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USNO-B1.0 1329-0132547, a New Double-Mode High-Amplitude δ Scuti Variable

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We present our discovery of a new double-mode high-amplitude δ Scuti variable, HADS(B) type, USNO-B1.0 1329-0132547. We found the frequencies $f_0 = 6.1770$ and $f_1 = 8.0561$. The period ratio $P_1/P_0 = 0.7668$ is typical of radially pulsating HADS(B) stars.

1 Introduction

In this paper, we present our discovery of the new variable star USNO-B1.0 1329-0132547. Its coordinates in the 2MASS catalog (Skrutskie et al. 2006) are $04^{\rm h}44^{\rm m}37\overset{\rm s}{.}78$, $+42^\circ54'34\overset{''}{.}4$ (J2000.0). According to our CCD observations, this star is a double-mode high-amplitude δ Scuti variable, HADS(B) type. The variable was discovered in the region of the double-mode variable GSC 2901-00089; our study of the latter star will be submitted to "Peremennye Zvezdy" later.

2 Observations

Our CCD observations in the Johnson BVR bands were performed at the Tien Shan Astronomical Observatory of the V.G. Fesenkov Astrophysical Institute, at the altitude of 2750 m above the sea level, using a Zeiss 1000-mm reflector with an Apogee U9000 D9 CCD photometer. Reductions were performed using the MaxIM DL aperture photometry package. The finding chart (Fig. 1) identifies the variable star, comparison star, and check star. The comparison star was USNO-B1.0 1329-0132636, at the coordinates $04^{\rm h}44^{\rm m}44\overset{\rm s}{.}88$ $+42^\circ55'08\overset{''}{.}7$ (J2000.0), and the check star, USNO-B1.0 1329-0132524, at $04^{\rm h}44^{\rm m}35\overset{\rm s}{.}82$ $+42^\circ54'19\overset{''}{.}1$ (J2000.0). The magnitudes of the comparison star in the AAVSO Photometric All-Sky Survey (APASS, http://www.aavso.org/download-apass-data) catalog are $V = 15\overset{\rm m}{.}107$ and $B = 16\overset{\rm m}{.}128$ (Johnson's system) . We express our R-band measurements as magnitude differences with respect to the comparison star.

Our observations are available online in the html version of this paper.

3 Results

We analyzed the time series using Deeming's method implemented in the WinEfk code written by V.P. Goranskij. Using our observations of USNO-B1.0 1329-0132547, we found the frequencies f_0 and f_1 (see the power spectrum in Fig. 2). The results are presented in the Table.

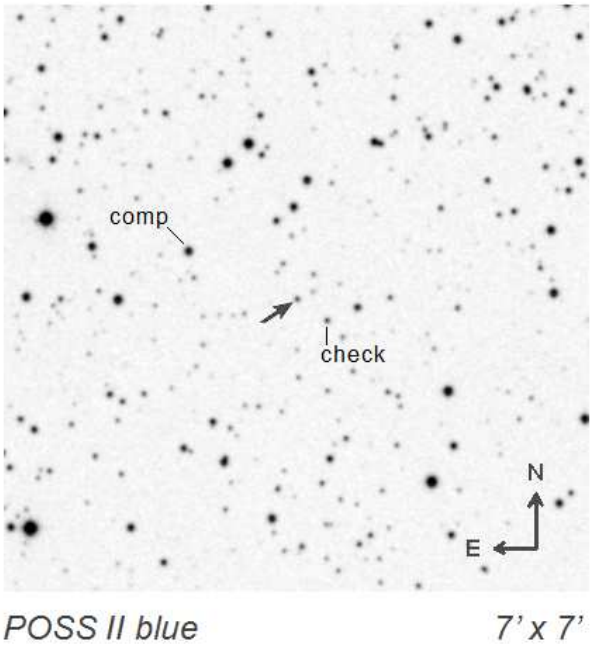

Figure 1.
The finding chart of USNO-B1.0 1329-0132547.

