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Preliminary Results of Low Dispersion Asteroid Spectroscopy Survey at NAO Rozhen†

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Abstract. We are presenting the first results of low dispersion spectroscopic observation of asteroids at Bulgarian National Astronomical Observatory Rozhen. Asteroids with unclassified spectra and brighter than 15 magnitude have been chosen. Besides just presenting the asteroid reflectance, classification according to Bus S. J. *et al.* (2012) has been done. The asteroid spectra of 590 Tomyris, 703 Noemi, 1596 Itzigsohn and 1826 Miller are presented together with standard spectra corresponding to the three best matches given by the public software tool M4AST (Popescu M. *et al.* (2012)). Our aim is to participate in the coordinated program of asteroids spectroscopy complementary to the observations of Gaia.

Keywords. minor planets, asteroids, techniques: spectroscopic

1. Introduction

Bulgarian National Astronomical Observatory (BNAO) - Rozhen (071 Rozhen) with astrometric observations has been already involved in GAIA Follow-Up Network for Solar System Objects since the end of 2011. One of our aims is to develop a coordinated program of asteroid spectroscopy complementary to Gaia's observations. In this paper the first results of asteroid spectroscopy at BNAO Rozhen are presented. Spectroscopic observations were made for four asteroids with unknown spectra: 590 Tomyris, 703 Noemi, 1596 Itzigsohn and 1826 Miller.

We obtained optical spectra of asteroids using the 2-m RCC telescope equipped with CCD VarsArray 1300B (pixel size 20 μm or 0.736 arcsec/px) in spectroscopic mode of FoReRo2 in its red channel (Jockers K. *et al.* (2000)). The spectroscopic characteristics are: low-dispersion grism Bausch & Lomb, working in the parallel beam of FoReRo2, with 300 lines/mm which gives 4.3 $\AA$/px and 200 μm width slit which corresponds to 2.6 arcsec. We determined spectral types of the asteroids (Bus S. J. *et al.* (2012)) by the overall shapes of the spectra between 450 nm and 700 nm. For spectral analysis in our work we use public software tool M4AST (Popescu M. *et al.* (2012)). It covers aspects related to taxonomy, curve matching with laboratory spectra, space weathering models, and mineralogical diagnosis.

† Based on data collected with 2-m RCC telescope at Rozhen National Astronomical Observatory.

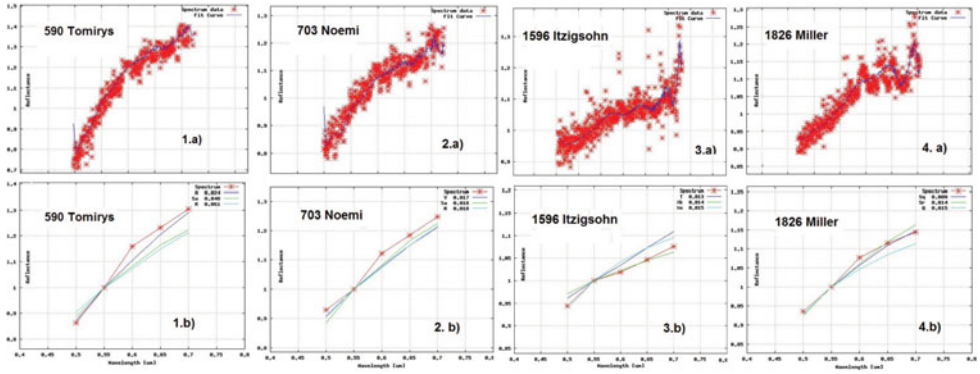

Figure 1. The asteroids observed spectrum is plotted in panels **a** and the standard spectra corresponding to the three best matches in panels **b**.

2. Observations and data reduction

Low dispersion spectroscopic observations of asteroids were taken on 29 December 2013. We have chosen asteroids with unclassified spectra and with apparent magnitudes not greater than 15. For each asteroid several (usually five) exposures were taken with approximate exposure time of 300 sec. In order to remove the solar contribution we obtained several images with exposure time of 300 sec. of a spectral solar analog star (SSAS) HD 28099. The wavelength interval of our observations is from 0.45 to 0.90 μm, but because of the strong fringing we had to cut at 0.7 μm.

For the preliminary data reduction of asteroid and SSAS spectra we did bias subtraction and flat field correction. The wavelength calibration of asteroid spectra was made by measuring the pixel position of the Ballmer lines in the spectrum of HD28099 and fitted them with their laboratory wavelengths. The background sky was obtained from the spectra along the slit, apart from object spectrum and was subtracted from the SSAS and asteroids spectra. The extinction correction was applied to each extracted (one dimension) spectrum (for the asteroid and SSAS). After these calibrations we divided asteroid spectrum by that one of the SSAS. To find the relative reflectance of the asteroid and to facilitate the comparison of spectra for different objects we normalised asteroids reflectivity to unity at 0.55 μm.

3. Results

Most of observed asteroids belong to some families and there are no published spectra. Besides plotting the spectra (the reflectance as a function of wavelength) classification according to Bus S. J. *et al.* (2012) has been done. The asteroid spectrum is plotted together with standard spectra corresponding to the three best matches (see figure 1).

590 Tomirys is a asteroid from the EOS family. We determined its spectral class as A type or probably Sa. **703 Noemi** is member of FLORA family and its reflectance corresponds to V type spectral class. **1596 Itzigsohn** is a outer main-belt asteroid and its reflectance spectrum fits well Xk type asteroid class spectra. **1826 Miller** is a asteroid from the EOS family and we determined its spectral class as Sq type.

References

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