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Discovery of Possible Dwarf Nova in Cygnus USNO-B1.0 1413-0363790

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Star Name:	USNO-B1.0 1413-0363790, 2MASS 20315512+5119384		
Coordinates (J2000):	20 31 55.12, +51 19 38.5		
Variability type:	UGSU:;	**Limits, System:**	13.0 - 19.0 (R);
Period:		**Epoch:**	JD

Remarks:

The Kourovka Planet Search project, aimed at finding transiting exoplanets in a 2° x 2° field in Cygnus, started in summer 2012 at the Kourovka Astronomical Observatory of the Ural Federal University.

During our work, we have discovered a previously unknown variable star, a possible dwarf nova USNO-B1.0 1413-0363790. Our observations were carried out between May and August, 2012 with the Master-URAL system consisting of two parallel optical telescopes on the same mount (40-cm aperture, 1:2.5 focal ratio) and equipped with two Apogee Alta U16M CCD cameras (Kodak KAF16803 chip, Peltier cooled) (Lipunov et al. 2010).

We acquired about 4000 images during 50 nights in the R filter with exposure times of 50 seconds. The initial reductions and aperture photometry were performed in the PyRAF package. Astrometric reductions were performed using Astrometry.net (Lang et al. 2010). To get and to correct the magnitudes, we used a console application Astrokit written by two of us (V. Krushinsky and A. Burdanov) on the basis of modified algorithm of Everett & Howell (2001). This application allows us to introduce corrections for brightness variations associated with variability of atmospheric transparency, to search for variable stars with the RoMS algorithm of Rose & Hintz (2007), and to perform their differential photometry. Astrokit also permits to process large numbers of objects simultaneously, in an automatic mode. To convert the instrumental magnitudes to the standard ones, we used the UCAC4 catalogue (Zacharias et al. 2012). The magnitude of USNO-B1.0 1413-0363790 during observations from May 14, 2012 to August 22, 2012 was $19^m.0 \pm 0^m.7$. Within less than 24 hours, its brightness reached a maximum value of $13^m.00 \pm 0^m.05$. Our images taken before the outburst and during the maximum brightness are shown in Fig. 1 and the light curve, in Fig. 2.

The scatter of observed data points during the outburst is about $0^m.20$, larger than the typical errors of photometry. The light curve on JD 2456167 shows several single peaks similar to superhumps typical of SU UMa dwarf novae. We have tried to search for the superhump period, but unfortunately the data are too noisy for a reliable estimate.

Our photometric data in quiescence are in a good agreement with the magnitudes from the USNO-B1.0 catalogue (R1 = 18.89, B2 = 20.22, R2 = 19.00, I = 17.78) (Monet et al. 2003). According to the 2MASS catalogue (Skrutskie et al. 2006), the color indices for this object are J–H = 0.79 and H–Ks = –0.12, but the quality of photometry is reported to be poor. Following Pickles (1998), two color indices, R–I from USNO-B1.0 and J–H from 2MASS, were used to estimate the approximate spectral type of the star in quiescence. To determine the galactic extinction, we used the galactic extinction calculator on the NED web site (http://ned.ipac.caltech.edu/forms/calculator.html), based on Schlafly and Finkbeiner (2011). The formal spectral type of the object is K2–K7.

The proper motion of the star is pmRA = 5.6 mas/yr, pmDEC = –1.6 mas/yr (Roeser et al. 2010).

We have also checked the Moscow archive of sky photographs stored at the Sternberg Astronomical Institute and the Heidelberg Digitized Astronomical Plates database available online. No previous outbursts of USNO-B1.0 1413-0363790 were found. The star was below the limit on 55 photographic plates of the Moscow collection (typical limiting magnitude $17^m.0$) taken between 1992 April 30.04 UT and 1996 October 08.85 UT. It is not visible on two Heidelberg plates of 1904 July 18 and 1958 September 05.

Unfortunately this region was not observed by GALEX, CRTS (Drake et al. 2009), or SDSS (Adelman-McCarthy et al. 2011). There is no information on the star either in the GCVS (Samus et al. 2009) or in AAVSO VSX (Watson et al. 2012) databases.

Follow-up photometric observations are planned for the near future.

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This research made use of Aladin (Bonnarel et al. 2000), SIMBAD database (operated at the Centre de Données astronomiques de Strasbourg), the International Variable Star Index (VSX) database (operated at AAVSO, Massachusetts, USA), PyRAF (product of the Space Telescope Science Institute, operated by AURA for NASA), and the NASA/IPAC Extragalactic Database (NED) (operated by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration).

