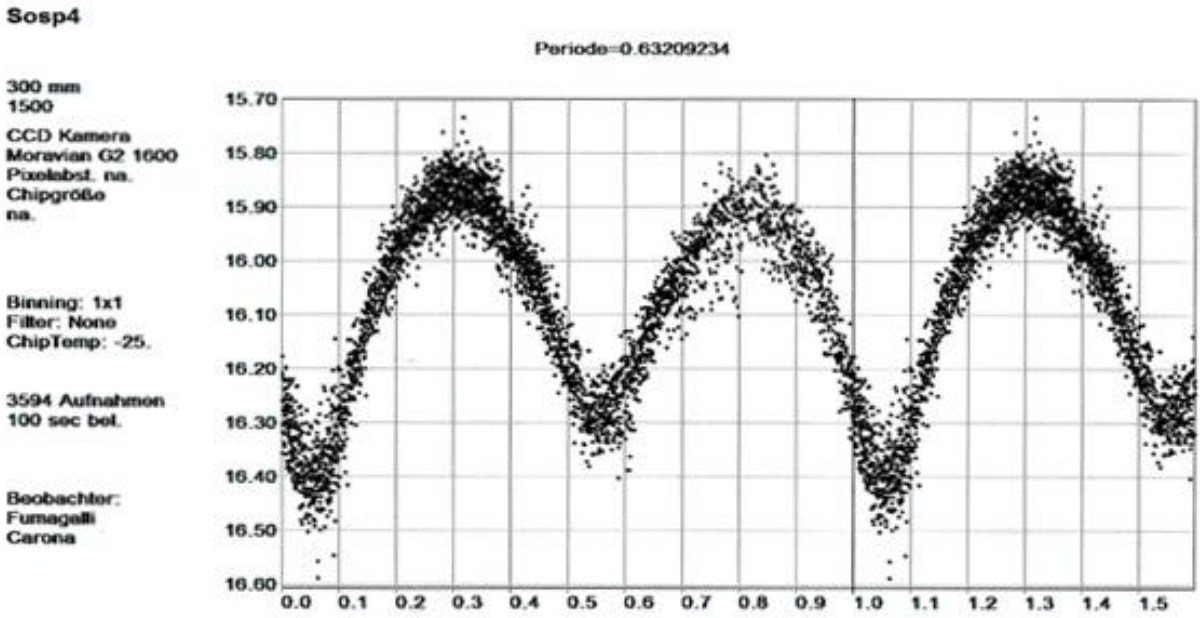


We obtained 2122 measurements:
6 minima observed : HJD 2456000 + 634.33080 637.51308
634.50868 657.30387
637.43169 682.40698



