# KOROAPS – SYSTEM FOR A LARGE SCALE MONITORING AND VARIABLE STARS SEARCHING

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ABSTRACT. We give an introduction information about the KOROAPS (KOšice ROztoky Automatic Photometry System). It is a system for a large scale automatic multicolor monitoring and variable stars searching. It is in a development at Šafárik University in Košice in cooperation with Roztoky Observatory. The system is now in a test operation at Roztoky Observatory. System consists of Nikkor photolense 2/200 equipped with SBIG ST8 CCD camera and set of the standard VRI photometric filters. It is placed on Celestron's CG-5 Advanced mount. We give description of the basic properties of the instrument, data reduction pipeline and operational modes of the instrument.

**Key words**: Instrumentation: miscellaneous, Methods: data analysis, Techniques: photometric

## 1. Basic Properties of the System

### *1.1 Optics*

The optical part of the system consists of Nikkor photographic photolense 2/200. The diameter of the input aperture is 100mm and focal length is 200mm. The focal plane is optimized for the field with classical dimension of 24 × 36 mm. It gives us a possibility to use a CCD camera with larger chip in the future.

### *1.2 CCD camera*

The Nikkor photolense is at present time equipped by SBIG ST-8 CCD camera. The chip dimension is 1530 × 1020 pixels with 9 $\mu$m pixel. We use set of standard Johnson $VRI$ filters. The field of view of the camera at used optics is 4 × 2.5$^o$ with pixel scale 9.5"/pixel. We use exposure times typically from 30 seconds up to 2 minutes. The limiting magnitude in $V$ filter for 1 minute exposure is ∼16.5 mag.

### *1.3 Mount*

Optics with CCD camera are placed on Celestron CG-5 Advanced Mount with GoTo system. This mount is LX200 compatible mount, which enables us to use an open protocol for its control. Maximum slew speed of the mount is 3$^o$/second. The pointing accuracy is <1', but strongly depends on quality of calibration of the mount (north pole setting and calibration stars selection and alignment). The mount enables to use an autoguiding system using the second camera chip with accuracy better then 10".

### *1.4 Software*

CCD camera and mount control as well as data reduction pipeline are realized by Python scripts, which used corresponding programs depending on operational mode. Data archiving (CCD images, light curves) are performed by MySQL and PHP scripts. We plan to put data on-line on the web page.

## 2. Data Reduction Pipeline

The reduction and analysis of the obtained CCD images can be summarized to the following steps:

1. standart photometric reduction using master bias and dark frame and flat-field. Masters are created every night, if it is permitted by weather conditions.
2. sorting of the CCD images considering to operational mode and used filter.
3. object detection and their photometry. In non-crowded fields we use SEXTRATOR code (Bertin & Arnouts, 1996). For the crowded fields we plan to implement ISIS package (Alard and Lupton, 1998)

Table 1: Operational modes of KOROAPS system and types of observed objects.

| Mode | Description |
|---|---|
| 1 – one region | multicolor photometry of the selected field, typically all night |
| | light curves of eclipsing binaries and CVs |
| 2 – region scan | photometry of 2, 4 or 9 partially overlapping fields |
| | variable stars and/or exoplanets searching, monitoring of variable stars |
| 3 – multiregion | photometry of maximum 16 fields one after another |
| | multicolor monitoring of CVs minima times of eclipsing binaries |

4. cross identification between detected list of objects and catalogs (Tycho2 or USNOA). World Coordinate System (WCS) transformations are calculated and WCS is written to FITS image header.

5. calculation of all necessary corrections (e.g heliocentric correction).

6. calculation of instrumental differential magnitudes with respect to selected comparison stars

7. transformation of magnitudes to international system.

8. final light curves generation and data archiving.

## 3. Operational Modes

KOROAPS can operate in 3 operational modes as listed in Table 1. These modes can be easily changed during night depending on observational conditions as well as types of observed objects.

## 4. Conclusion

KOROAPS is now in a test operation at Roztoky Observatory. We plan to put it to regular work during 2008. We also plan to use new CCD camera with a large chip to maximize field of view. It will be necessary to improve our software and implement other photometric packages.

We have found that KOROAPS could be very useful for the observations of the objects that we want to study, like cataclysmic variables and eclipsing binary stars.

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## References

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