Contrib. Astron. Obs. Skalnaté Pleso **43**, 445 – 446, (2014)

Observations of artificial satellites of Earth and natural satellites of Jupiter in Crimean Laboratory of SAI

T.R. Irsmambetova[1], N.N. Borisova[1], G.V. Borisov[1], L.A. Bagaev[1], V.M. Agapov[2] and I.E. Molotov[2]

[1] *Crimean Laboratory of Sternberg Astronomical Institute, M.V.Lomonosov Moscow State University Nauchny, Crimea, 98409, Ukraine*

[2] *Keldysh Institute of Applied Mathematics RAS, Miusskaja sq.4, Moscow, 125047, Russia*

Received: November 12, 2013; Accepted: January 23, 2014

Abstract. In the report possibilities of the telescope RST-220 (diameter of the mirror 22cm) for the solution of various observation tasks are shown. Since 2008 this tool has been used for regular high-precision astrometric observations of geostationary satellites within cooperation of observations according to the ISON program. In addition to astrometric observations photometric observations have been made as well. In 2009 the worldwide campaign on photometric observations of mutual occultations and eclipses of Galilean satellites of Jupiter was founded. Using RST-220 it was managed to obtain some light curves. The light curve of the unique double event - an occultation and an eclipse - is given for satellites Io and Europe.

Key words: geostationary satellites – occultations and eclipses in Galilean satellites – astrometric and photometric observations

1. Astrometric observations of geostationary satellites

Since 2005 the International Scientific Optical Network (ISON) has carried out the observations of objects in the geostationary region (GEO) under auspices of the Keldysh Institute of Applied Mathematics (KIAM), Russian Academy of Sciences. Now 26 observatories and observation posts in 10 countries of the world cooperate with ISON (http://lfvn.astronomer.ru/main/english.htm). The main ISON Research Goals are: reviews of area of a geostationary orbit, maintenance and research of fragments of space debris, observations of bright objects on targeting, photometric observations of satellites and observations of asteroids.

Regular observations of geostationary satellites on targetings within cooperation of ISON have been made since January 2008 in the Crimean laboratory(SAI MSU). As the detector PL-16803 CCD is used (4096 x 4096 pix; 1pix - 9 μm). CCD is established on the RST-220 telescope (aperture - 220 mm, focal length - 495 mm). The telescope is designed and made by G.V. Borisov. The angular size of a field of view is 4.2 x 4.2 degrees. Registration of time is carried out by a GPS receiver. All software, namely registration of images and further processing, is made by V.V. Kupriyanov. (GAO, Russian Academy of Sciences). Images are registered by means of the "Camera Control" program. The final stage of processing - high-precision calculations of coordinates - are carried out by means of the universal program "Apex". The precision of a single measurement is usually 1 angular second.

2. Photometric observations of mutual eclipses and occultations of Galilean satellites of Jupiter

In 2009 the world campaign for observations of Jupiter satellites was launched. From observation of light curves of satellites during their mutual occultations or eclipses it is possible to determine a difference of coordinates of two satellites participating in the phenomenon. Speeds of movement and the sizes of satellites are such that the accuracy of position data obtained thus is better than the accuracy of usual astrometric observations.

On August 17, 2009 we observed a unique double event by the RST-220 telescope - an occultation and eclipse of satellites Io (1) and Europe (2) (1O2+1E2). Observations were made in integrated light. The light curve is usually represented as the difference of brightness in magnitude of satellites which participate in an eclipse or occultation, relative to a "comparison star". In this case the difference of brightness in magnitude of total brightness of satellites 1+2 (Io+Europe) related to the satellite 3 (Ganymede) was defined. The satellite Ganymede didn't participate in a mutual occultation and an eclipse, therefore it was used as a "star of comparison".

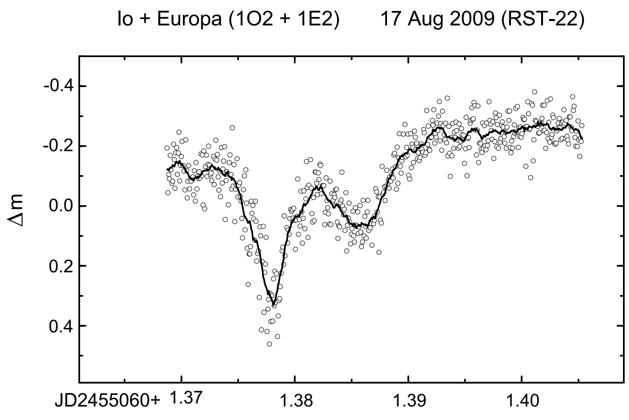

Figure 1. The light curve of the occultation and eclipse of satellites Io (1) and Europe (2). Circles mark total brightness of Io and Europa. Δm - magnitude relative to the satellite Ganymede (3).