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Continuous Simultaneous Monitoring of the Asteroid Hazard Throughout the Celestial Sphere and the Earth's Climate by the Lunar Observatory

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Abstract

For the first time, a concept of an automatic system of two identical special optical robotic telescopes (SOTR-300VM), which will be installed along the lunar equator at longitudes of ±81° has been developed. Their distance of 162° from each other along the equator of the Moon for the first time ensures round-the-clock continuous observations of all astronomical objects throughout the celestial sphere. Successively replacing each other depending on the change of day and night the robots will perform the function of a single telescope of the Lunar Observatory (LO). SOTR-300VM telescopes will installed in the central zone of a special dustproof bowl to protect the mirrors from charged particles of lunar dust falling onto their surface. Additional insurance against possible impact of charged particles of lunar dust is provided by a continuous inversion of the polarity of the charge of electrically insulated shells of the mirrors, entrance pupil and dust-protecting bowl with a given frequency, protected by three Russian patents. The twin-telescope system of the LO operating as one telescope for the first time will ensure continuous observations of all astronomical objects throughout the celestial sphere. This system will realize continuous monitoring of near-Earth asteroids and comets (more than 10 m in diameter), including those approaching the Earth from the side of the Sun, as well as the Earth's energy imbalance (EEI) and climate simultaneous by telescopes located on the day and night sides respectively. Full coordinate-photometric monitoring and study of potentially dangerous asteroids and comets by the LO telescope system with an exposure of 60 seconds or more will be carried out continuously across the entire celestial sphere in less than 360 hours. A separate survey of the starry sky region around the Sun (at a distance of 15° and more from the direction of the Sun) will be carried out every 48 hours.

Keywords: Asteroid-comet hazard; System twin-telescopes; Dust-protecting mirrors; Dustproof bowl; Asteroid patrol; Lunar observatory; Earth's energy imbalance; climate

Introduction

Asteroids and comets approaching the Earth with a diameter more 10 m, which coming into near-Earth space from interplanetary distances, pose the greatest threat, and they appear unexpectedly [1-11]. The hazard from asteroids and comets as one of the most significant problems of the environment and outer space requires the most serious attention, assessment of the degree of real threat, analysis and determination of possible countermeasures. This requires the development of a program for their continuous search throughout the celestial sphere, detection and creation of a catalog of potentially dangerous natural space objects by a specialized astronomical observatory. However, today, the guaranteed detection of dangerous celestial bodies using ground-based telescopes encounters a number of serious difficulties. They are caused by the presence of a near-Earth atmosphere, and the limitation of observation only at night and the search only in a small part of the celestial sphere. In addition, observations of asteroids and comets, the line of sight of which passes near the Sun, are practically impossible from Earth. About half of such bodies as the Chelyabinsk events of February 15, 2013 one arrives from the daytime sky [7]. However, in this case, ground-based and even near-Earth optical detection equipment cannot work effectively due to strong illumination. Therefore, they are still the least studied celestial bodies that pose the greatest danger. They can only be detected in advance from space, and from a sufficient distance from the Earth. Overcoming such barriers and solving this most important scientific and practical problem of surveying the entire sky for long-term continuous coordinate-photometric monitoring and research of asteroid-comet hazards throughout the entire celestial sphere requires the creation of stationary space platforms precisely on the visible surface of the Moon [12-14]. Using the Moon as a platform for astronomical observations has advantages such as global-scale coverage, never-retired stationary and highly stable platform.

Therefore, to solve the complex of these most important scientific and applied problems, since 2010 at the Pulkovo Observatory we having actively developing the Lunar Observatory (LO) project. Automatic LO will be a system of two modernized absolutely identical compact special optical robotic telescopes with the primary mirror of the diameter 300 mm and with sliding visor (SOTR-300VM) in a special protective (from charged near-surface particles of lunar dust) bowl [15-18]. Twin telescopes will be placed along the equator on the opposite edges apparent surface of the Moon at the longitudes ± (81±0.1°) to provide continuous monitoring of all astronomical objects across the entire celestial sphere for 100% of the lunar day (Figure 1) [12]. The modernized alt-azimuthal mounting of SOTR-300VM telescopes makes it possible to observe astronomical objects over the entire celestial sphere. That is, any part of the celestial sphere is accessible for observations by this system of twin telescopes located at opposite edges of the equator at a distance of 162° from each other, protected by 4 patents of Russian [12,17,19-21]. The telescopes system on the lunar platforms that we develop working as a single telescope, replacing continuously each other depending on the change of day and night only in the daytime during 100% of the lunar day in the automatic mode will survey continuous the stellar field of the entire sky. LO is designed for simultaneous coordinate-photometric monitoring of the asteroids and comets approaching the Earth, including of asteroids those arriving from solar directions throughout the entire celestial sphere during the daytime continuously (summary observations at the installation locations of each telescope) for 100% of the lunar day, as well as the Earth's energy imbalance and climate during the nighttime continuously for more 94% of the lunar day [16,17].

