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Optical transients, detected by MASTER Global Robotic Net as cataclysmic variables

G.A. Antipov[1], A.R. Chasovnikov [1,2], V.M. Lipunov[1], P.V. Balanutsa[1], O.A. Gress[3], V.P. Shumkov[1], K.A. Vetrov[1]

[1]*Sternberg Astronomical Institute of Lomonosov Moscow State University*
E-mail: gantipov@sai.msu.ru
[2]*Physics Department of Lomonosov Moscow State University*
[3]*Irkutsk State University*

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Abstract. We present several cataclismic variables outbursts, discovered by MASTER Global Robotic Net during regular survey. There are MASTER OT J085602.90-710244.1, MASTER OT J151902.07+823951.2, MASTER OT J060553.93+283325.6 and MASTER OT J022753.99+004441.0.

Introduction

The outbursts of close binary systems like cataclysmic variables are often registered by MASTER Global Robotic Net (Lipunov et al. 2010, 2019, Kornilov et al. 2012) during regular and inspect surveys. MASTER network consists of 9 observatories distributed around the earth (MASTER-Amur, -Tunka, -Kislovodsk, -Ural, -Tavrida, in Russia -SAAO in South Africa, -IAC in Spain, Tenerife, -OAFA in Argentina, OAGH in Mexica) with identical equipment, consisting of a twin 40-cm wide field telescopes as main instrument with own photometers (unfiltered, BVRI, PP filters in 2 ones) that was designed to discovery and investigate high energy astrophysics sources, so the usual observations made in unfiltered mode to detect the faint objects (Lipunov et al. 2022b).

One of the main feature to discover the short events like gamma-ray bursts optical counterparts, Kilonova, UVCet type flares, SU UMa type outbursts and other is own auto-detection system, that identifies all objects at every image during 1-2 minutes (less then next exposition) and compares them with cataloged ones to mark outburst. We have as minimum 2 images of each square (4 square degrees) per night with shift about $1'$ to exclude artifacts at CCD for optical flare detection. The second mode of MASTER wide field images reduction uses the difference between current and earlier images with similar characteristic (FWHM, m_{lim}). During all type of observations we detected optical transients (OT), and present several cataclysmic variables. All magnitudes are unfiltered, calibrated by GAIA stars. We checked all transients in minor planet center MPC NASA to exclude moving objects.

Dwarf nova outbursts detection by MASTER auto-detection system

1) **MASTER OT J085602.90-710244.1** discovery

During regular survey MASTER-SAAO auto-detection system detected optical transient at (RA, Dec) = $08^h56^m02.90^s$ $-71°02'44.1''$ on 2023-02-06 23:33:38UT with unfiltered magnitude $16.28^m \pm 0.05^m$ ($m_{lim} = 18.52^m \pm 0.50^m$) and with $m_{OT} = 16.27^m \pm 0.05^m$ at the second image (2023-02-06 23:40:40UT). This transient was detected by MASTER in 2020 as AT2020ame and classified as UG https://www.aavso.org/vsx/index.php?view=detail.top&oid=2228223. We used reference image on 2019-06-20.75882 UT with unfiltered $m_{lim} = 19.62^m \pm 0.05^m$.

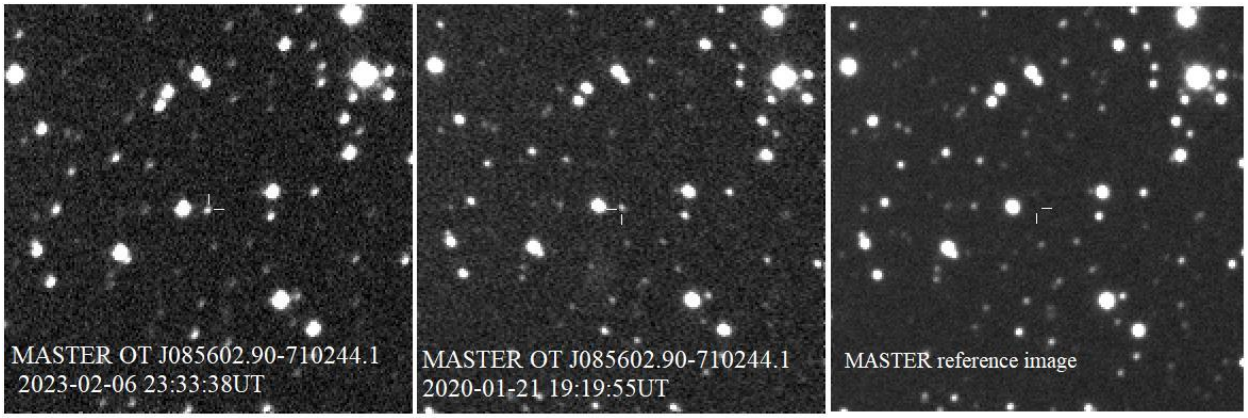

Figure 1: MASTER OT J085602.90-710244.1 detection history

2) **MASTER OT J151902.07+823951.2** discovery

MASTER-Tunka auto-detection system discovered OT source at (RA, Dec) = $15^h19^m02.07^s$ $+82°39'51.2''$ on 2014-03-30.64057 UT with T unfiltered magnitude $17.34^m \pm 0.04^m$ ($m_{lim} = 19.42^m \pm 0.50^m$). The OT was seen in 6 images. There is no minor planet at this place. We have reference image without OT on 2011-12-18.97449 UT with unfiltered magnitude limit 19.5^m. Taking into account, that there was no any sources at discovery date at this position

