The cataclysmic variable SDSS J102146.44+234926.3 (SDSS J1021 hereafter; α2000 = 10h21m46s44; δ2000 = +23°49′26″3) was discovered in outburst having a V magnitude of 13.89 by Christensen on CCD images obtained in the course of the Catalina Sky Survey on October 28.503 UT 2006. In an archival image there is a star with V ∼ 21.0 at this position (Christensen, 2006) and there is an object in the database of the Sloan Digital Sky Survey Data Release 5 (Adelman-McCarthy et al., 2007; SDSS DR5 hereafter) with the following magnitudes, measured on January 17.455 UT, 2005: u = 20.83, g = 20.74, r = 20.63, i = 20.84, z = 20.45. In the USNO-B1.0 catalog this object is listed as USNO-B1.0 1138-0175054 with magnitudes B = 20.82 and R = 20.75. The large amplitude and the blue color imply that the object could be a dwarf nova of SU UMa or WZ Sge type (Waagen, 2006).

Fig. 1 (left) shows the 8′ × 8′ image of the SDSS J1021 vicinity, generated from SDSS DR5 Finding Chart Tool (http://cas.sdss.org/astrodr5/en/tools/chart/chart.asp).

Time resolved CCD photometry has been carried out from different sites by the authors since November 21, 2006 (the first night after the discovery was reported) until 2006 December 06 (Data available for download at http://www.aavso.org/data/download and from IBVS server; See Table 1 for log of observations). The photometry was done in the V and Rc bands as well as unfiltered; this did not affect the following period analysis.
The error of a single measurement can be typically assumed to be \( \pm 0.02 \). Fig. 1 (right) shows the overall light curve of the object. Here we assume \( m_R = m_{\text{unfiltered}} \). The light curve could be divided into three parts, denoting the plateau stage, dip and long-lasting echo-outburst (rebrightening).

Before carrying out Fourier analysis for the presence of short-periodic signal in the light curve (superhumps), each observer’s data set was individually transformed to a uniform zero-point by subtracting a linear fit from each night’s observations. This was done to remove the overall trend of the outburst and to combine all observations into a single data set.

From the periodogram analysis (Fig. 2, left) the value of the superhump period \( P_{sh} = 0^d 05633 \pm 0.00003 \) was determined. Such a value is typical for the WZ Sge-type systems and is just 58.7 seconds shorter than \( P_{sh} \) of another WZ Sge-like system: ASAS 002511+1217.2 (Golovin et al., 2005).

The superhump light curve (with 15-point binning used) folded with \( 0^d 05633 \) period is shown on Fig. 2 (right). It is plotted for two cycles for clarity. Only JD 2454061.0-2454063.6 data was included. Note the 0.1 amplitude of variations and the double-humped profile of the light curve. There remain many questions concerning the nature of a double-humped superhumps in the WZ Sge-type stars. The explanation of a double-humped light curve could lie in a formation of a two-armed precessional spiral density wave in the accretion disk (Osaki, 2003) or a one-armed optically thick spiral wave, but with the occurrence of a self-eclipse of the energy emitting source in the wave (Bisikalo, 2006).

Other theories concerning a double-peaked superhumps can be found in Lasota et al. (1995), Osaki & Meyer (2002), Kato (2002), Patterson et al. (2002), Osaki & Meyer (2003).

