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FIRST TEST OF LOW-RESOLUTION CCD DEVICE FOR DEEP-SKY OBJECTS

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Abstract. The CCD device, based on high sensitivity monochromatic sensor with resolution of approximately 0.25 megapixels will be tested. The model of CCD device is Deep -Sky Imager PRO, manufactured by Meade, USA. The RGB Color Filter Set will be used in order to obtain color images. We plan to take photographs of planets and various deep-sky objects and then compare obtained images with those obtained with classical DSLR camera (Nikon D70s). The influence of different setting parameters (exposure, contrast, histogram sliders, dark subtraction) on the image quality will be analysed.

1. INTRODUCTION

Astronomical Society "ADNOS" from Novi Sad was established on 04 March 1974. by Prof. Ž. Ćulum and J. Francisti. It is now located on the Petrovaradin Fortress where we have Planetarium and Observatory in two separated buildings. As the equipment Astronomical Society has seven telescopes, three binoculars, several teleobjectives as well as several analogue cameras, one CCD, and one DSLR camera Nikon D70s. Our biggest instrument is 10" Meade LXD75 reflector, and the one used for testing the CCD is 6" Meade LXD75.

Recently the Society bought CCD camera. It is monochrome CCD camera supplied with red, green, blue and IR filters. They are used consecutively in order to obtain colored RGB and LRGB images. CCD sensor is High Sensitivity Sony© ExView HAD Monochrome CCD Sensor and it is 2.3 times more sensitive and has an effective resolution 4 times higher than chip used in Meade Deep Sky Imager. It has a slider that accepts up to four 1.25" filters and USB 2.0 high-speed connection which allows fast reaction time for computer. The camera resolution is 510 x 492 pixels (250 kPix) and pixel size is 9.6 microns (W) and 7.5 microns (H). Minimal and maximal exposure times are from 1/10 000 of a second up to one hour. Convection cooling design - allows longer exposures with less noise and less noise means more data. Along with the camera AutoStar Suite software package came which includes Sky Software, Image Capture Software, and Image processing Software, including these features:

- Time Lapse photography tool creates movies of the rotation of Jupiter, moons transiting Jupiter, etc.

- Auto and Manual exposure settings let Meade Deep Sky Imager Pro optimize the exposure, or set it manually.
- New Stretch Options Auto-stretch automatically brings out dim objects at short exposures. Optimizes the contrast of objects, with adjustable contrast settings.
- Automatic Dark Subtraction Dark frames are automatically stacked and averaged then subtracted giving a clean image.
- Automatically align and stack images using state-of-the-art techniques.
- Magic Eye focus for super fast, no-hassle focusing.
- Live histogram helps to optimize for the best exposure.

Figure 1: M 13 globular cluster in constellation of Hercules.

2. WORK AND RESULTS

Due to bad weather conditions and other obligations of members involved in this project, we had only one good night for testing. We used it to photograph the M 13, globular cluster in constellation of Hercules. Here, we have to point out that the testing was carried out on the location of Observatory on Petrovaradin Fortress, so we had fairly large light pollution. That is the main reason we chose this globular cluster because it was high enough on the night sky. As mentioned before, we used 6" Meade LXD75, and we also used that very night to learn to calibrate the guiding system on the telescope itself using three known stars in process. We made 113 frames during that night with exposure time of 10 seconds. We used only 103 frames because ten of them were blurry and also we didn't use any dark frames because AutoStar was making some problems with them. What happened is that, we took 10 dark frames, but the software summed them into one of exposure time of 100 seconds, so it was useless to us. Than we used software package Maxim DL and used tool called Remove Bad Pixels in order to remove hot pixels. We couldn't remove the background thermal noise, but it was only the first test. Maxim DL is also used to stack the raw images and we obtained the image shown in Fig. 1.

3. CONCLUSIONS

What we concluded from this test is, that the camera itself is fairly nice for deep-sky photography, even in light-polluted areas such as Novi Sad. Apart from some small problems with the software (which we solved later) and problems with aligning the telescope (because it is a mobile instrument, and we have to set it up every time), there were no major setbacks during the test itself, except the lack of experience with this type of astrophotography. We are still learning and we get better and better results on each try. So, in general our goal is to create pictorial atlas of Messier objects using colour filters and perhaps our other members can carry out some other projects such as extracting the luminosity profiles of globular clusters and perhaps even galaxies.

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