

TALLINNA TÄHETORN TALLINN OBSERVATORY

V

Number 1

2008



Tallinna Tähetorn
Tallinn Observatory

**TALLINNA TEHNIKAÜLIKOO
FÜÜSIKAINSTITUUT
TALLINNA TÄHETORN**

**TALLINN UNIVERSITY OF TECHNOLOGY
INSTITUTE OF PHYSICS
TALLINN OBSERVATORY**

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Koostanud ja toimetanud
T. Aas, V. Harvig

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Tehniliste aruannete ja eelartiklite kogumik
Collections of technical reports and preliminary articles

ISSN 1406–8559

The mystery of V2148 Cygni.

P. Kalv

Autor deceased (1934-2002)

T. Aas

Tallinn University of Technology, Institute of Physics, Tallinn Observatory,
Tähetorni 2, Tallinn, Estonia
aast@hotmail.ee

V. Harvig

Tallinn University of Technology, Institute of Physics, Tallinn Observatory,
Tähetorni 2, Tallinn, Estonia
Tartu Observatory
vharvig@hotmail.com

Introduction

The star is known for a long time as star with bright H_α lines by Merrill & Burwell(1933). The GCVS name, as the variable star discovered by the *Hipparcos* mission, is given in Kazarovets (Kazarovets et al., 1999). From miscellaneous sources the spectrum of HD 201733 is shell B4IVp and it is a member of open cluster NGC 7039. According to *Hipparcos* Catalogue the distance is 336 ± 70 parsecs and $MV = -1^m.03 \pm 0.45$.

The Be star V2148 Cyg = HD 201733 has been monitored with the 50 cm telescope of Tallinn Observatory (from 1981, up to 1996 during 129 nights in *UBVR*). *UBVR* observations were carried out in connection the international campaign on photoelectric observations of bright Be stars.

The root-mean-square errors of the normal points, as a result of the calculations of the measurements of comparison and the check stars, are less than $0^m.004$ for *V*, *B-V* and *V-R*, in *U* may reach up to $0^m.006$. It took 30-40 minutes to get one normal point, depending on the weather conditions. The data of V2148 Cyg, comparison, check and red standard stars are given in Table 1. The finding chart in Figure 8.

Observation

All measurements have been reduced to the Johnson's system and are available in our recent technical report Kalv (Kalv et al., 2004) and shown in Figure 1 and Figure 2. The observations were carried out at Tallinn Observatory (former observational station of Tartu Observatory which now is the educational observatory of Tallinn University of Technology). The photoelectric photometers were attached to the Cassegrain focus of the 48 cm reflector AZT-14A ($d/f=16$).

Since in Tallinn only differential observations of variable stars relative to a comparison stars are carried out, attention was given to the determination of the mean extinction coefficients. Among several methods of the determination of extinction the differential method (Hardie, 1962) is the most suitable for our purposes.

Tabel 1: The data of V2148 Cyg, comparison, check and red standard stars

Star	Spectra	V	$B-V$	$U-B$
V2148 Cyg = HIP 201733	B3	6.5		
Comparison Star = HIP 103213	A2	6.68	+0.05	
Check Star = HIP 103322	B9	6.80	-0.04	
Red Standard = HIP 106551	K1	4.91	+1.08	+1.01

Tabel 2: Photomultiplier Tubes and Filters

Julian Date	Photomultiplier Tube	Filters
JD 2439430-2444000	EMI 9502B	B BG-12 + GG-13 (1mm+2mm) V GG-11 (2mm)
JD 2444100-2444317 and JD 2445500-2450220	EMI 9502SA	U UG-2 (2mm) B BG-12 (1mm) V GG-11 (2mm) R Photographic
JD 2444317-2445000	FEU-79	U UG-2 + SZS-21 (2mm+3mm) B BG-12 + SZS-21 (1mm+3mm) V GG-11 + SZS-21 (2mm+3mm) R Interference Filter $H_\alpha \pm 450\text{\AA}$ H $_\alpha$ Interference Filter $H_\alpha \pm 45\text{\AA}$

