SOLAR SYSTEM

NEW WIDE-FIELD TELESCOPE WITH HYPERBOLIC MAIN MIRROR (DIAMETER 60 CM) AND ROSS CORRECTOR: JOINT RESEARCH INSTITUTE PROJECT BETWEEN ASTRONOMICAL OBSERVATORY OF ODESSA NATIONAL UNIVERSITY AND MAIN ASTRONOMICAL OBSERVATORY OF UKRAINE

***Fashchevsky N.N.*, *Podlesnyak S.V.*[1], *Bondarenko Yu.N.*[1], *Andrievsky S.M.*[1], *Romanyuk Ya.O.*[2]**

[1] *Astronomical Observatory, Odessa National University, Odessa, Ukraine*

[2] *Main Astronomical Observatory of NAS of Ukraine, Kyiv, Ukraine*

At the Astronomical Observatory of Odessa National University, the work is underway to create a telescope of an original optical scheme, consisting of a main hyperbolic mirror (diameter 60 cm) and a two-lens Ross corrector.

The use of additional free parameters made it possible to practically avoid all five third-order aberrations. The working field of the telescope is 2x2 degrees, the equivalent focus is 1366 mm, the relative aperture is D/f = 1: 2.28. Such a telescope will make it possible to effectively conduct observations, the purpose of which is the search for asteroids, as well as the detection of previously cataloged and previously unknown objects in the geostationary zone.

GROUPS OF METEORITE-PRODUCING METEOROIDS AND METEORITES IN ASTEROID ORBITS AND THEIR SOURCES

***Yu. M. Gorbanev*[1],*N. A. Konovalova*[2], *N.H. Davruqov*[2]**

[1] *Astronomical Observatory Odessa National University, Ukraine,*

[2] *Institute of Astrophysics of the Academy of Sciences of the Republic of Tajikistan*

In this paper we present the results of our study of the existence of near-Earth meteorite-producing groups comprised of sporadic fireballs from the IAU MDC database 2007 [1], sporadic meteors from the SonataCo database [2], instrumentally observed meteorites and their respective parent near-Earth objects (NEOs). Orbits of the sampled members of meteorite-producing groups were distinguished and classified as those of asteroid type using the Tisserand parameter [3] $T_J > 3.1$. Dynamic links between members of the investigated meteorite-producing groups and respective parent NEOs were tested using orbital similarity criteria – namely, the D_{SH} and D_D criteria by Southworth & Hawkins [4] and Drummond [5], respectively. Based on the resulting orbital similarity, we deduced plausible relationship between discovered near-Earth asteroids, known meteorites and examined small meteoroids and meteorite-dropping fireballs. As a result, we have recognised several meteorite-dropping sporadic fireballs and small meteoroids, whose orbits are similar to orbits of known meteorites, as potential members of meteorite-producing groups and considered possible regions of their parent bodies.

1. http://www.astro.sk/~ne/IAUMDC/Ph2007/database.html
2. SonotaCodatabase. http://sonotaco.jp/doc/SNM/index.html
3. Kresak, L. 1979, in Asteroids, ed. T. Gehrels (Tucson: Univ. of Arizona Press), 289
4. Southworth R.B., Hawkins G.S. // Smiths. Contrib. Astrophys., 1963, V. 7, P. 261.
5. Drummond J.D. // Icarus, 1981, v. 45, p. 545-553.

CLARIFYING OF ORBITAL ELEMENTS OF LOW-ORBIT SPACECRAFT BY THE RI "MAO" DOPPLER STATION

Kaliuzhnyi M.*, *Bushuev F.*, *Kryuchkovskiy V.*, *Kulichenko M.*, *Shulga O.

Research Institute "Mykolaiv Astronomical Observatory", Mykolaiv, Ukraine

nikalyuzhny@ukr.net

The equipment and software of the Doppler station, created at the RI "MAO", have been improved in order to simultaneously automatically track several satellites, as well as to reduce the error in determining the frequency and time. The temperature stabilization of the receiver operation and the measurement of frequency and time by reference signals have been used to reduce the error. The reference signals are high-frequency harmonics of video pulses with a frequency of 100 kHz, fed to the antenna input of the station, and synchronized by GPS. The report presents data on the clarifying of the orbital elements obtained on the results of simultaneous tracking by the station of four satellites. The clarified satellite orbits have been compared with data of space-track.org.

UKRAINIAN-LATVIAN-ITALY SIMPLE VLBI NETWORK OF GEOSTATIONARY SATELLITES MONITORING

***Kaliuzhnyi M.*[1], *Bushuev F.*[1], *Shulga O.*[1], *Bezrukovs V.*[2], *Tuccari G.G.*[3], *Reznichenko O.*[4], *Bryukhovetsky A.*[5], *Malynovskyi Y.*[6]**

[1] *Research Institute "Mykolaiv Astronomical Observatory", Mykolaiv, Ukraine*

[2] *Ventspils University College, Ventspils, Latvia*

[3] *HAT-Lab srl, Catania, Italy*

[4] *Institute of Radio Astronomy of the NASU, Kharkiv, Ukraine*

[5] *Western Center of Radio Engineering Surveillance, Mukacheve, Ukraine*

[6] *Rivne Minor Academy of Science of School Age Yourh, Rivne, Ukraine*

nikalyuzhny@ukr.net

The network of simple VLBI was created on the initiative of the RI "MAO" and has been operating since 2015. This year, a station located in Pietramarina (Isl. Sicily, Italy) has

been included in the network. Thus, the network currently consists of 10 stations located in Mykolaiv (3 stations), Kharkiv, Mukacheve, Ventspils (2 stations), Rivne (2 stations), and Pietramarina. The equipment, software, and geographical location of the available number of the stations are allowed to track simultaneously three satellites located in the same geostationary cell. It is also appearing the possibility to track any commercial communications geostationary satellite due to the successful test of a station receiver that supports current DVB-S and DVB-S2 standards of satellite TV. The daily values of the orbital elements of tracked satellites, obtained using observations of the network, are placed on the RI "MAO" website.