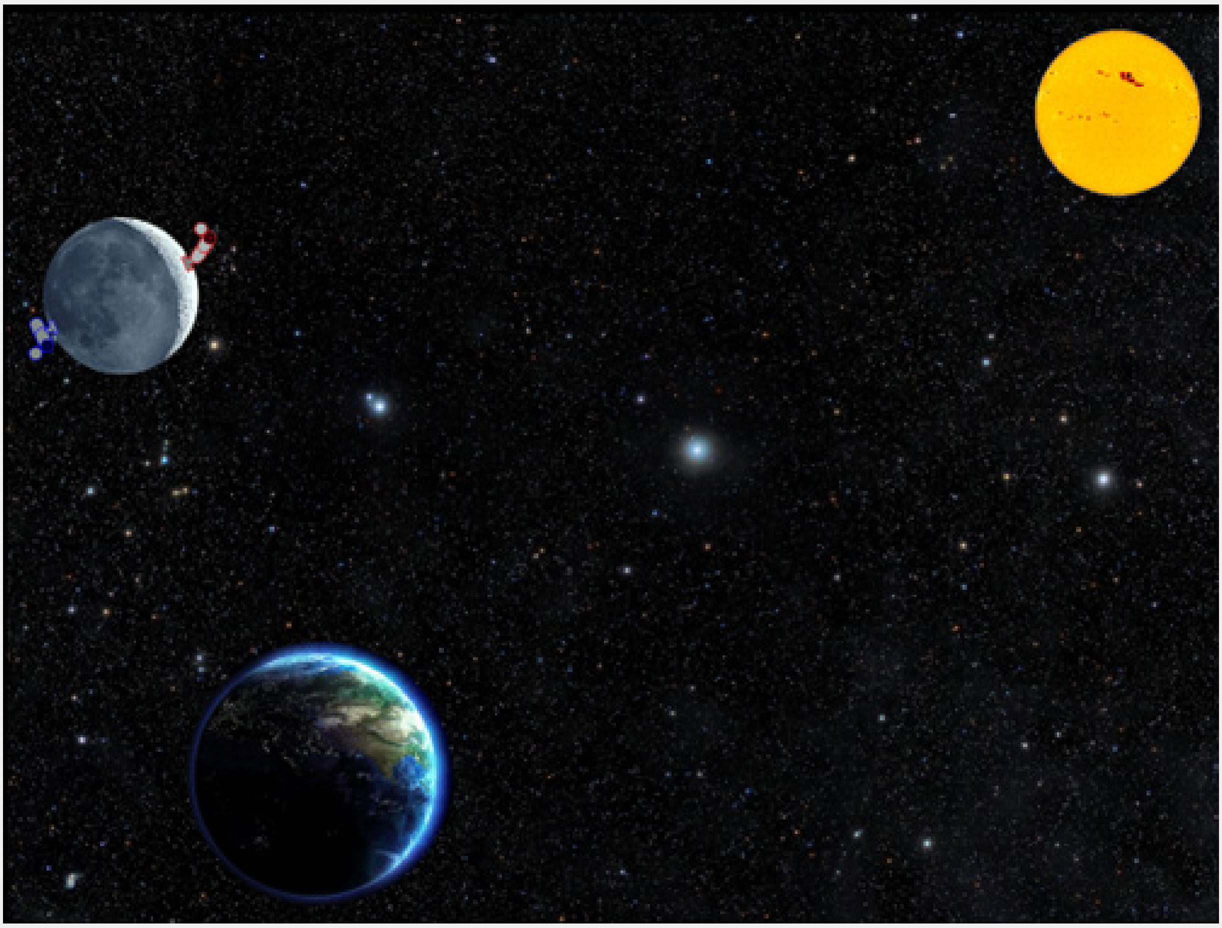

Figure 1: Simultaneous continuous operation of each SOTR-300VM telescope of the system with successively changing of observation objects depending on the change of lunar day and night at the installation site of each telescope: continuous simultaneous monitoring of near-Earth asteroids and comets (with a diameter greater than 10 m) throughout the entire celestial sphere as well as the EEI and climate, respectively, by telescopes located on the day and night sides.