The generic formulae for reductions of observations are:

$$\begin{aligned} \Delta(U - B) &= [\Delta(u - b) - k'_{u-b} \times \Delta X] \times C_1 \\ \Delta(B - V) &= [(1 + k''_{b-v} \times \bar{X}) \times \Delta(b - v) - k'_{b-v} \times \Delta X] \times C_2 \\ \Delta V &= \Delta v - k'_v \times \Delta X - C_3 \times \Delta(B - V) \\ \Delta(V - R) &= [\Delta(v - r) - k'_{v-r} \times \Delta X] \times C_4 \end{aligned}$$

And the coefficients in formulae above are:

Julian Date	k'_{u-b}	k'_{b-v}	k'_v	k'_{v-r}	k''_{b-v}	C_1	C_2	C_3	C_4
JD 2439430-2444000		0.20	0.36		0.05		1.19	0.07	
JD 2444100-2444317 and JD 2445500-2450220	0.26	0.20	0.36	0.11	0.05	1.19	0.94	0.09	1.09
JD 2444317-2445000	0.32	0.18	0.24	0.11	0.04	1.12	1.00	0.11	1.09

The problems occurred, when we tried to construct the light curve of the star with the light elements given by Otero et al.(2005). The more we tried, the worse the situation turned out to be. As the star was observed at Tallinn Observatory once a night and the number of the *Hipparcos* measurements is small, we can't study possible rapid variations. We started the additional observations, but the weather conditions are poor this (2007-2008) season. From literature, one can see, that the object is in observing program of several observatories. We hope that some of our colleagues would observe V2148 Cyg and we should be very glad to anyone interested in cooperative investigation of this star.

Acknowledgements. Financial support of this investigation by a Grant No. 7691 of the Estonian Science Foundation and BF44 are acknowledged.

Luige V2148 müsteerium

V2148 Cygni't vaadeldi Tallinna Tähetornis 129-l ööl aastatel 1981. kuni 1996. Vaatlusi teostati seoses heledate **Be** tähtede rahvusvahelise kampaaniaga. Arusaamatused algasid siis, kui me püüdsime konstrueerida heleduskõverat kirjanduses avaldatud perioodi järgi. Selgus, et tõenäoselt ei ole tegemist varjutustega ja lisaks sellele esineb tähe heleduse aeglane muutumine (mis on nähtav ka ilma täpsema uurimiseta). Kuna Tallinnas vaadeldi V2148 Cygni't vaid korra öö jooksul ja *Hipparcos*'e vaatlusi on vähe, ei saa me kiireid heleduse muutusi uurida. Kirjanduse andmetel vaadeldi seoses ülalnimetatud kampaaniaga seda tähte mitmes observatooriumis, kuid meil ei ole õnnestunud leida neid vaatlusi.

Kuna tegemist on sedavõrd heleda tähega, et ka tagasihoidlike võimalustega amatöör saab seda tähte edukalt vaadelda, oleks me rõõmsad, kui keegi oleks huvitatud koostööst selle objekti uurimisel.

