ABILITIES OF CELESTIAL OBSERVATIONS IN ASTRONOMICAL OBSERVATORY OF PHYSICS INSTITUTE IN OPOLE

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ABSTRACT. We present possibilities of astronomical investigation in Astronomical Observatory in Opole. Our observatory uses two telescopes: Celestron CGE-1400 XLT (35 cm) and Meade LX200 (30 cm) with spectrograph and CCD Camera. Main topic of our observational investigation is connected with observations of variable stars, minor bodies of the solar system, blazers and the Sun.

Key words: instrumentation; methods: observational;

1. Introduction

Our Observatory (named prof Teodor Kaluza) was created in the year 2006. However, because of technical problems it has been efficiently working since 2009. It is located on top of "Niechcic", the highest building in Opole ($50°40'21''N, 17^056'01''E$). It is in the city centre which is mostly commercial area, free during night time. As a result the light pollution is not a big problem. Presently our Observatory is equipped with two main telescopes, Celestron CGE-1400 XLT (35 cm) and Meade LX200 (30 cm) with spectrograph and CCD Camera. Our observational investigation is focused on observations of variable stars, minor bodies of the solar system, blazers and the Sun. The aim of the paper is to show that even with small telescopes located inside the city it is possible to obtain important scientific observations.

2. Instrumentation

The Celestron CGE-1400 is optically designed Schmidt-Cassegrain telescope with aperture 356 mm (14.02 in), focal length 3910 mm (153.94 in) and focal ratio 10. Meade LX200 is also optical design Schmidt-Cassegrain telescope with aperture 305 mm (12 in) focal length 3048 mm (120 in) and focal ratio 10.98.

Our observatory is equipped with two CCD cameras. The first one is SBIG ST-7E, Kodak KAF-0401E CCD NABG (715x510, pixel 9 microns, max QE - 0.6 at 6000 Angstroms, front side illuminated, thermoelectric cooling). It is equipped with filter wheel with UBVRI and RGB filters. The field of view for LX200 telescope is (for focal ratio f/10) 5.3x7.9 arcmin. The second one is FLI IMG-6303E Kodak KAF-6303E CCD NABG (3088x2056, pixel 9 microns, max QE - 0.7 at 6000 Angstroms, front side illuminated, tree-stage thermoelectric cooling) with filter wheel UBVRI where field of view for LX200 telescope is (for f/10) 21.2x31.9 arcmin. For both cameras maximum photometry range is 14 mag. The picture from our CCD Camera is presented in the Figure 1.

We possess the spectrograph SBIG SGS with custom modification - we added two calibration lamps - Ne and Xe. The spectrograph has two gratings with 150 and 600 lines per mm and two slit 18 and 72 microns respectively. The wavelength range of the spectrograph is from 3800 to 7500 Angstroms, the dispersion is 1.07 or 4.3 Angstroms per pixel while the spectral coverage per frame is 750 or 3200 Angstroms respectively. As a result, depending on configuration, the resolution is: for slit 18 and grating 150 - 2.4 Angstroms per pixel, for slit 18 and grating 600 - 10 Angstroms per pixel, for slit 72 and grating 150 - 10 Angstroms per pixel and for slit 72 and grating 600 - 38 Angstroms per pixel.

We have also used two smaller telescopes: Schmidt-Cassegrain Celestron NexStar 8i with aperture 203mm and focal length 2032mm and Carl Zeiss Jena Meniscas Telescop with aperture 180 and focal length 1800. We also have 40 millimetre Sun Telescope Coronado PST (H-alpha) with focal ratio 10.

3. Observations in Astronomical Observatory in Opole.

Observations in our Astronomical Observatory of Physics Institute in Opole University is focused on a