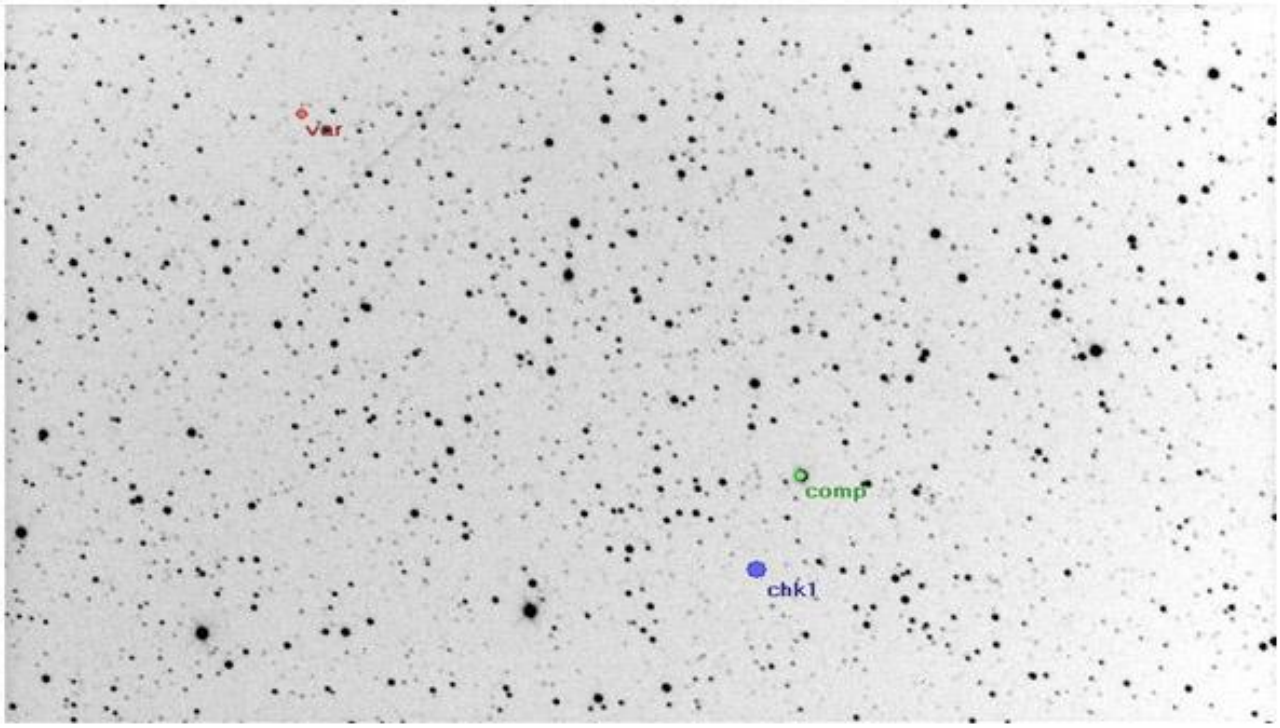
TU Per : field of Suspected 3

Suspected 4: USNO-B1.0 1434-0100414
Variation M.instr 15.80-16.45 Type EB Min I : 2456634.32622 + 0.63209234 x E
α 03h 09m 10.488s δ +53° 25' 41.9''



We obtained 3594 measurements:

14 minima observed: HJD 2456000 +	634.32622	639.38115	923.51731	981.34425
	635.27795	641.27405	924.45843	983.55287
	637.48418	657.40367	953.53620	
	638.42880	670.35417	957.32012	