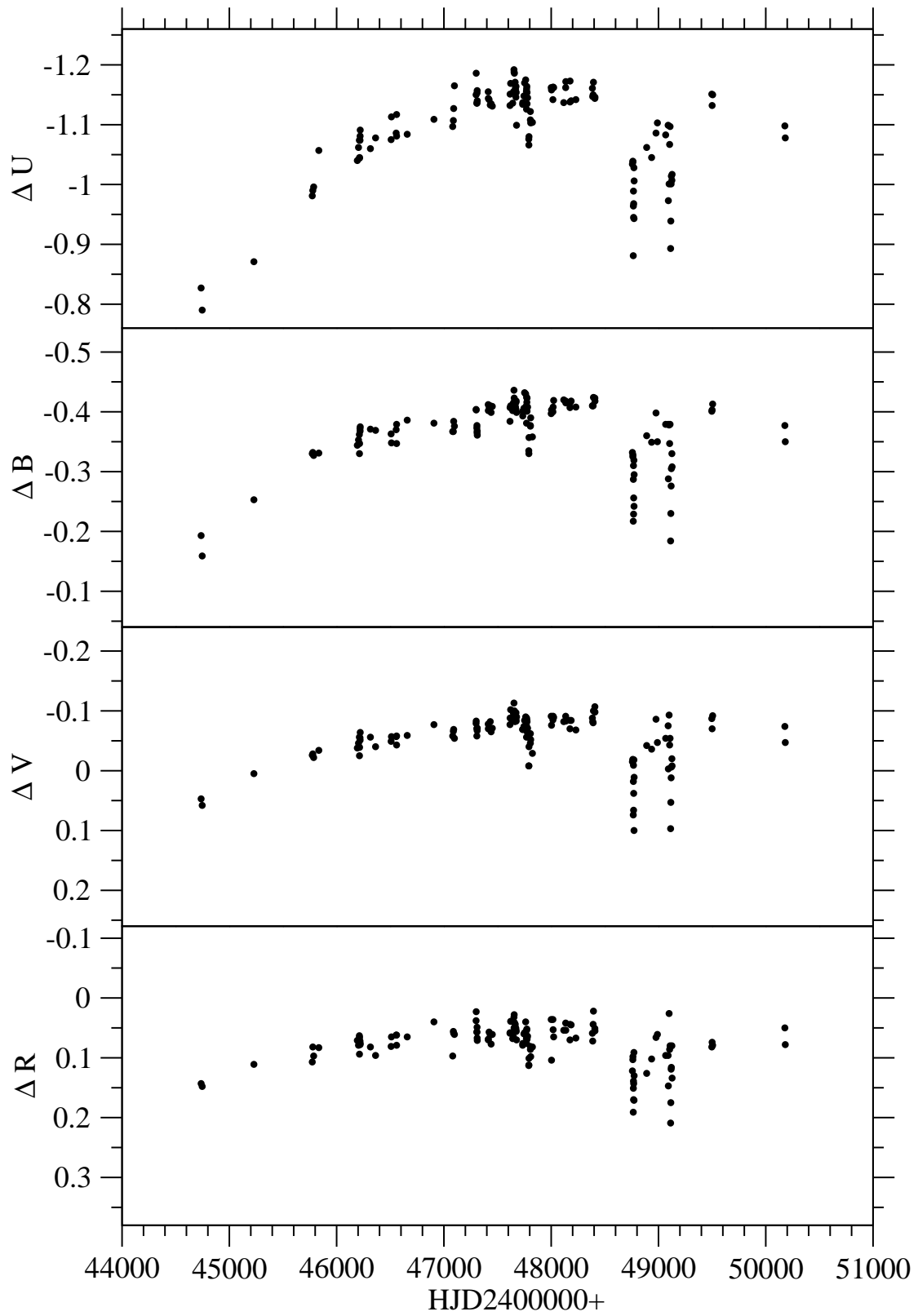


Figure 1: Time function diagram of all observations made at Tallinn Observatory.