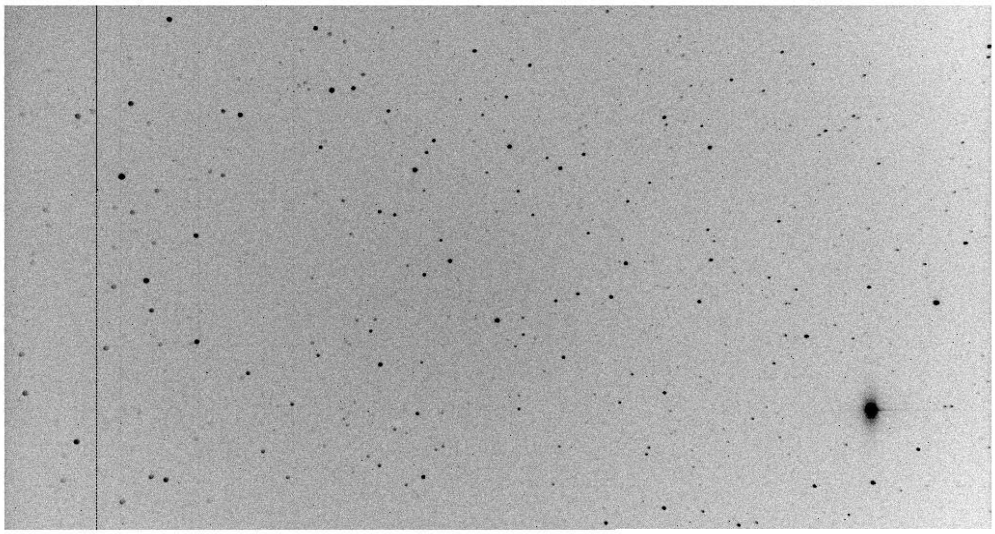

Figure 1: The picture TZ Bootis from CCD Camera in Opole.

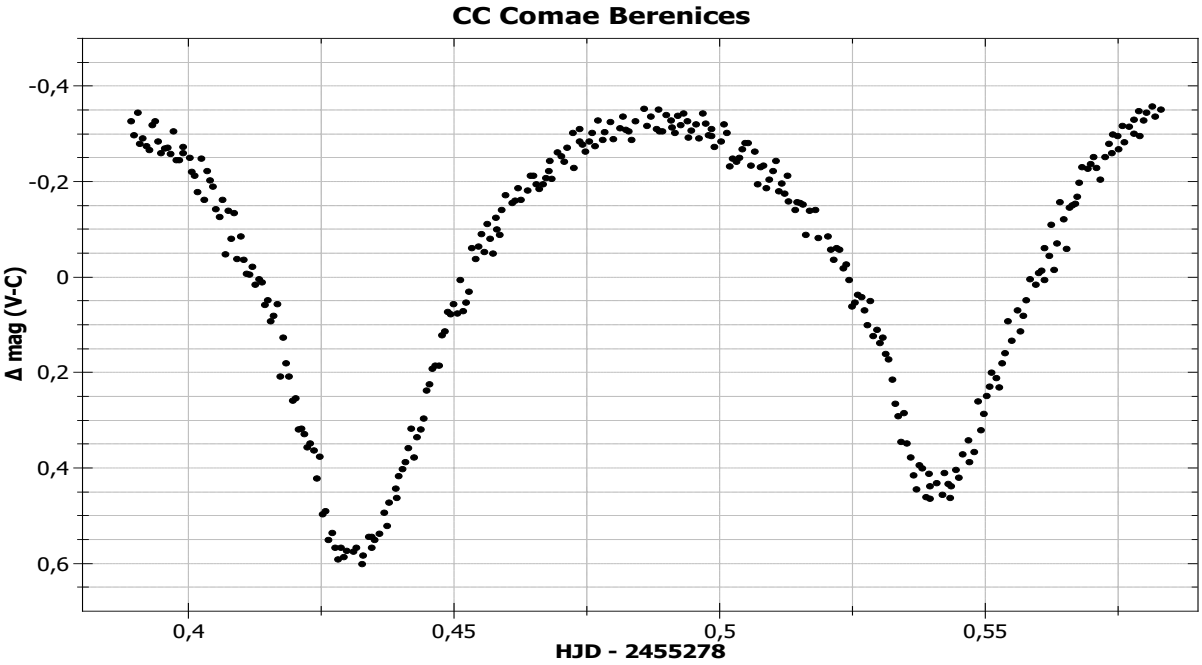

Figure 2: Light curve for CC Comae Berenices from Observations in Opole.

Table 1: Theoretical and observed efemerydes for Messalia 20.

Messalia	NASA Efemerydes		Observed	
data	α	δ	α	δ
05.11.2009; 20:44:44	23h 37m 23,68s	$-02^0 10' 33,0''$	23h 37m 23,61s	$-02^0 10' 32,4''$
20.11.2009; 20:53:33	23h 38m 50,12s	$-02^0 07' 03,2''$	23h 38m 50,06s	$-02^0 07' 02,2''$
07.12.2009; 19:22:27	23h 47m 42,94s	$-01^0 15' 10,8''$	23h 47m 42,98s	$-01^0 15' 11,0''$