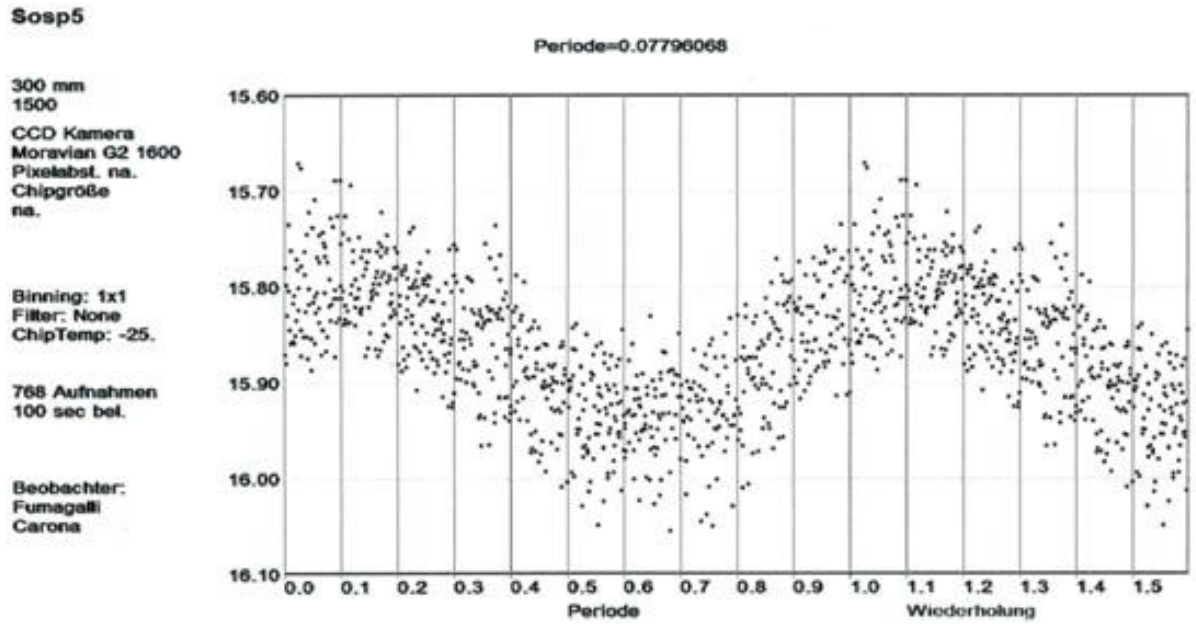


TU Per : field of Suspected 4

Suspected 5: USNO-B1.0 1435-0093997

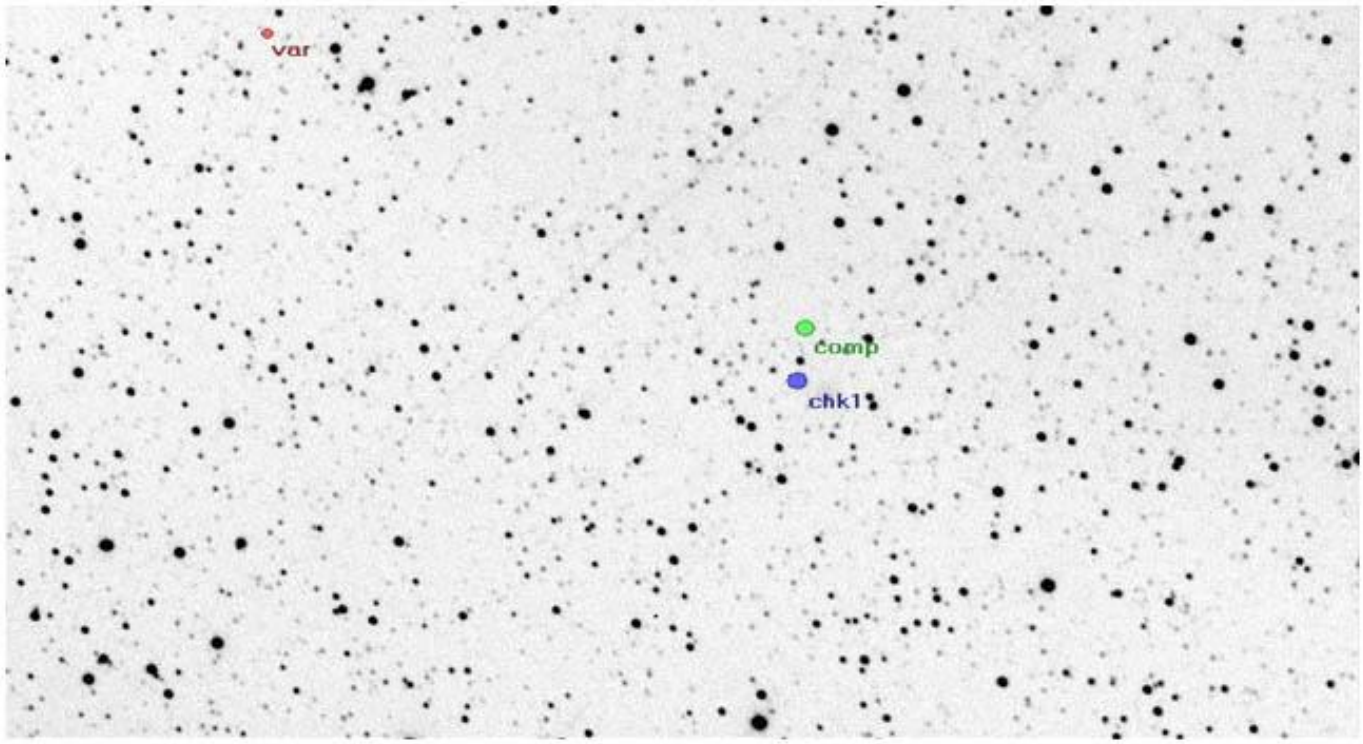
Variation M. instr 15.72-16.02 Type δ Sct Min I : 2456634.39961 + 0.07796860 x E

α 03h 09m 20.774s δ +53° 33' 37.69''



We obtained 768 measurements:

17 minima observed:	HJD 2456000 +	634.39961	635.57811	639.55836
		634.52142	637.53436	639.63410
		634.59074	637.60648	641.44435
		635.35406	639.34443	641.51028
		635.37666	639.41721	641.55607
		635.50332	639.48322	