Figure 2: MASTER OT J151902.07+823951.2 detection history

on the digitized Palomar plates and on their combination to the limiting magnitude ~ 22.5,

and that there is an UV counterpart GALEX J151901.9+823951 ($FUV = 19.58 \pm 0.11$ $NUV = 19.48 \pm 0.07$) in VIZIER database, and the fact, that this object didn't present in 1RXS, 2MASS, USNO, GCVS and AAVSO VSX at discovery date we classified it as new optical transient — dwarf nova outburst. Based on the outburst amplitude (at least 5^m) and UV detection, this optical transient was classified as dwarf nova of SU UMa (UGSU) type in superoutburst.

3) **MASTER OT J060553.93+283325.6** with $> 3.9^m$ outburst amplitude

MASTER-Tunka auto-detection system found OT source at (RA, Dec) = $06^h05^m53.93^s$ $+28°33'25.6''$ on 2015-10-25.75079 UT with $15.54^m \pm 0.06^m$ unfiltered magnitude (the limit was $18.04^m \pm 0.50^m$). This OT was seen in 9 images. We used reference image without OT on 2013-12-01.66689 UT with 18.9 unfiltered magnitude limit. There is USNO-B1 star with B2=20.53, R2=19.10, so this OT was classified as dwarf nova outburst with amplitude more than 3.9^m. We detected other outbursts of this OT at 2018-04-08 01:09:50UT with $m_{OT} = 16.86 \pm 0.08^m$.

Figure 3: MASTER OT J060553.93+283325.6 detection history

4) **MASTER OT J022753.99+004441.0** — dwarf nova outburst with amplitude more than 1.6^m.

MASTER-IAC auto-detection system discovered OT source at (RA, Dec) = $02^h27^m53.99^s$ $+00°44'41.0''$ on 2020-01-15.87453 UT with $18.46^m \pm 0.04^m$ unfiltered magnitude ($m_{lim} = 19.86^m$). The OT is seen in 4 images. We used reference image on 2018-11-04.11958 UT with unfiltered $m_{lim} = 20.22^m$. This OT was classified as UG (AAVSO ID= 1540372).

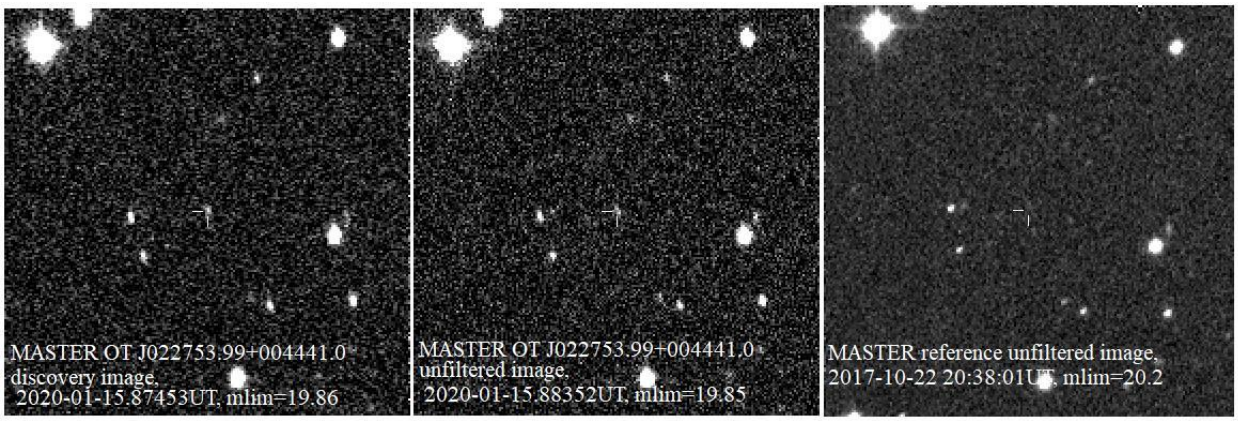

Figure 4: MASTER OT J022753.99+004441.0 detection history

Conclusions

We presented the results of MASTER auto-detection system work during regular survey with detection of MASTER OT J085602.90-710244.1 as dwarf nova, MASTER OT J060553.93 +283325.6 and MASTER OT J022753.99+004441.0 as dwarf nova outbursts and MASTER OT J151902.07+823951.2 as dwarf nova UGSU in superoutburst.

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Оптические транзиенты, открытые роботизированной сетью MASTER как катаклизмические переменные

Г.А. Антипов[1], А.Р. Часовников[1,2], В.М. Липунов[1], П.В. Балануца[1], О.А. Гресь[3], В.П. Шумков[1], К.А. Ветров[1]

[1] *ГАИШ МГУ*
E-mail: gantipov@sai.msu.ru
[2] *физический факультет МГУ*
[3] *Иркутский государственный университет*

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Резюме. Представлены несколько вспышек катаклизмических переменных, обнаруженных сетью MASTER во время выполнения регулярного обзора. Наблюдались транзиенты МАСТЕР ОТ J085602.90-710244.1, МАСТЕР ОТ J151902.07+823951.2, МАСТЕР ОТ J060553.93+283325.6 и МАСТЕР ОТ J022753.99+004441.0.