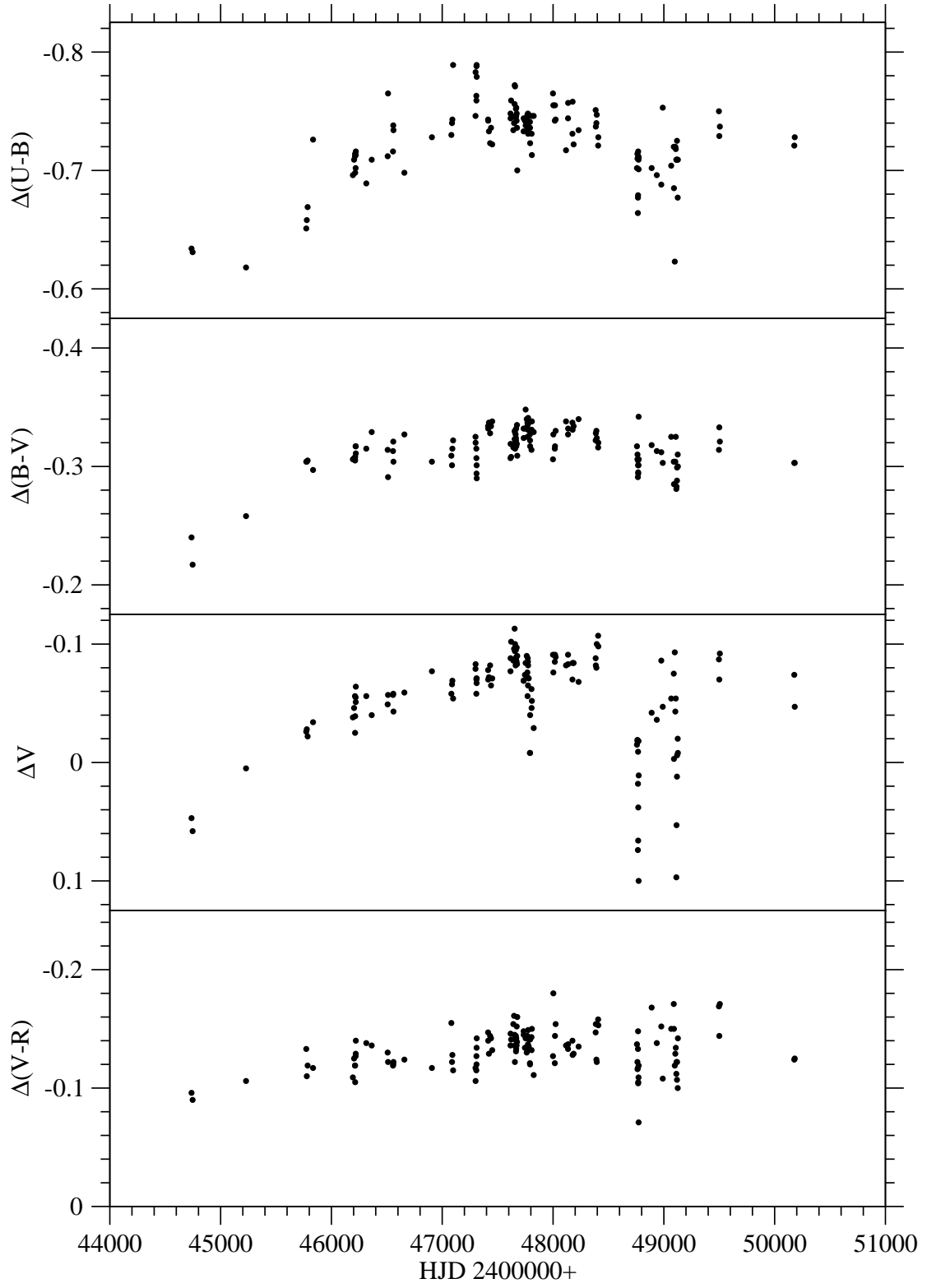


Figure 2: Time function diagram of all observations made in Tallinn Observatory (color).