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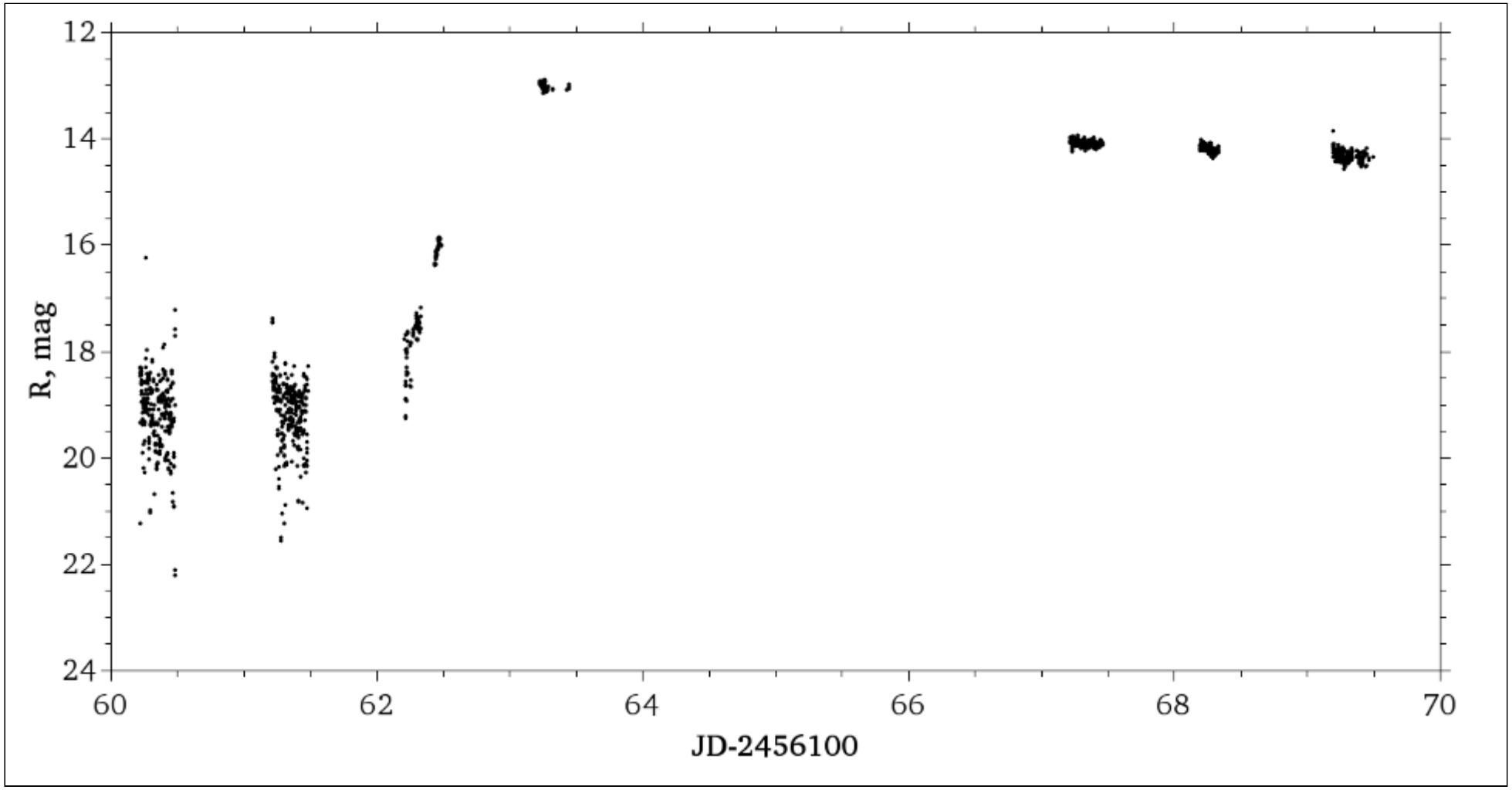
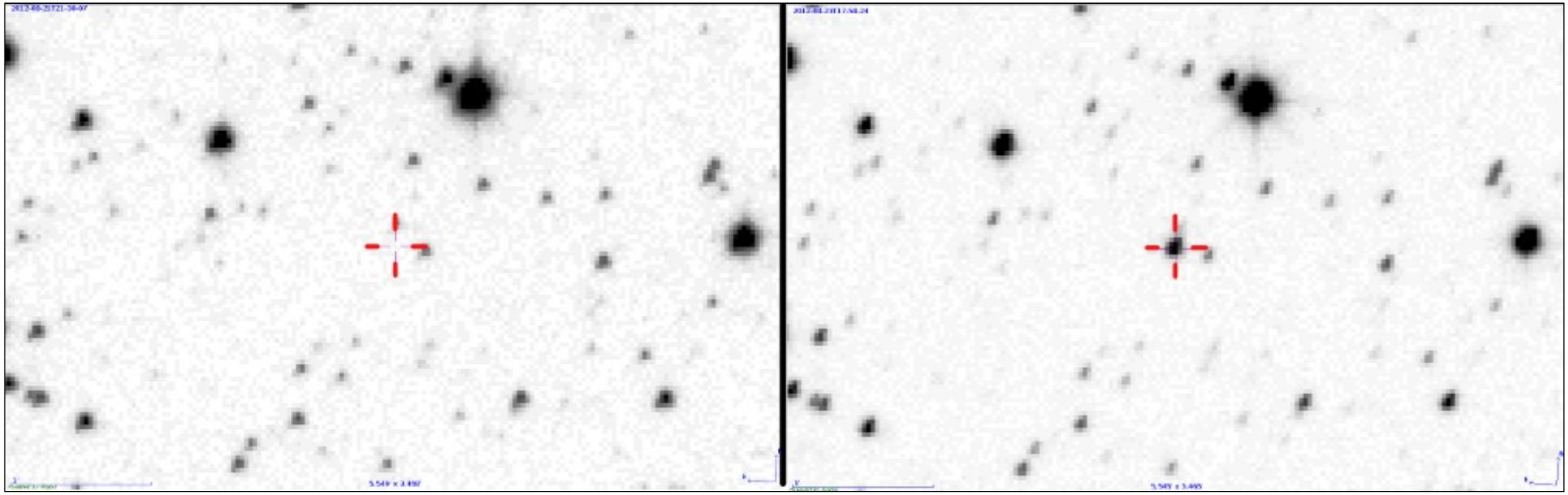
Light Curve



The outburst light curve of USNO-B1.0 1413-0363790

Finding Chart



Two images of the field of USNO-B1 1413-0363790, with the star in quiescence and in the outburst. North is on top, east is to the left. The narrow sides of the images are 3′.5 long.

Data Source

1. 1413-0363790.txt