Table. Detected frequencies

Mode	Frequency, c/d	Semi-amplitude			Period, d	Epoch, HJD
		B, mag	V, mag	R, mag		
f_0	6.1770	0.051	0.046	0.034	0.16189	2456585.582
f_1	8.0561	0.053	0.049	0.040	0.12413	2456585.598

The light curves of USNO-B1.0 1329-0132547 in the B, V and R bands are displayed in Figs. 3, 4, 5. The power spectra of USNO-B1.0 1329-0132547 (Fig. 2) are plotted both for the raw data and with the fundamental-mode oscillations subtracted.

The V-band range of USNO-B1.0 1329-0132547 is from $17\overset{\text{m}}{.}28$ to $17\overset{\text{m}}{.}58$; the B-band range is $18\overset{\text{m}}{.}3$–$18\overset{\text{m}}{.}7$. The delta magnitude R-band range is 2.18–2.40. The period ratio $P_1/P_0 = 0.7668$ is typical of high-amplitude double-mode δ Scuti stars radially pulsating in the fundamental and first overtone modes (Petersen & Christensen-Dalsgaard 1996). The infrared color index $J - K = 0.547$ (2MASS) does not contradict the suggested type if we take into account possible reddening for the galactic latitude $b = -1\overset{\circ}{.}84$.

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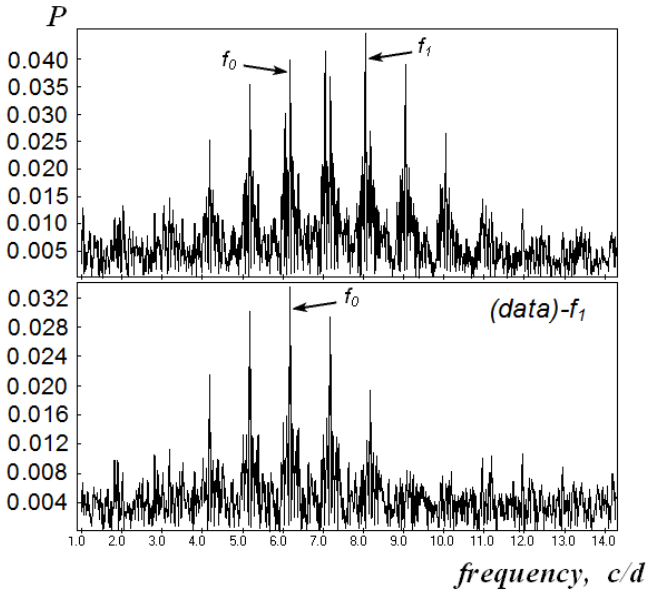

Figure 2.
The power spectra of USNO-B1.0 1329-0132547 for the frequencies f_0 and f_1, R band.

References:

Skrutskie, M.F., Cutri, R.M., Stiening, R., et al., 2006, *Astron. J.*, **131**, 1163
Petersen, J.O., Christensen-Dalsgaard, J., 1996, *Astron. and Astrophys.*, **312**, 463

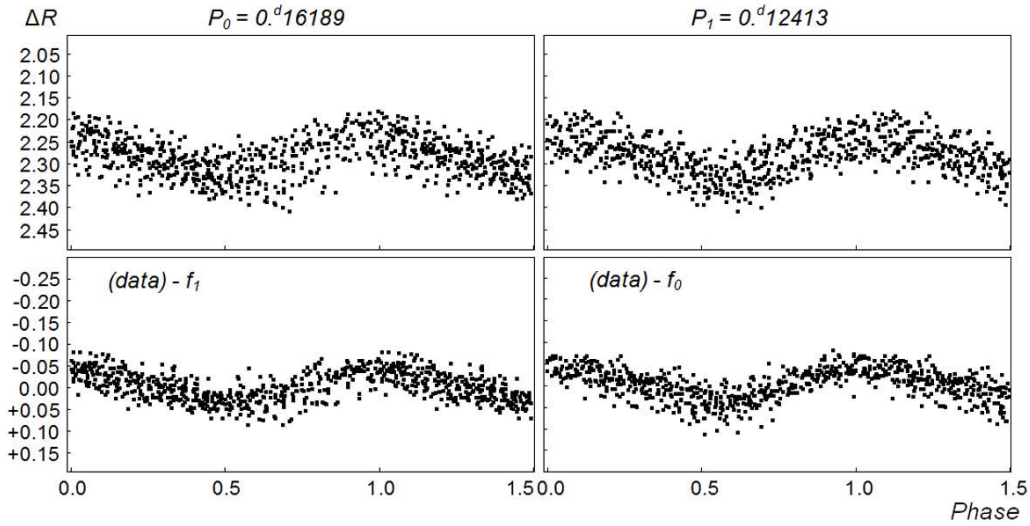

Figure 3.
The light curves of USNO-B1.0 1329-0132547, R band. Upper panels: raw data; lower panels: the folded light curves with the other oscillation pre-whitened.