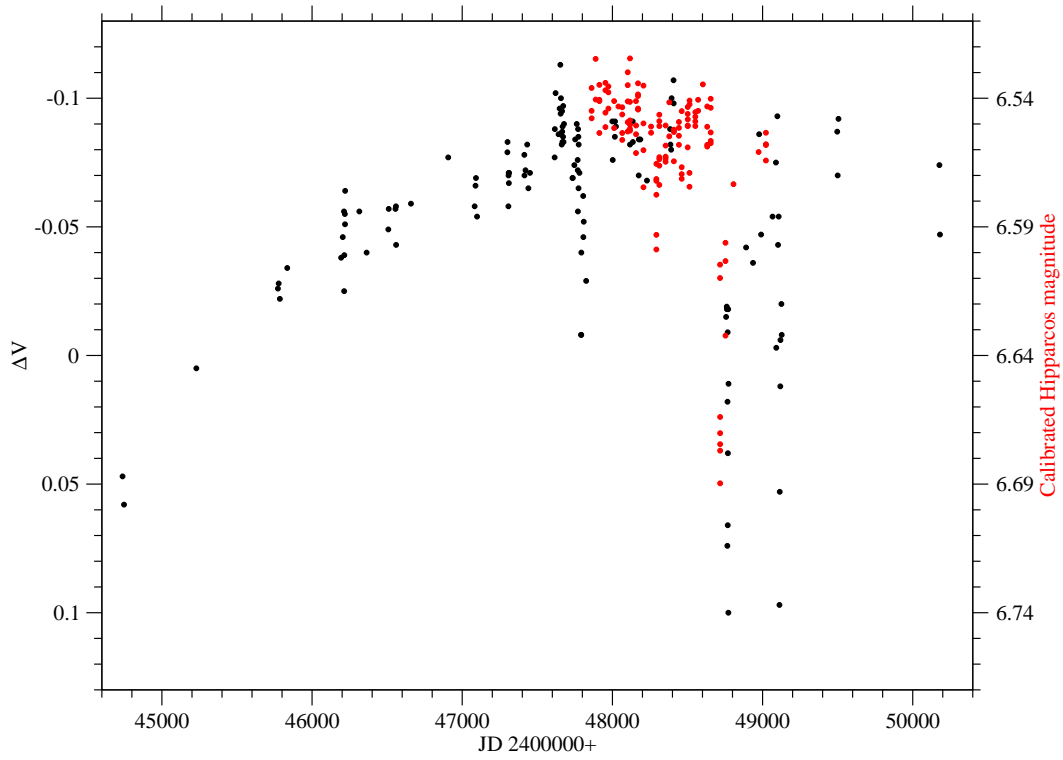


Figure 3: The black dots symbolize the results of the observations at Tallinn Observatory and the red dots show the calibrated *Hipparcos* magnitude (the calibration coefficient is $-6^m.64$).

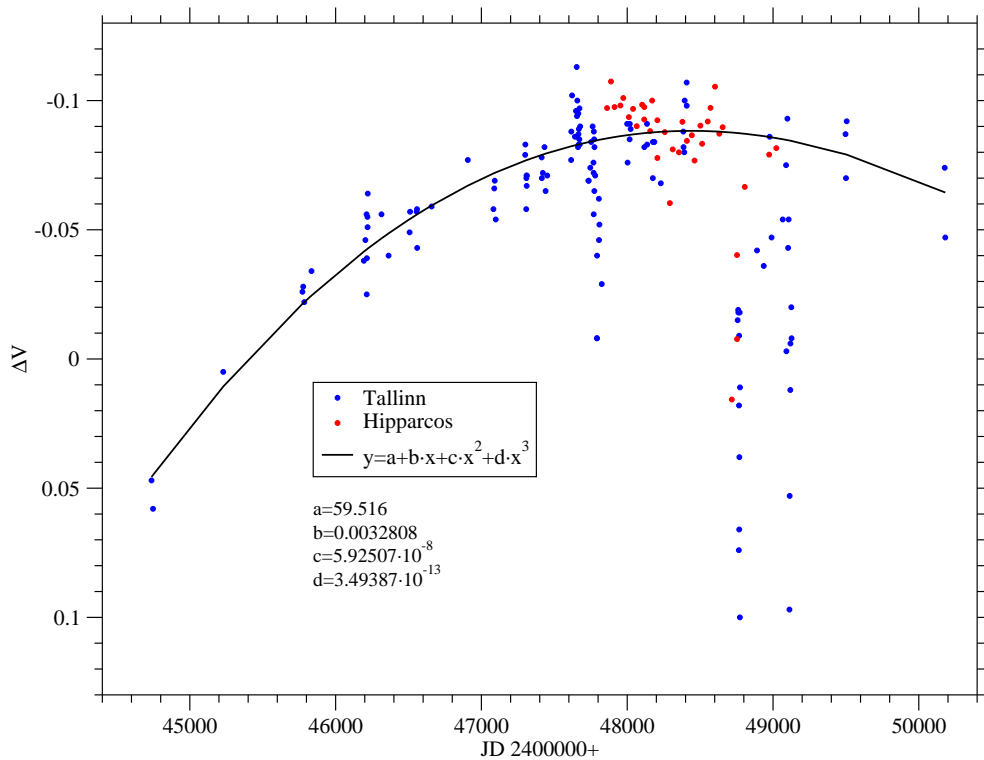


Figure 4: Observations approximated with the polynomial.