A SPECIFIC OF MOVING OF BODIES FROM THE OUTER EDGE OF THE ASTEROID BELT TO NEAS AND CENTAURS

A. Kazantsev, L. Kazantseva
Astronomical observatory of Kyiv National Taras Shevchenko University

There were carried out numerical calculations of orbits evolution of asteroids at the 2:1 mean-motion commensurability with Jupiter (semi-major axes $a \approx 3.3$ AU) on intervals to 100,000 years. Transfers of the bodies both to the near-Earth asteroids (NEAs), and to the Centaurs, and even outside the Solar system were revealed.

Such transfers occur due to a significant increase of eccentricities of separate orbits which are involved in the mean-motion resonance with Jupiter. The conditions under which such increase takes place were analyzed. The range of changes of the orbit eccentricities depends mainly on the amplitude of oscillations of the libration argument - an angular value that characterizes the stay of the body in stable resonance zones.

The moving of bodies to NEAs occurs mainly without reduction of semi-major axes of the orbits. The moving of asteroids to the outer zones of the Solar system occurs after approaches to Jupiter. Such approaches become possible only after the bodies leave the stable zones in the resonance. And the exit from stable zones occurs after approaches with the planets of the terrestrial group.

Numerical calculations and their analysis show that the overwhelming majority of asteroids, which leaved the 2:1 gap, have went beyond the Jupiter orbit in one's time.

POSSIBLE OCCULTATION OF THE STAR TYC 1280-832-1 BY THE ASTEROID (486) CREMONA AS OBSERVED IN KYIV

Kleshchonok V.V.[1], Karbovsky V.L.[2], Buromsky N.I.[1], Lasko M.V.[2]
[1]*Astronomical Observatory of Taras Shevchenko National University of Kyiv*
[2]*Main Astronomical Observatory of NAS of Ukraine*

The occultation of the star TYC 1280-832-1 by the asteroid (486) Cremona was observed on December 5, 2019. During the observations, we used a complex for observation of occultation based on an Apogee Alta U47 CCD camera (1024x1024, 13μx 13μ pixel), which operates in drift scan mode with a transfer time of 0.2 s. The observations were carried out using the Mirage 7 small telescope with a diameter of D = 180 mm and a focal length of F = 1800 mm. The time was determined by the computer system timer in the course of observations, the correction to which was determined continuously using a GPS receiver with an accuracy of 20 ms. The occultation time is 21:39:57 UT with an error of 2 s with a maximum occultation duration of 1.6 s in accordance with the ephemeris. This interval includes a segment of the star's photometric curve, which shows a signal attenuation exceeding 2σ for a duration of about 1.4 s. Comparison star tracks show no decrease in brightness with similar parameters at this time. The middle of the stellar brightness decrease area corresponds to 21: 39: 56.5 UT. The mathematical model was developed that takes into account diffraction phenomena with the given dimensions of the asteroid and the angular dimensions of the star, the spectral sensitivity curve of the complex and the ephemeris data of the asteroid for the moment of occultation for testing the hypothesis that this may be a real occultation. The obtained model photometric curve was recalculated to the occultation curve for registration with the given parameters of the complex in terms of time resolution and the observed profile of the star. The description of this approach to the interpretation of observations of occultation is given. The comparison of the model used with the change in the brightness of the star showed the possibility of obtaining the observed curve with a tangential occultation. This occultation pattern does not contradict the ephemeris, since the observation point is beyond the 1σ limit of the occultation band error.

MOBILE COMPLEX FOR OBSERVATION OF STAR OCCULTATIONS

Kleshchonok V.V.[1], Karbovsky V.L.[2], Lasko M.V.[2], Buromsky N.I.[1]
[1]*Astronomical Observatory of Taras Shevchenko National University of Kyiv*
[2]*Main Astronomical Observatory of NAS of Ukraine*

Observations of star occultations by celestial bodies makes it possible to obtain valuable information about the bodies themselves, as well as about the stars that are occulted. Unfortunately, the eclipse band often passes in places where there are no stationary astronomical telescopes. The mobile complex for observing occultations was created in order to be able to observe such events. The description of the mobile complex, which is located in the car and can be quickly deployed to a remote observation point, is presented. The composition of the complex allows observations without the use of an electrical network. The mobile complex consists of a telescope (D = 153 mm, F = 1200 mm) with an automatic guidance system Sky-Watcher EQ-5; filter block with 3 BGR filters; Apogee Alta U47 CCD cameras (1024x1024, 13μ x 13μ pixel); control computer; GPS-receiver, power supply unit of electronic components of the complex. The complex records occultations in drift scan mode. Test observations were carried out with the mobile complex, which made it possible to determine its characteristics. The following system parameters were obtained: image scale - 2.2"/px, field of view - 37.5 arc minutes, star image size 2.3″-2.8″. Objects with a limiting magnitude of 16.8 mag were obtained for 100 seconds of exposure without a filter.