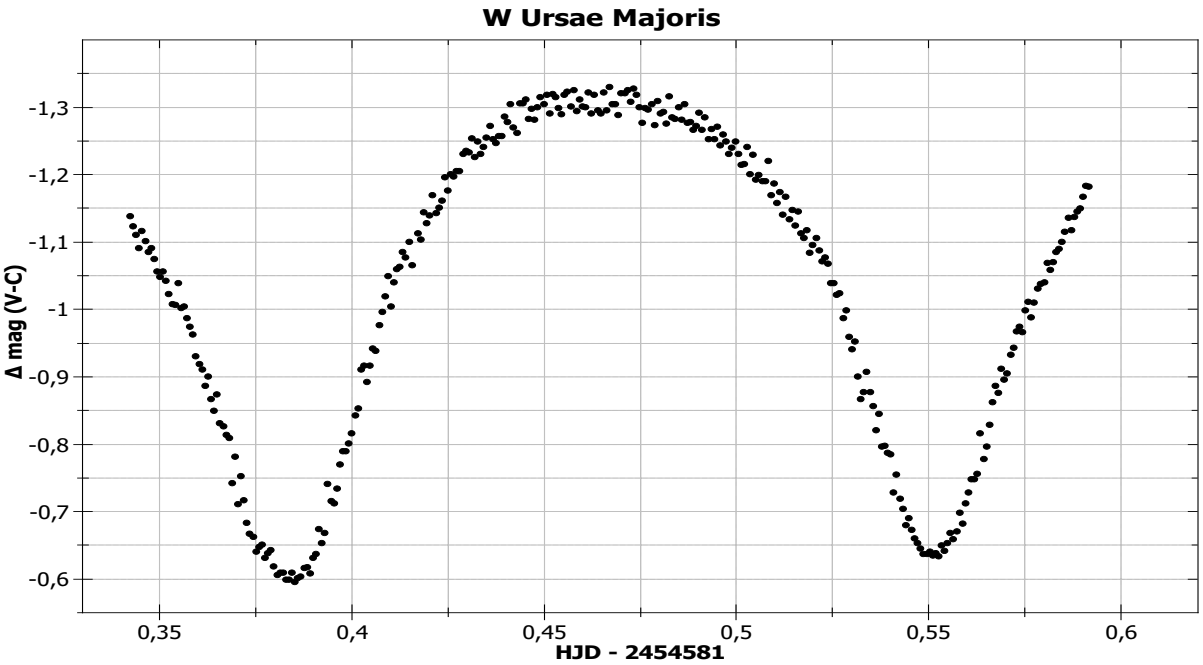

Figure 3: Light curve for W Ursea Majoris from observations in Opole.

