

# Differential photometry of delta Scuti stars on Maidanak Observatory

S.Ayukov • B.Artamonov • O.Ezhkova •  
A.Magnitskiy • S.Ehgamberdiev • A.Serebryanskiy

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**Abstract** Several delta Scuti stars (V350 Peg, V2455 Cyg, V459 Cep) were observed on Maidanak observatory in Uzbekistan in frame of Russian-Uzbek scientific collaboration on asteroseismology. Differential photometry data were obtained on two 60 cm telescopes using CCD. These are pilot observation aimed to estimate instrument and site capabilities for astroseismic observations. Our data indicate that photometry precision can reach 0.001 magnitude. We also present results on two observed stars.

**Keywords** delta scuti; photometry; astroseismology

## 1 Introduction

During the first year of Russian-Uzbek collaboration pilot observation of two delta Scuti stars were performed at Maydanak observatory in Uzbekistan. The main goal was to set up instrumentation, establish observation and processing procedures and estimate equipment capabilities.

## 2 Instrumentation

Unlike most Earth-based astroseismic projects, we measure the brightness, not velocity. While this method is

less sensitive to oscillations it allows to observe much fainter stars.

Differential CCD photometry was employed on two identical Zeiss-600 telescopes of Uzbek Academy of Science. They have 600 mm main mirror, 7200 mm focal length. There is also Zeiss-1000 telescope with 1000 mm main mirror on the observatory but it was not used in these observations.

Instruments are located on Maydanak High-Altitude Observatory in Uzbekistan 40 km south of Kitab. This site is known for its excellent seeing and excellent weather conditions.

Two different CCD cameras were used. One is Santa Barbara Instrument Group SBIG ST-402ME Class 2, with Kodak KAF-0402ME CCD. CCD size is 4.6 x 6.9 mm, 765 x 510 pixels. Its full well capacity is 100 000e. Three filters (B, V, I) were used in observations. The field of view on Zeiss-600 is 3.29 x 2.19 arcmin. The camera has USB 2.0 interface, frame download time is less than 1 second. Second CCD camera is Finger Lakes Instrumentation FLI PL1001E, with Kodak KAF1001E CCD. CCD size is 24.5 x 24.5 mm, 1024 x 1024 pixels. Its full well capacity is 500 000e. V filter was used in observations. The field of view on Zeiss-600 is 11.7 x 11.7 arcmin. Single channel photomultiplier photometer for asteroseismology is under development; it should provide even higher photometric precision.

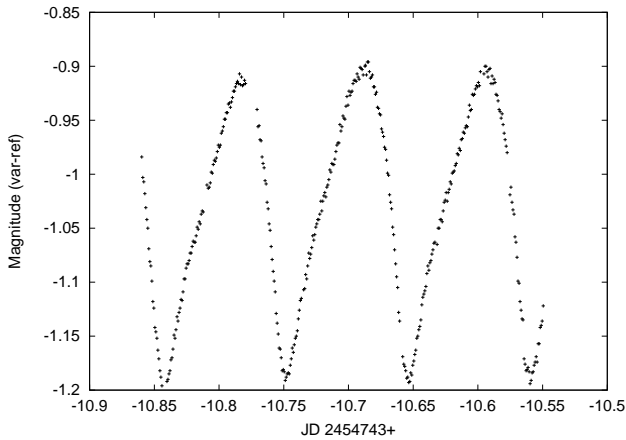
## 3 Observations and processing

Since photometry is differential one needs a comparison star in the field of view. SBIG ST-402ME has rather small field of view, so this is one of the problems when selecting stars to observe: comparison star must be close enough.

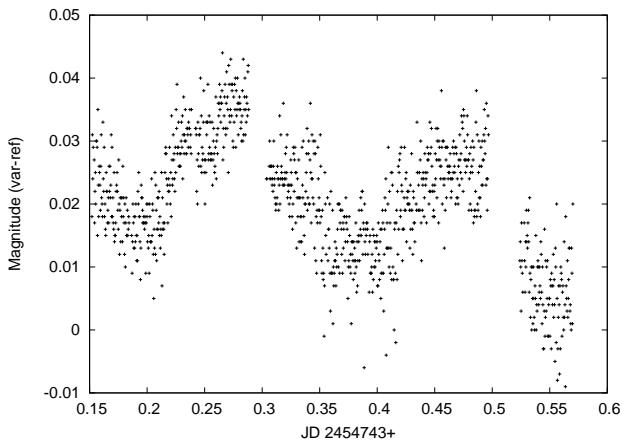
Three stars were selected for observations, V350 Peg, V2455 Cyg (Wils et al. (2003)) and V459 Cep (Duerbeck, Hilmar (1997)). Each star was observed for 6-13

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S.Ayukov  
B.Artamonov  
O.Ezhkova  
A.Magnitskiy  
Sternberg Astronomical Institute, Moscow, Russia  
S.Ehgamberdiev  
A.Serebryanskiy  
UBAI, Tashkent, Uzbekistan



**Fig. 1** V2455 Cyg, light curve for one night



**Fig. 2** V259 Cep, light curve for one night

nights by Russian and Uzbek observers. V350 Peg was observed on different instrument and results are not presented here; see Ehgamberdiev et al. (2009).

V2455 Cyg observations produced most consistent and precise data (see Figure 1 for one night sample). Estimates suggest precision of  $0.001 - 0.002^m$ . It is a high-amplitude delta Scuti star; its amplitude is  $0.44^m$ . Other names for this star are BD+46 3325, GSC 03590-01884, HD 204615 (F), NSV 25610, PPM 61522, SAO 50907.

V259 Cep observations have been flawed by selection of comparison star; later examination has discovered that it is marked as non-star object. The photometric precision obtained is discouraging, about  $0.01^m$  (Figure 2). Expected amplitude is  $0.03^m$ . Other names of this star are BD+76 911, HD 220237, HIP 115262, SAO 10712.

## 4 Results

The differential photometry precision reached is about  $0.001 - 0.002^m$  for stars  $9^m$ . The following frequencies were detected in V2455 Cyg by Fourier analysis: 10.6131, 21.2263, 31.8514, 42.4526 1/d. All of them except first one are multiples of 10.6131 within obtained precision. Suggested frequency for this star is 10.6150 1/d (see Wils et al. (2003)).

One of the observed stars (V459 Cep) has been observed with nonstar comparison object and its photometry appeared unsatisfactory. Known period for this star is 0.35d; our estimate is 0.179d.

## 5 Acknowledgements

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## References

- Wils, P., van Cauteren, P., Lampens, P.: IBVS, 5475...1W (2003)
- Duerbeck, Hilmar W.: IBVS, 4513....1D (1997)
- Ehgamberdiev, Sh., Artamonov, B., Chou, D.-Y. et al.: IAU XXVII General Assembly Proceedings, Rio de Janeiro, in press (2009)