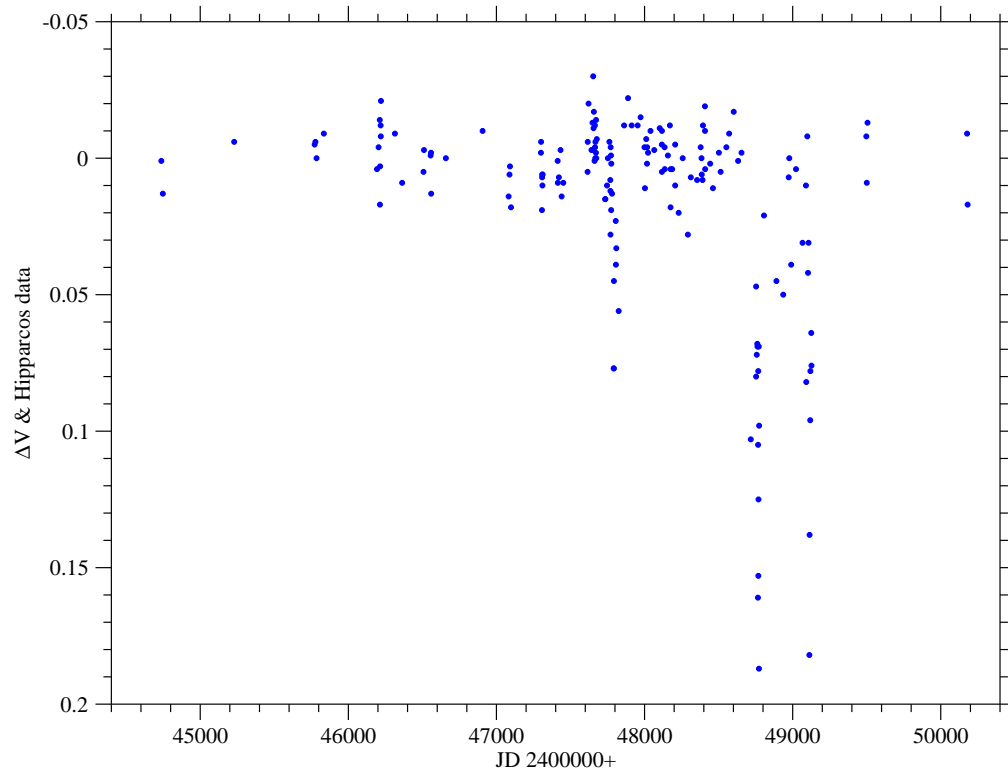


Figure 5: Observation results reduced to a long trend.