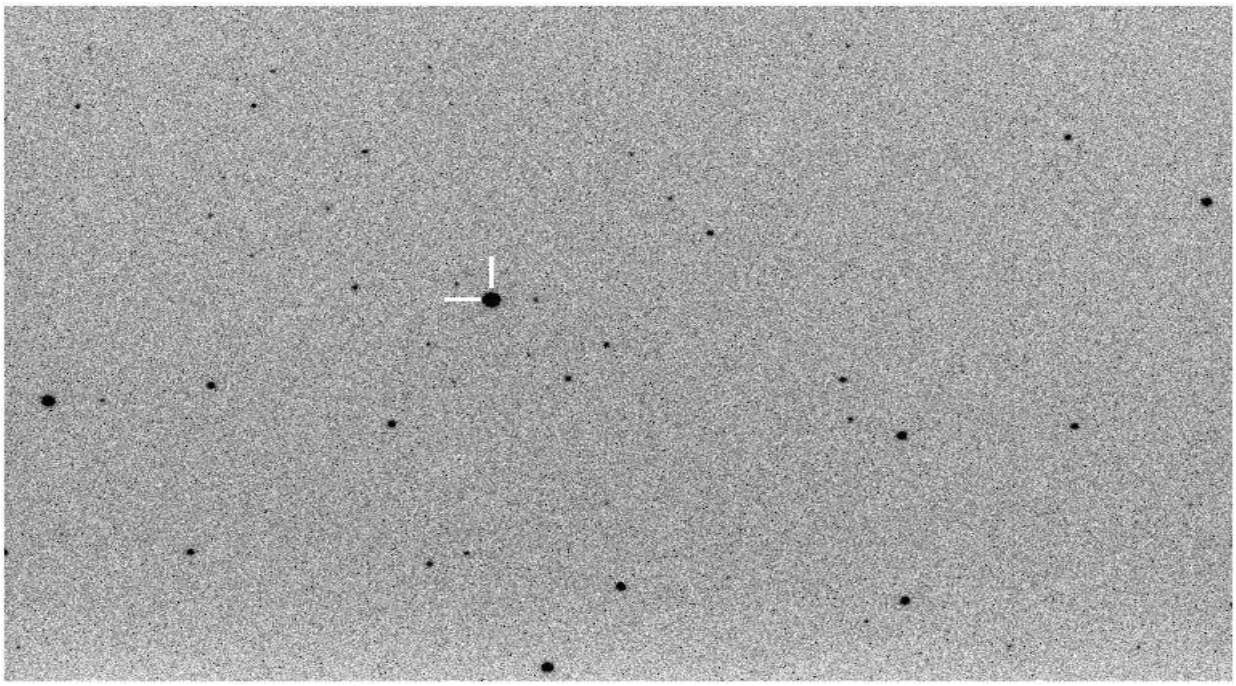

Figure 4: The picture Melpomena 18 from CCD SBIG ST-7E Camera in Opole.

Table 2: Differences between efemerydes and observed position Messalia 20 (in arcsec)

Messalia	α			δ		
data	α^*	$\Delta\alpha$	$\sigma = \lvert\alpha^*/\Delta\alpha\rvert$	δ^*	$\Delta\delta$	$\sigma = \lvert\delta^*/\Delta\delta\rvert$
05.11.2009; 20:44:44	1,049”	1,188”	0,883	0,600”	1,432”	0,419
20.11.2009; 20:53:33	0,889”	0,947”	0,950	1,000”	0,775”	1,290
07.12.2009; 19:22:27	0,600”	4,980”	0,120	0,200”	2,068”	0,097

few topics, namely: variable stars, small bodies of the Solar System, Blazars Observations and observations of the Sun.

First observational program started in the year 2006 was observations of the variable stars. Due to observational condition - inside the city, very few night with very good weather for us the best object for observations are variables type WUma or long terms variables. In the figures 2 and 3 we present light curves obtained in our observatory for two variables W Ursae Majoris and CC Coma Berenices. One should not that presently we start also program of the observation cataclismic variables.

Another type of our activity is observing small bodies of the Solar System. Such programs are very interesting not only because of pure science but also in connection with the program of preventing Earth from cosmic impacts. It is comonly accepted that astreoid or comet kill dinosaurs 65 milion years ago. Such huge impact is unlikly but even astreoid that has only 100 meter diameter can cause significant demage on the Earth. During last year we observed three planetoids: Juno (3), Melpomene(18) and Messalia (20). The picture of Melpomene (18) obtained in November 2009 in our observatory is presented in the Figure 4. The results of observation from November and December 2009 for Messalia (20) is presented in the Tables 1 and 2. Unfortunately, during the whole autumn and winter 2009/2010 we did not have good weather in Opole. We present theoretical NASA efemerydes and observed positions of Messalia (20) as well as differences between theoretical and observed positions of this small celestial body. One can observe that differences both in right ascension and declination: $\alpha^* = cos\delta|\alpha_{the} - \alpha_{obs}|$ and $\delta^* = |\delta_{the} - \delta_{obs}|$ not exceeding $1arcsec$, which is a criterion of well done observation. One can observe that even for in the case not very well weather it was possible to obtain reasonable observations.

Since present year we have started the observations of blasars. Presently, because of observational conditions, our observational program is connected with blazars OJ287, 3C273 and 3C279.

Another important subject of our scientific work are observations of the Sun. The Sun is interesting not only because it allows life on the Earth, but also have influence on our present life. Even with our small Coronado telescope it is possible to investigate the Sun activities.

One of important aspects of the Solar influence is the Space Weather. A solar wind stream is buffeting Earth's magnetic field, and this could cause geomagnetic activity at high latitudes. The one-hour blast does not produce a bright flash of electromagnetic radiation nor a substantial coronal mass ejection. However, huge halo coronal mass ejections are likely to be geoeffective. The strength of geomagnetic storms is highly correlated with source location and space velocity of a given event (Michałek et al. 2006). Activities of the Sun is also important for both, present Earth climate (Friis-Christensen 1991, Abdussamatov 2005, Wilson 2008) and for the Earth climate in the past i.e. for Climate Optimum in X century and Mauder's Minimum XVII century (Mangini 2005).

4. Conclusions.

With the abilities of Astronomical Observatory Institute of Physics Opole University we are able to participate in scientific programs connected with observations of variable stars, minor bodies of Solar System, blazars and investigations of Solar activities. Even small telescopes give possibilities to obtain important scientific results!

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