TU Per: field of Suspected 5

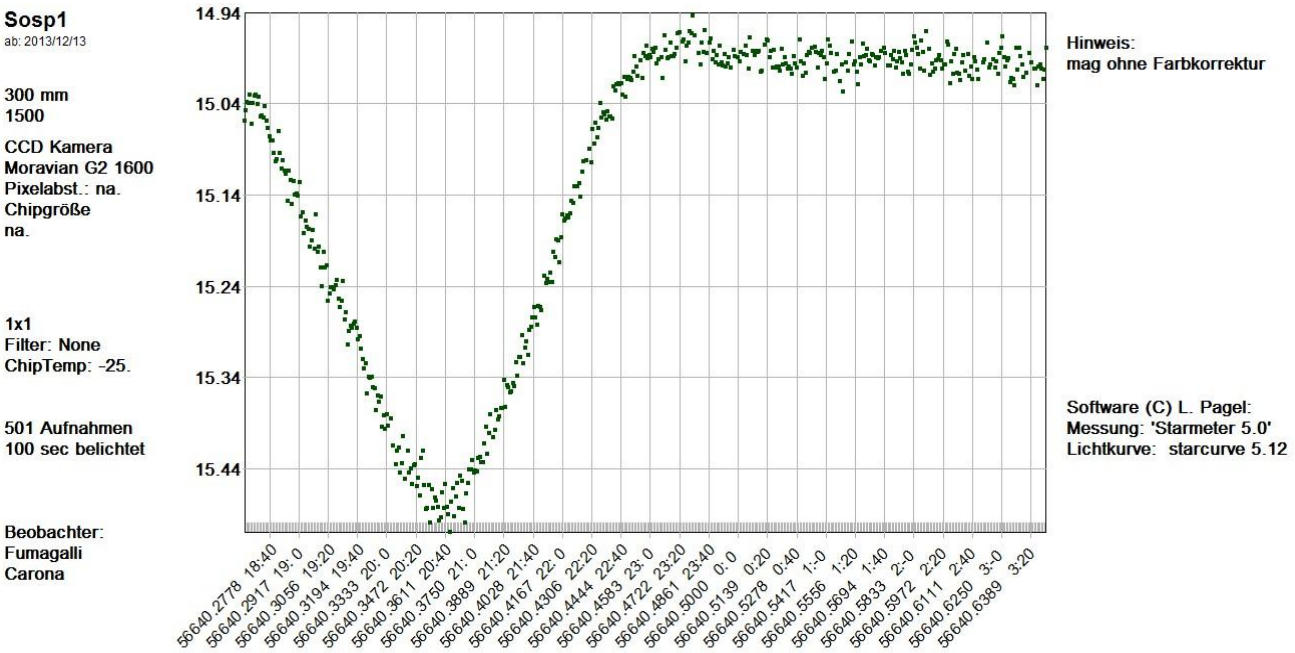
Field of V 375 Per

This star and its field were observed during 2013-2014 and 2014-2015 seasons.
We carried observations for 4 nights in the winter 2013 and 5 nights in the winter 2014. Finally four suspected star were discovered.
For this field we have chosen the following two check stars:
GSC 02865 :01227 α 03 27 13 δ +40 12 21
GSC 02865 :00945 α 03 27 15 δ +40 15 54

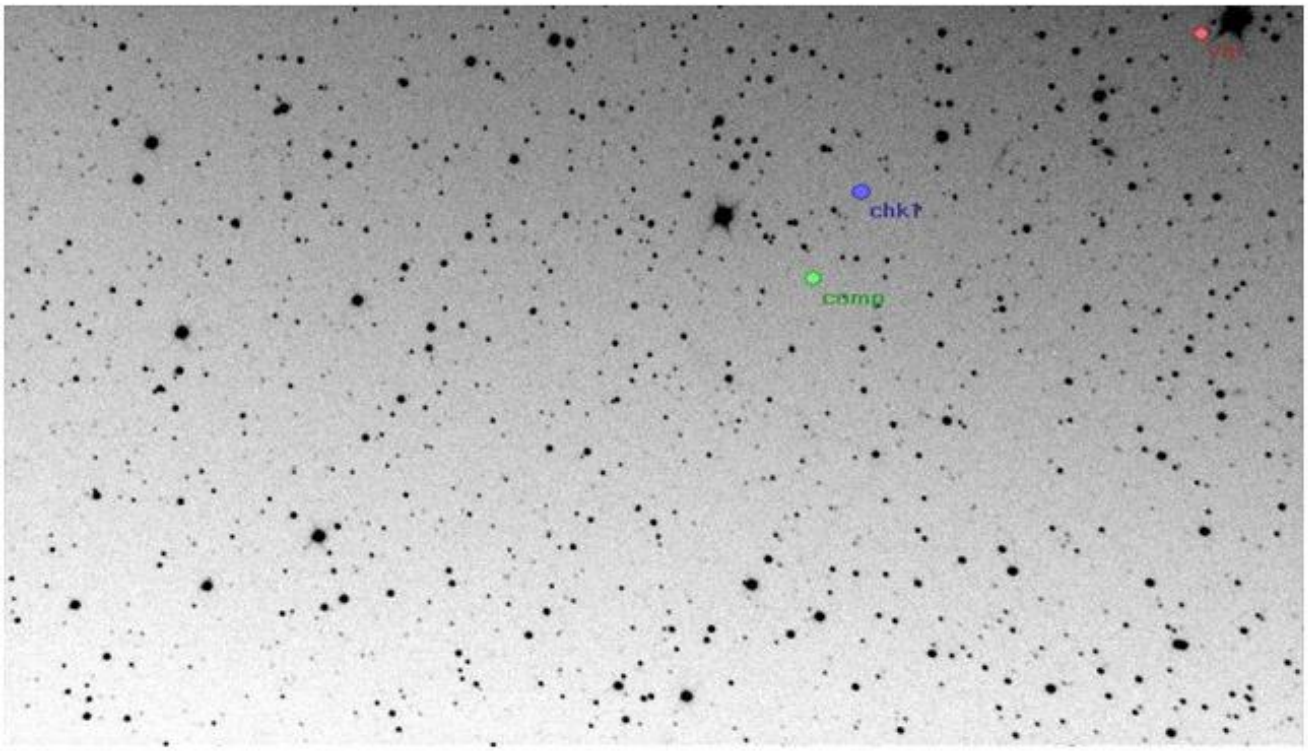
Suspected 1: USNO-B1.0 1299-0067121
Variation M. instr 14.97-15.53 Type EA Min I : 2456640.36749
α 03 h 28m 17.03s δ +39° 53' 37.06''

This star has been recognized as a binary Algol type variable, unfortunately we have observed only one minimum and could not obtain a period.

The light curve obtained on the night of 2013, Dec 13 is shown below.

