PHOTOMETRY OF SMALL MAIN-BELT ASTEROIDS: ROTATION, BINARY AND PHYSICAL CHARACTERISTICS. V. G. Chiorny, Institute of Astronomy of Kharkiv V.N Karazin National University, (Sumska Str. 35, 61022, Kharkiv, Ukraine. chiorny@astron.kharkov.ua)

Introduction: Regular photometric observations of small asteroids of the main belt are held at the Institute of Astronomy of KhNU since 2005 as part of the joint program BinAstPhotSurvey [1,2]. The aim of the researches is to obtain high-precision lightcurves of small (diameter less than 15 km) asteroids of the main belt, determination of the periods of their axial rotation; detection of multiple system among these objects and the research of their parameters, as well as the determination of physical characteristics - absolute brightness, color indices, diameter or geometric albedo of individual small asteroids.

Observations: Photometric observations are carried out in the Johnson-Cousins photometric system on the 0.7 m telescope at the Chuguev station and equipped with CCD-camera IMG 1024S and IMG 10-47.

The objects of investigation are the asteroids of the inner main-belt with heliocentric semi-major axes a <2.5 AU, the absolute value H >12 and with unknown rotation period.

Differential photometry of an asteroid in the CCD frame usually provided an uncertainty of measurements of the order of 0.01—0.03 mag (rms). Standardization of observations was carried out in photometric nights (with a good seeing). The accuracy of measurements of the color indices for the individual night is equal to 0.02—0.04 mag.

Results: Here are present photometric observations of 70 main-belt asteroids with diameters of less than 15 km carried out for the first time, which made it possible to obtain the values of the rotation periods for these asteroids. Figure 1 shows the characteristic lightcurve of a single asteroid 3956 Caspar, which shows a stable periodicity of 2.77 hours

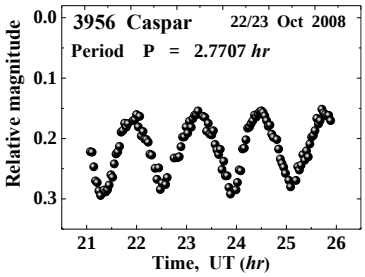

Fig. 1. Lightcurve of asteroid 3956 Caspar.

However, the lightcurves of binary asteroids, along with the periodicity, show the attenuation of the asteroid shine characteristic of the occultation / eclipse phenomena of two bodies. In addition, the presence of a trend of average brightness of the asteroid (see Fig. 2) means the presence of a second periodicity in the composite lightcurve.

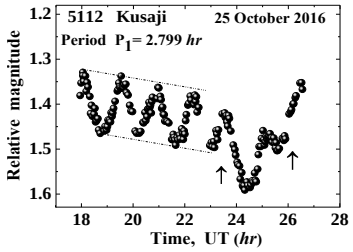

Fig 2. Lightcurve of the binary asteroids 5112 Kusaji obtained on 25/26 October 2016.

An important result of this researches is discovery of 15 new binary and 4 triple systems among small main-belt asteroids and determination of their the orbital periods and the rotation periods and diameter ratio of their individual components [3-6].

A fully synchronous binary system of asteroid 8474 Rettig was discovered among the new multiple systems [7]. It represents a rare group of binary asteroids with approximately equally-sized components and synchronous rotation. Lightcurve of this object show on fig. 3. The parameters of the system have been determined and the diameters of the components have been estimated.

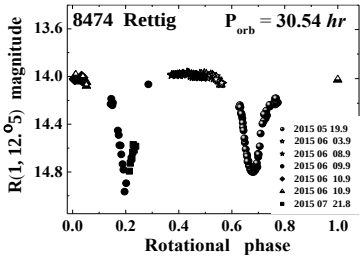

Fig 3. Lightcurve of the synchronous binary asteroids 8474 Rettig.

The analysis of the obtained main parameters of asynchronous multiple systems with a short period of rotation close to the destruction boundary and weak elongation of the primary component has shown that their mean parameters support the theoretical hypotheses of the influence of the YORP effect on the binary formation mechanism.

The photometric observations for 25 main-belt asteroids were standardised and for the first time their absolute magnitude and colour index V – R were determined, as well as their diameters, albedo and the mineralogical surface composition were assessed.

References: [1] Pravec P. et al.. (2008) *Icarus 197*, 497-504. [2] Chiorny V. et al. (2011) *Planet Space Sci. 59*, 1482-1489. [3] Pray D. et al.(2014) *CBET 4012*. [4] Pollock J. et al. (2015) *CBET 4206*. [5] Chiorny V. et al. (2016) *CBET 4336*. [6] Pravec P. et al.(2016) *Icarus 267*, 267-295. [7] Chiorny V. et al. (2015) *CBET 4122*.