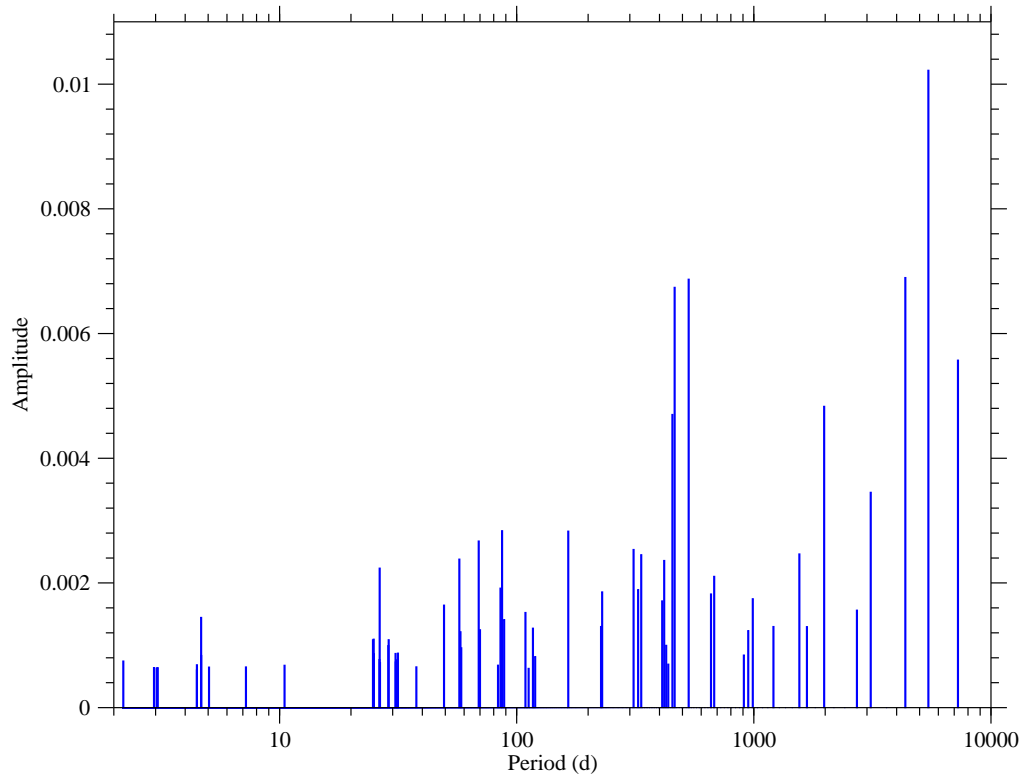


Figure 6: Time-series spectrum of the V2148 Cyg found by using the CLEAN algorithm (Roberts et al., 1987).