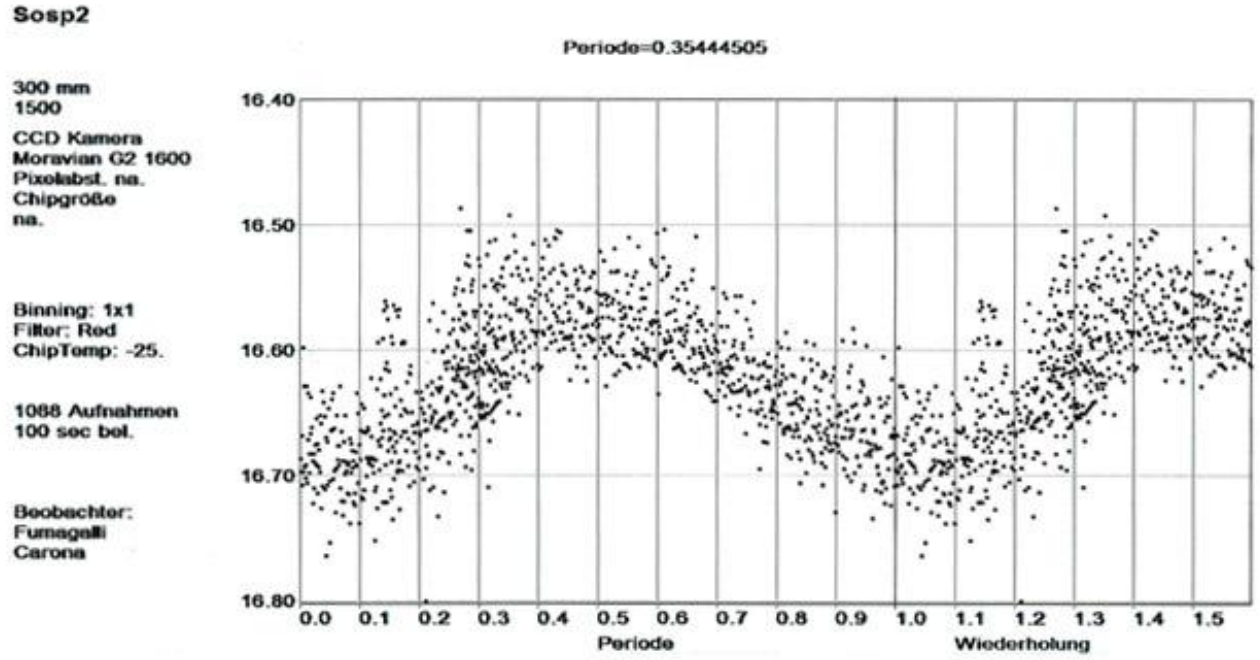


We obtained 377 measurements:
1 minimum observed: HJD 2456640.36749

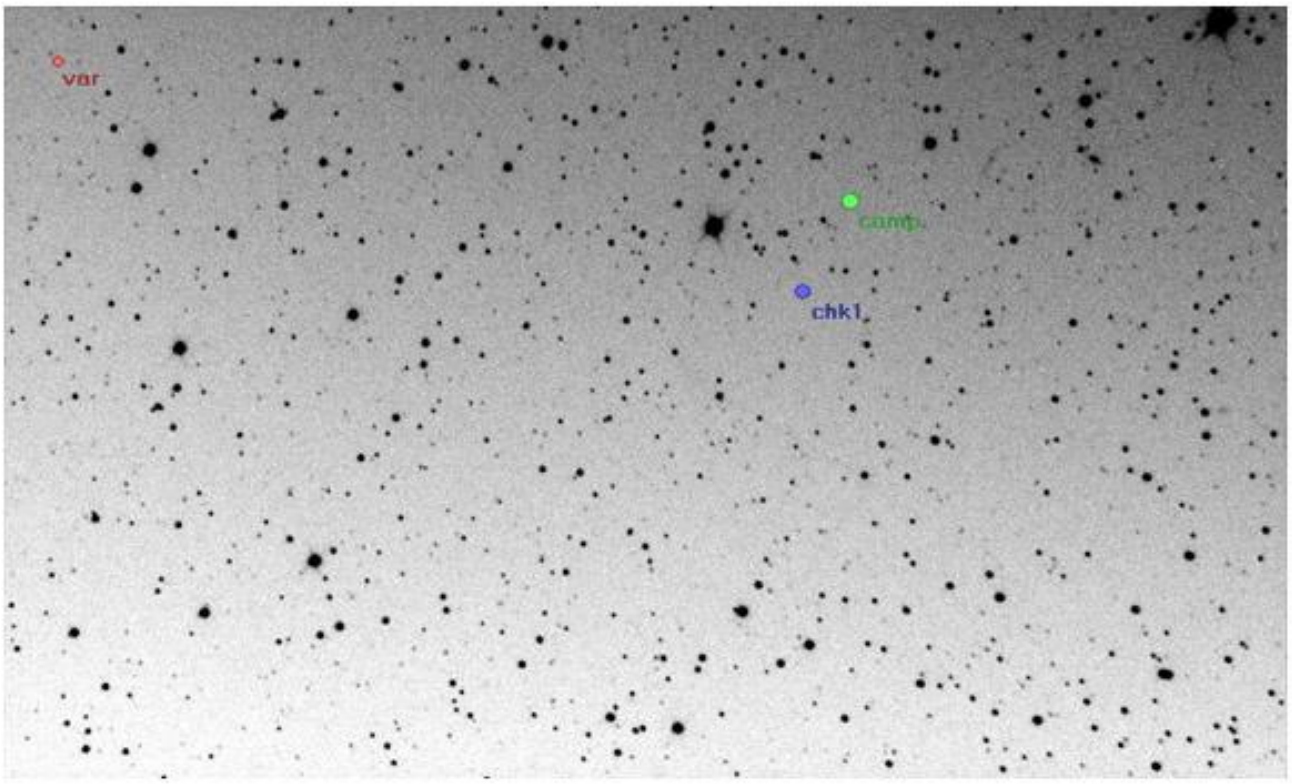


V 375 Per : Field of Suspected 1

Suspected 2: USNO-B1.0 1303-0062421
Variation M.instr 16.51-16.73 Type RR Lyr Max : 2456640.55461 + 0.35444505 x E
α 03h 26m 54.266s δ +40° 23′ 32.17″



We obtained 977 measurements:
2 maxima observed: 2456000 + 640.55461
