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MONECOM: PHYSICAL CHARACTERISTICS OF MAIN BELT COMETS

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Abstract. The aim of the MONECOM project is to carry out photometric observations of several Main-Belt Comets (MBCs). Observations and data reduction were performed by high-school students from three countries (Croatia, Greece and Serbia), supervised by their teachers and local astronomers. Here we present some results obtained by the Serbian group.

1. INTRODUCTION

In order to get high school students interested in science, particularly in astronomy (which is not part of standard high school curriculum in Serbia, see paper by Atanacković, these proceedings), it is of great importance to give them opportunity to use modern equipment, as well as to introduce them to modern trends and recent discoveries. The MONECOM project tries to address both issues. The idea of the project it to gather three groups of high school students, one from Croatia, one from Greece and one from Serbia, and to apply for the observing time on the remote MONET telescopes in order to observe main belt comets (MBCs). The MONET telescopes are superior to any of the local telescopes available to those students. Also, main belt comets are a relatively recent discovery in solar system astronomy. Only a handful of them are discovered so far and they seem to attract significant attention of researchers interested in small bodies of the Solar system.

The main educational goal of the project is to get the students through whole process of observations, data reduction and, if possible, data interpretation. However, we wanted the project to have a scientific aspect as well: via multi-band photometry we hoped to detect some signs of activity in the observed MBCs.

Preparation and initial training of the students were carried out by their teachers/tutors, and supervised by a local professional astronomer. In this paper we report on the activities done by group of students from Serbia. The group consisted of eight

students, age 15 to 19. They all come from different high schools but attend astronomy seminars in Petnica Science Center (PSC; for details see contribution by Milić et al. in these proceedings). The group was coordinated by Igor Smolić and Ivan Milić, senior assistants and former department heads at PSC. The whole project was supervised and supported by Milan Bogosavljević, member of the staff of the Astronomical Observatory of Belgrade. Additional support and assistance were provided by four more junior assistants (undergraduate/master students) from the department of Astronomy department of PSC.

2. OBSERVATIONS

The initial plan was to apply for two nights for each of the groups. Our group covered nights of $28/29^{th}$ and $30/31^{st}$ of October. We used MONET North telescope, located at McDonald observatory (Bischoff et al., 2006; Hessman, 2007). Telescope was remotely controlled by students and supervisors from the Astronomical station Vidojevica. The additional pedagogical effect was to allow students to get familiar with the 60 cm reflector telescope at Vidojevica and to also perform some test observations using it. The MBCs observations were part of a four-day "mini-seminar" held for Petnica students since at the moment main objects of PSC were closed for renovation.

Prior to observations, instructions on using the MONET interface, taking various kinds of frames and taking necessary precautions were given to all the students. All of them had attended some elementary lectures on telescopes, CCDs and photometry in general on seminars in previous years. The main observational plan consisted of observing three MBCs:

1. 176P/Linear,
2. 238P/Read (P/2005 U1),
3. P/2010 R2 (La Sagra).

3. RESULTS

We gathered data during approximately eight hours of observations, in two intervals. The data were preliminary examined "on the fly", and later processed during the summer school of astronomy in Petnica Science center in 2012. A short image processing workshop was organized with students who were participating in the MONECOM project, and also to other interested students.

The data processing was completely performed by Nina Bogdanović, high school student attending the seminar at the time, using MaximDL, AstroArt and DS9 software packages. Dark current subtraction and flat-field reduction were performed for all the images and images were stacked in order to increase S/N ratio and visually identify the objects. In Figure 1 we show the detection of READ/238P MBC in the R filter. The total of 20 minutes of exposure was stacked in order to obtain the image. We see that the comet can be identified, however, precise photometry was impossible due to the fact that the comet happened to be transiting a star in the field at the moment of observation. We have dedicated approximately the same exposure to

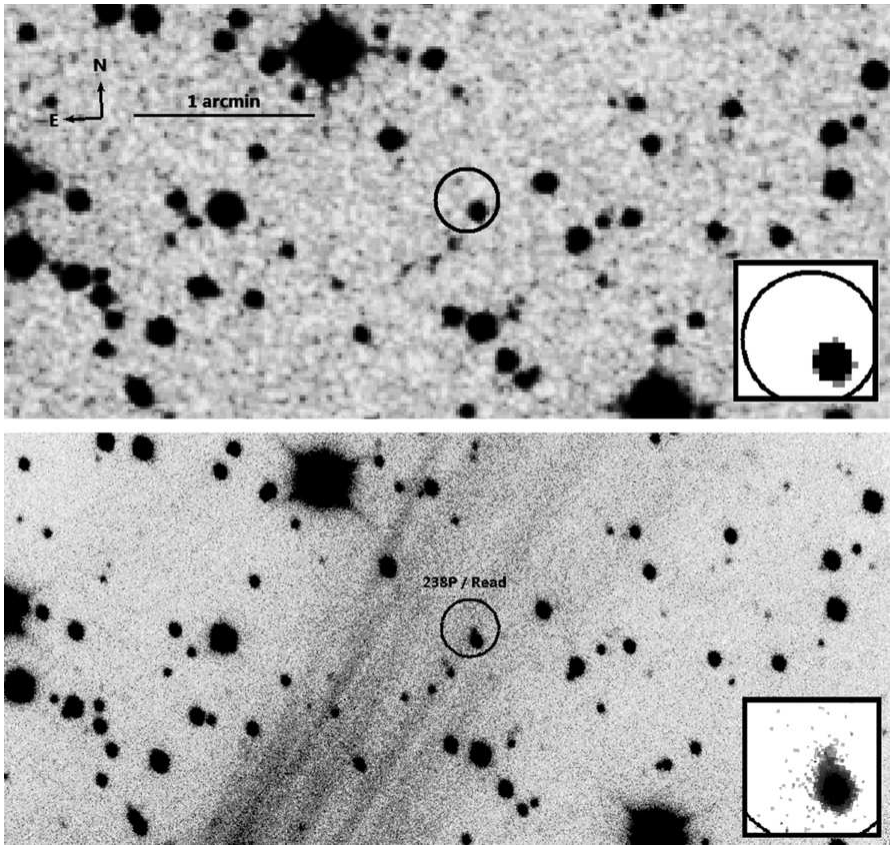

Figure 1: Zoom-in on the field where READ/238P MBC was detected in the night of $30^{th}/31^{st}$ of October. The R filter was used with total of 20 minutes exposure time.

other MBCs (176P/Linear and P/2010 R2) but failed to detect any of them. It seems that additional observations with much longer exposure times are needed in order to detect and study these objects with the telescope of this aperture.

4. CONCLUSIONS

We have conducted a collaborative observing session using MONET/North telescope with three participating groups of high-school students (from Croatia, Greece and Serbia). The Serbian group, consisting of eight high-school students, attempted photometric observations of there MBC objects: 176P/Linear, 238P/Read and P/2010 R2. We have been able to detect only 238P/Read in our data. In our best data stack of 20 minutes of exposure time in the R photometric band, the position of the 238P/Read at the time of observation was near a bright foreground star, which prevented our attempts at precise photometry and we were not able to place any constraints on the presence of a cometary tail.

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