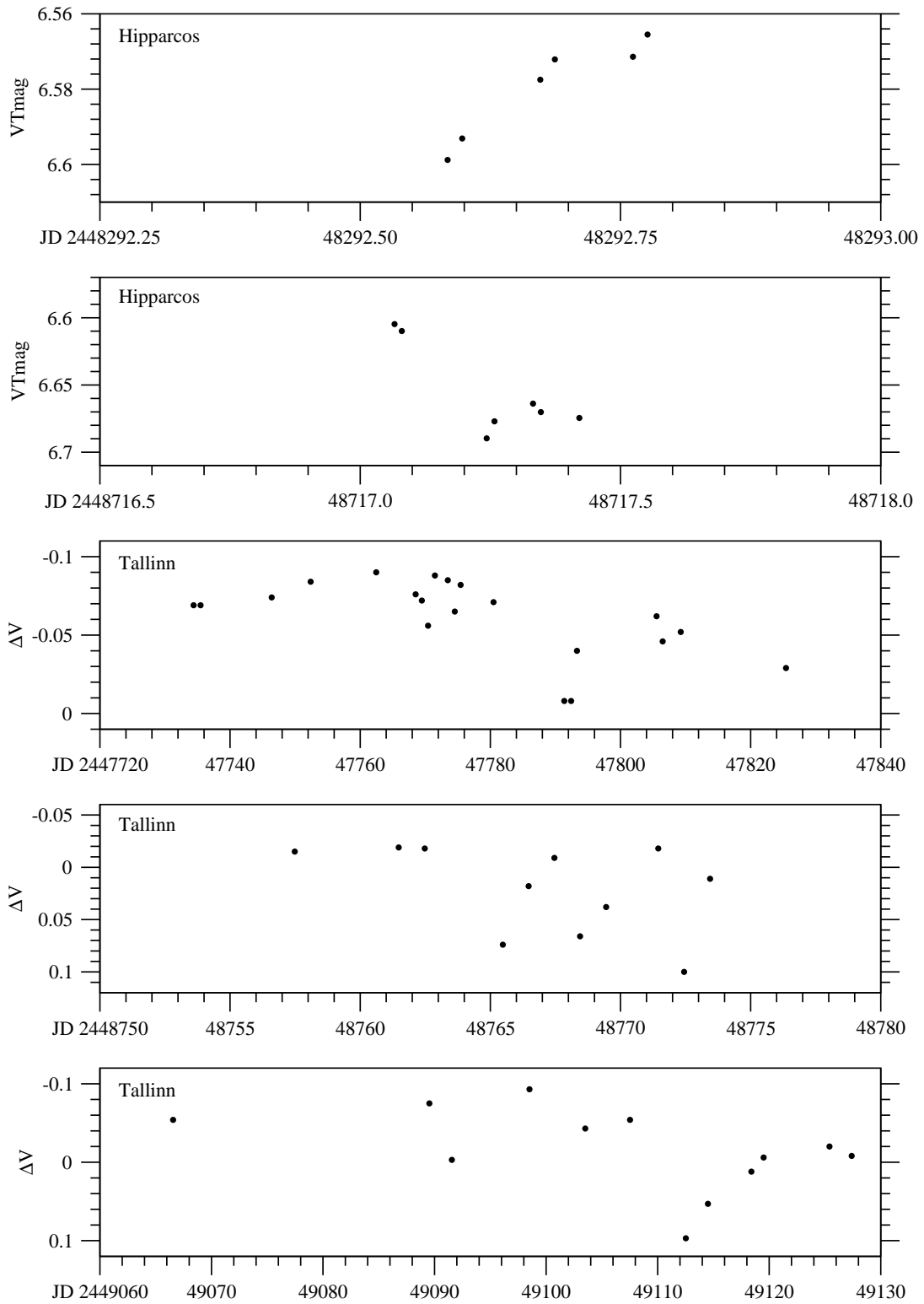


Figure 7: Zoomed light curve fragments for Tallinn and the *Hipparcos* data.

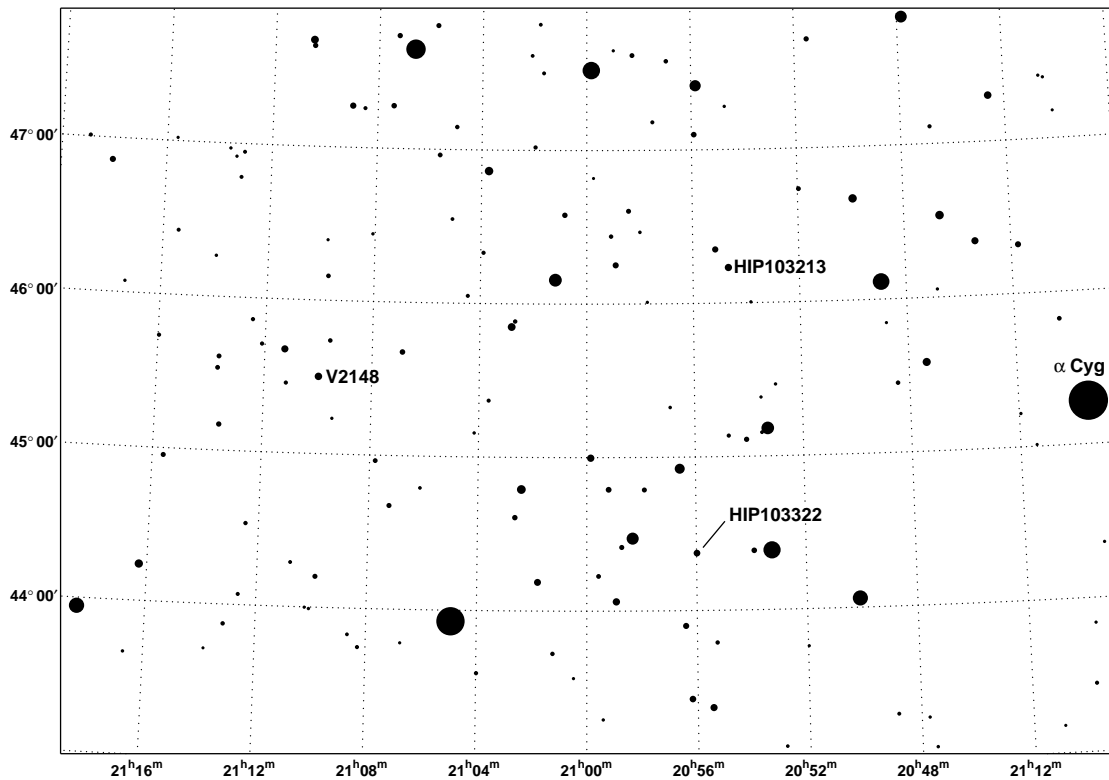


Figure 8: Finding chart of V2148 Cyg, comparison star HIP 103213 and check star HIP 103322.

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