656.50657



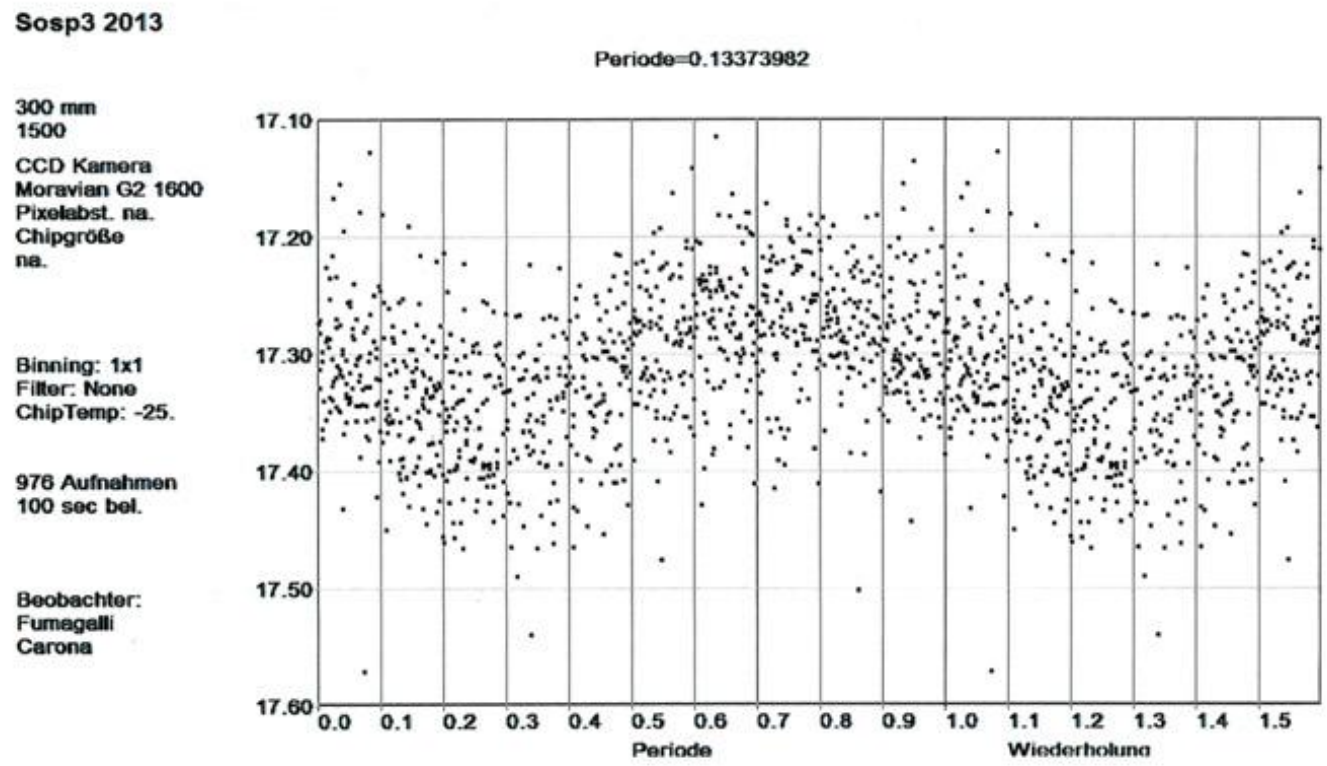
V375 Per : Field of Suspected 2

Suspected 3: USNO-B1.0 1300-0062534

Variation M. instr 17.19-17.45 Type δ Sct Max : 2456640.56099 + 0.13373982 x E

α 03 h 26m 48.825s δ +40° 04' 32.55''

This star has a very short variation period that allows us to catalog it as a δ Sct type. Indeed, the observed period was 0.13373982 d in 2013.