| JD (mid of observational run) | Duration of run [minutes] | Observatory | Telescope | CCD | Filter |
|-----------------------------|---------------------------|-------------|-----------|-----|--------|
| 2454060.9                   | 214                       | Rolling Hills, FL, USA | Meade LX200-10 | SBIG ST-9 | V     |
| 2454061.0                   | 158                       | Cloudcroft, NM, USA | C-11 | SBIG ST-7 | none  |
| 2454062.0                   | 259                       | Cloudcroft, NM, USA | C-11 | SBIG ST-7 | none  |
| 2454062.9                   | 288                       | Cloudcroft, NM, USA | C-11 | SBIG ST-7 | none  |
| 2454063.6                   | 115                       | CrAO, UKRAINE | K-380 | SBIG ST-9 | R     |
| 2454064.6                   | 222                       | CrAO, UKRAINE | K-380 | SBIG ST-9 | R     |
| 2454066.7                   | S.D.P. *                  | Pic du Midi, FRANCE | T-60 | Mx516 | None  |
| 2454067.6                   | 90                        | CrAO, UKRAINE | K-380 | Apogee 47p | R     |
| 2454067.9                   | S.D.P.                    | Las Cruces, NM, USA | Meade LX200 | SBIG ST-7 | V     |
| 2454069.0                   | S.D.P.                    | Arch Cape, USA | SCT-30 | SBIG ST-9 | V     |
| 2454069.0                   | S.D.P.                    | Las Cruces, NM, USA | Meade LX200 | SBIG ST-7 | V     |
| 2454069.6                   | 63                        | CrAO, UKRAINE | K-380 | Apogee 47p | R     |
| 2454071.9                   | S.D.P.                    | Las Cruces, NM, USA | Meade LX200 | SBIG ST-7 | V     |
| 2454072.9                   | S.D.P.                    | Las Cruces, NM, USA | Meade LX200 | SBIG ST-7 | V     |
| 2454073.9                   | S.D.P.                    | Las Cruces, NM, USA | Meade LX200 | SBIG ST-7 | V     |
| 2454074.9                   | S.D.P.                    | Las Cruces, NM, USA | Meade LX200 | SBIG ST-7 | V     |
| 2454075.9                   | S.D.P.                    | Las Cruces, NM, USA | Meade LX200 | SBIG ST-7 | V     |
| 2454166.8                   | S.D.P.                    | Sonoita Observatory, USA | 0.35 m telescope | SBIG STL-1001XE | V     |
| 2454167.7                   | S.D.P.                    | Sonoita Observatory, USA | 0.35 m telescope | SBIG STL-1001XE | V     |

* S.D.P. - Single Data Point
Applying the method of "sliding parabolas" (Marsakova & Andronov, 1996) we determined, when it was possible (JD 2454061.0 - 2454063.6), the times of maxima of superhumps (with mean 1σ error of 0.0021) and calculated O-C residuals based on founded period. The moments of superhump maximua are given in Table 2. No period variations reaching the 3σ level were found during the time of observations.

Another prominent feature of the SDSS J1021 light curve is the echo-outburst (or rebrightening - another term for this event) that occurs during the declining stage of the superoutburst. On Nov. 27/28 2006 (i.e. JD 2454067.61-2454067.68) a rapid brightening with the rate of 0.13 m per hour was detected at Crimean Astrophysical Observatory (Ukraine; CrAO hereafter), that most probably was the early beginning of the echo-outburst. Judging from our light curve, we conclude that rebrightening phase lasted at least 8 days. Similar echo-outbursts are classified as "type-A" echo-outburst according to classification system proposed by Imada et al. (2006) as observed in the 2005 superoutburst of TSS J022216.4+412259.9 and the 1995 superoutburst of AL Com (Imada et al., 2006; Patterson et al., 1996).

Rebrightenings during the decline stage are observed in the WZ Sge-type dwarf novae (as well as in some of the WZ Sge-type candidate systems). However, their physical mechanism is still poorly understood. In most cases, just one rebrightening occurs (also observed sometimes in typical SU UMa systems), though a series of rebrightenings are also possible, as it was manifested by WZ Sge itself (12 rebrightenings), SDSS J0804 (11) and EG Cnc (6) (Pavlenko et al., 2007). There are several competing theories concerning what causes an echo-outburst(s) in such systems, though all of them predict that the disk must be heated over the thermal instability limit for a rebrightening to occur. See papers by Patterson et al. (1998), Buat-Menard & Hameury (2002), Schreiber & Gansicke (2001), Osaki, Meyer & Meyer-Hofmeister (2001) and Matthews et al. (2005) for a discussion of the physical reasons for echo-outbursts.