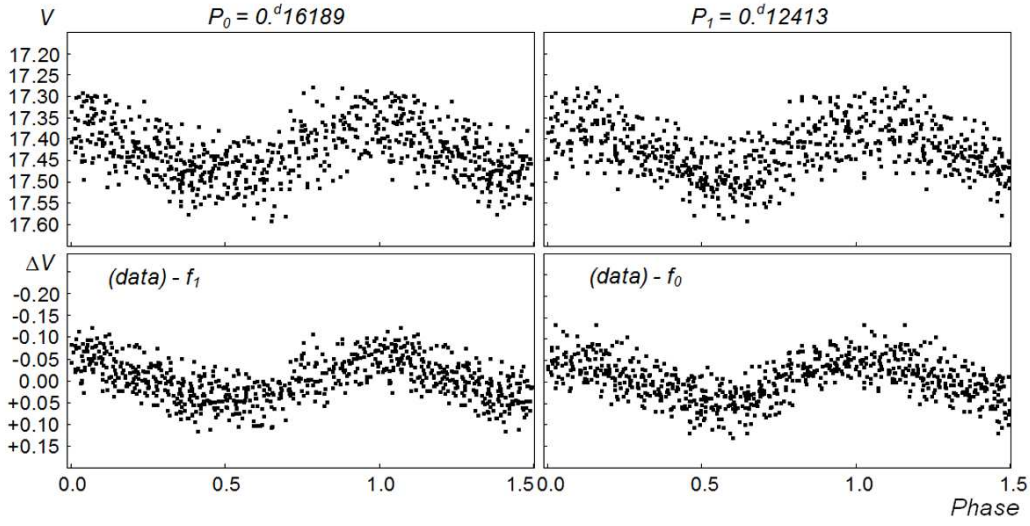

Figure 4.
The light curves of USNO-B1.0 1329-0132547, V band.

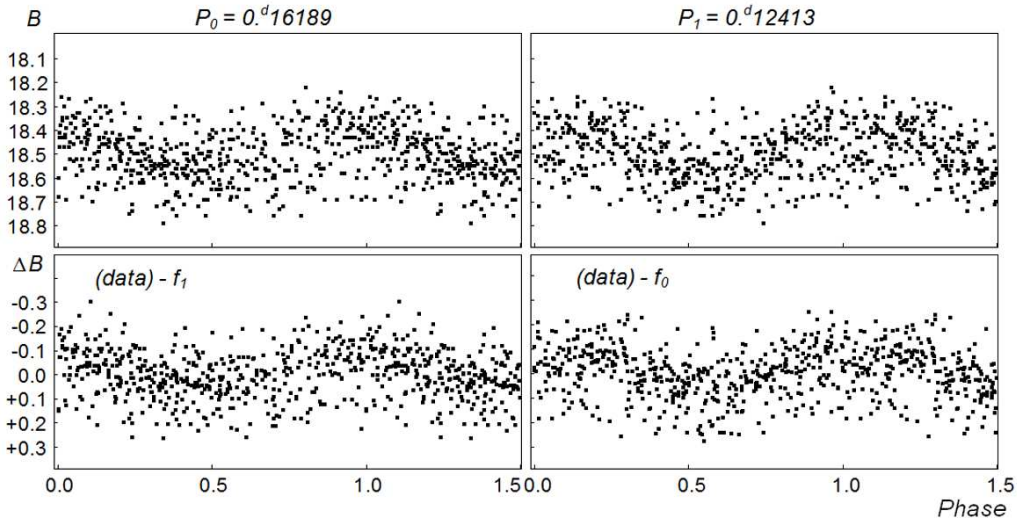

Figure 5.
The light curves of USNO-B1.0 1329-0132547, B band.