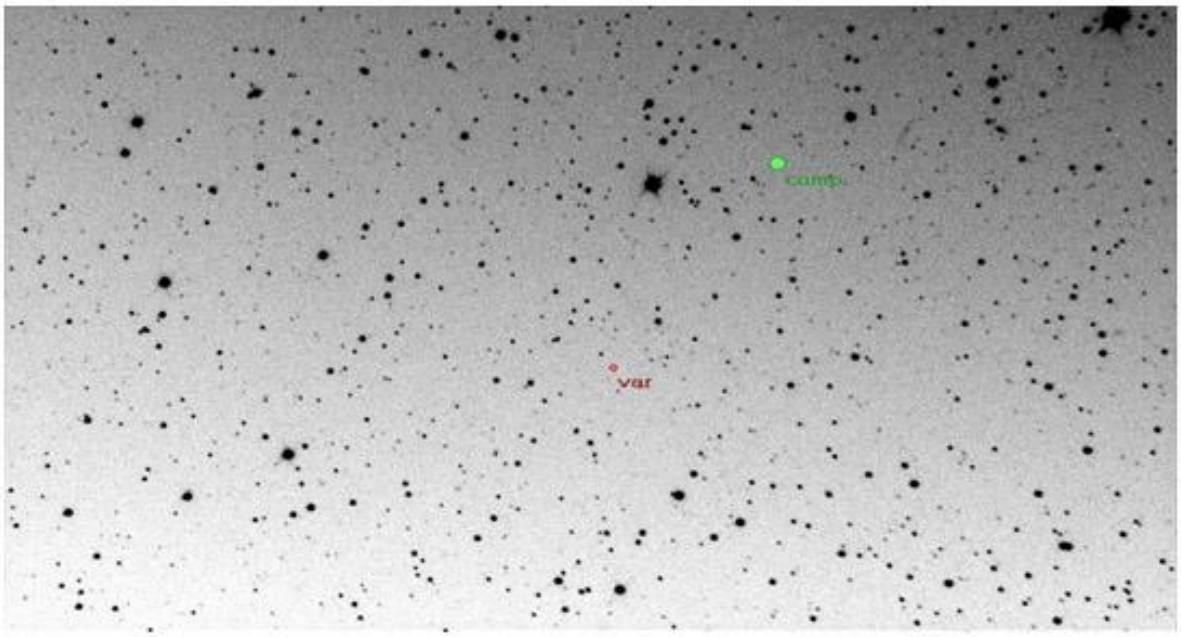


We obtained 977 measurements in 2013:

4 maxima observed:	HJD 2456000 +	640.56099	656.42206
		656.27791	656.55973

and we obtained 919 measurements in 2014:

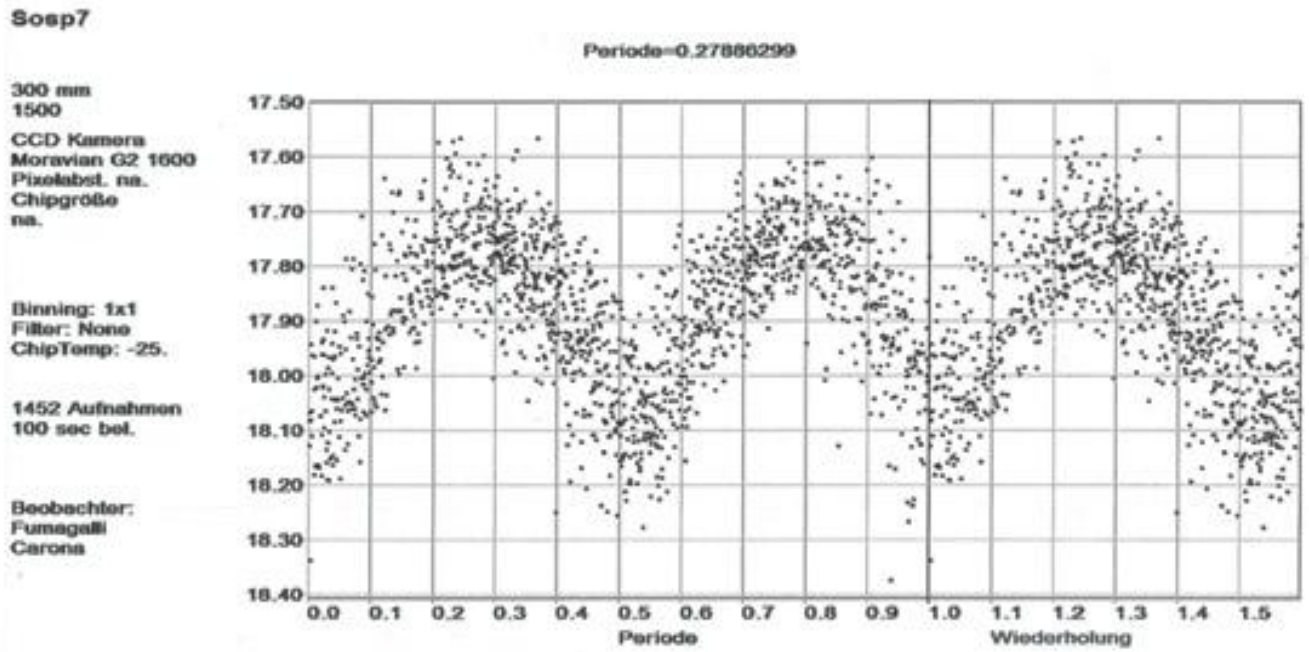
6 maxima observed:	HJD 2457000 +	003.34521	010.55932
		003.38750	011.42445
		010.42110	011.57560