Recent CCD-V photometry manifests that SDSS J1021 has a magnitude of 19.72±0.07 and 19.59 ± 0.07 as of 06 March and 07 March, 2007 (HJD = 2454165.80 and HJD = 2454167.74) respectively, at Sonoita Research Observatory (Sonoita, Arizona, USA) using a robotic 0.35 meter telescope equipped with an SBIG STL-1001XE CCD camera.

Spectroscopic observations were carried out on November 21.8 UT with the CCD spec-
The preliminary discussion of the spectra can be found in (Ayani & Kato, 2006). The spectral range is 400-800 nm, and the resolution is 0.5 nm at $H_\alpha$. HR 3454 ($\alpha_{2000} = 08^h 43^m 13^s 475; \delta_{2000} = +03^\circ 23' 55'' 18$) was observed for flux calibration of the spectra. Standard IRAF routines were used for data reduction.

Spectrum (Fig. 3) shows blue continuum and Balmer absorption lines (from $H_\epsilon$ to $H_\alpha$) together with K CaII 3934 in absorption. Very weak HeI 4471, Fe 5169, NII 5767 absorption lines may be present. $H_\alpha$ 3970 is probably blended by H Ca II 3968. The FeIII 5461 line resembles weak P-Cygni profile. Noteworthy, FeIII 5461 and NII 5767 may be artifacts caused by imperfect subtraction of city lights: HgI 5461 and 5770 (spectrum of the sky background which was subtracted, is available upon request). The HeI 5876 line (mentioned for this object in Rau et al., 2006) is not detectable on our spectrum. It is remarkable that $H_\alpha$ manifests a “W-like” profile: an emission component embedded in the absorption component of the line.

Table 3 represents EWs (equivalent widths) of detected spectral lines. EW was calculated by direct numerical integration over the area under the line profile.

The archive photographic plates from the Main Astronomical Observatory Wide Field Plate Archive (Kyiv, Ukraine; MAO hereafter) and Plate Archive of Sternberg Astronomical Institute of Moscow State University (Moscow, Russia; SAI hereafter) and plate from Crimean Astrophysical Observatory archive (Ukraine) were carefully scanned and inspected for previous outbursts on the plates dating from 1978 to 1992 from MAO, 1913-
Table 3. Equivalent widths of spectral lines

| Line                | EW [Å] |
|---------------------|--------|
| K CaII 3934         | -5.8   |
| HeI 3970 / H CaII 3968 | -8.7   |
| Hδ 4101             | -6.4   |
| Hγ 4340             | -8.5   |
| Hβ 4861             | -6.4   |
| Hα 6563             | -7.7   |
| Hα 6563 (emission)  | 2.3    |
| HeI 4471            | -0.95  |
| FeII 5169           | -0.65  |
| NII 5767            | -0.7   |

- 1973 from SAI and 1948 from CrAO archives. The number of plates from each archive is 22 for SAI, 6 for MAO and 1 for CrAO archives. For all plates the magnitude limit was determined (this data as well as scans of plates are available upon request). The selection of plates from MAO archive was done with the help of the database developed by L.K. Pakuliak, which is accessible at http://mao.kiev.ua/ardb/ (Sergeeva et al., 2004; Pakuliak, L.K. & Sergeeva, T.P., 2006). No outbursts on the selected plates from the MAO, SAI and CrAO archives were detected. This implies that outbursts in SDDS J1021 are rather rare, which is typical for the WZ Sge-type stars.

Figure 3. Spectra of SDSS J1021 obtained on November 21.8 UT on 1.01-m telescope of Bisei Astronomical Observatory (Japan)

Table 4 (available only electronically from IBVS server or via AAVSO ftp-server at ftp://ftp.aavso.org/public/calib/varleo06.dat) represents $BVR_cI_c$ photometric calibration of 52 stars in SDSS J1021 vicinity, which have a $V$-magnitude in the range of $11^m$21-17$^m$23 and can serve as a comparison stars. Calibration (by AH$^8$) was done at Sonoita Research Observatory (Arizona, USA).

The large amplitude of the SDSS J1021 outburst of 7$^m$, superhumps with a period
below the "period gap", rebrightening during the declining stage of superoutburst, rarity of outbursts and obtained spectrum allow to classify this object as a WZ Sge type dwarf nova.

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