V375 : Field of Suspected 3

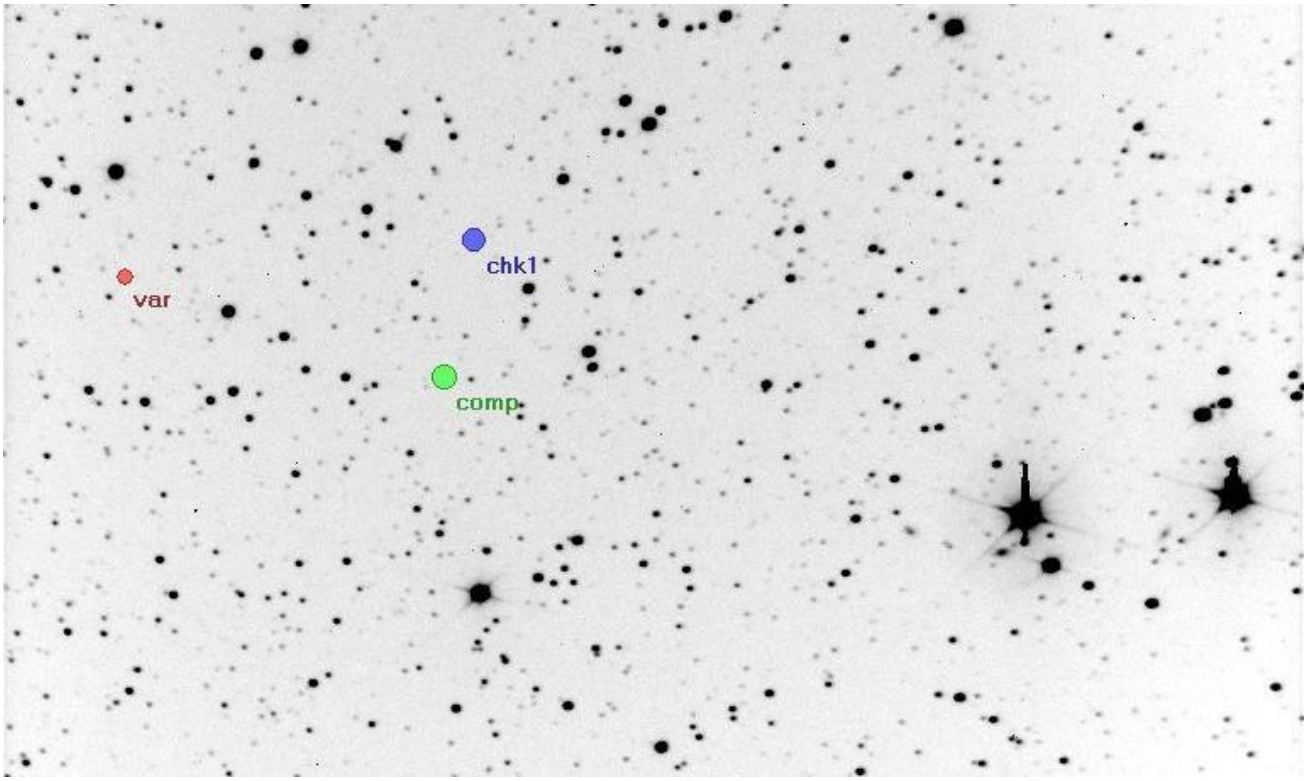
Suspected 7: USNO-B1.0 1302-0063124
Variation M.instr. 17.65-18.19 Type EW, equal minima. Min I or II : 2456640.36339 + 0.27886299 x E
α 03 h 26m 30.9s δ +40° 14' 08.5''

We observed this star in 2013 and in 2014 for 7 nights and obtained 12 minima.



We obtained 314 measurements in 2013 and 2014:

13 minima observed:	HJD	2456000 +	2457000 +	2457000 +
		640.36339	001.37471	010.33289
		640.50210	001.49740	010.47165
		642.50508	003.37246	010.59157
		645.31496	003.51234	011.40248
				011.53614



V375 Per : field of suspected 7

Conclusions and acknowledgements

The discovery of these new variable stars have been carried out during prospection observations in the framework of the GEOS RR Lyr survey managed by Jean-François Le Borgne. Since some of those new variable stars need further observations, we encourage other observers to follow them.

We wish to thank Lienhard Pagel for his kind attention and collaboration with the use of his program " Starcurve ".
We also want to thank Ennio Poretti and Jean François Le Borgne for their kind collaboration.

Bibliography

Starcurve program – Lienhard Pagel www.bav-astro.eu
Muniwin program – David Motl www.c-munipack.sourceforge.net
AAVSO VSX www.aavso.org/vsx/