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Continuous Monitoring of Near-Earth Asteroids and Comets Throughout the Celestial Sphere

Table 1: Main optical characteristics of the telescope SOTR-300VM.

Main Optical Characteristics of SOTR-300VM	Diameter, mm
1st concave mirror	287
2nd convex mirror	367
3rd concave mirror	173
Focal length	740.35
Radiation detector	~32x32
Working field of view	4.84 square degrees
Spatial resolution	diffractional

The main source of the *near Earth objects* (NEOs) is the Main Asteroid Belt (MAB), which supplies up to 94% of NEOs, and the source of the remaining NEOs is the Kuiper Belt [22]. Within the framework of the asteroid-comet hazard, it has been established that potentially may there are tens of millions of near-Earth objects approaching the Earth and penetrating into near-Earth space inside a sphere with a radius of 0.01 AU (1.5 million km) around the Earth. Although most of them are small. Only objects that are larger than 10 meters in size, although such bodies cannot cause a global catastrophe, they, nevertheless, can potentially pose a significant danger. An example is the Chelyabinsk events of February 15, 2013 [7]. According to estimates National preparedness strategy [23] less than one percent of these small (>10 m) bodies, which pose the greatest threat (due to a much higher frequency of potential impacts with Earth), have been discovered. According to data Zolotarev & Shustov [24] the average rate of entry of near-Earth asteroids larger than 10 m into near-Earth space is ~1 thousand per year. The lunar platforms that we develop working as a single telescope consistently, replacing each other, only in the daytime continuously during 100% of the lunar day in the automatic mode, according to the joint science program of observations of the stellar field [12,19]. The SOTR-300VM complex is shown in Figure 2, and in Figure 3 – view of the SOTR-300VM itself without the dustproof bowl from the entrance pupil, where (1) – is the reliable hermetic enclosure of a telescope tube, (2) – the concave mirror, (3) – the convex mirror, (4) – the concave mirror, (5) – the CMOS image sensor; (6) – the entrance pupil by the diameter D = 230 mm, (7) – the antiflash lens hood, (8) – the sliding visor, (9,10) – the mechanisms of the displacement of the sliding visor, (11) – the diffusing glass, (12) – the joint, (13) – dust-protecting bowl, (14) – basement of the mount, (15) – upper part of the mount, azimuth-rotating, (16) – means of azimuth rotation of the upper part of the mount, (17) – means of altitude rotation of the tube, (18) – support feet of the bowl, (19) – the lunar surface. Main optical characteristics of the telescope are reflected in quantitative in Table 1. The sealed telescope tube, thermally insulated from the rest of the complex, will have an external, thermally insulated, highly reflective sun shield to protect it from heating (solar radiation). Such sun shield of the telescope tube can continuously throw out the generated heat by several buses (tyres) into outer space, which will be located on the side of the telescope that is never illuminated by the Sun. These issues will be carefully studied further at the stage of developing the design of the telescope tube.

To protect the mirror of the telescope from the solar and Earth's radiations at the angular separation of 15° and more, the hood will be used. By shielding the entrance pupil from solar and terrestrial radiation with a hood the twin telescopes can also detect asteroids and comets approaching the Earth from the side of the Sun (at an angular separation exceeding 15°), thereby contributing very substantially into planetary defense. For continuous monitoring of asteroid-comet hazard, as well as novae and supernovae will be used a single CMOS image sensor of the GSENSE series with extreme low noise and optional backside illumination technology for quantum efficiency of up to 95% [25].

Matrix with size ~32×32 mm^2 (~8,192 × 8,192 pixels) with a cooling system approximately at level -40°C in the spectral range of 0.2-1.1 micron will be used. Replaceable filters will be used to conduct observations in three wide spectrum bands in the range of 0.2-1.1 micron. It is also planned to combine measurements in the entire range into a single set of observations. The cooling system of the CMOS image sensor, installed in an individual housing, will located in the focal plane of the optical system of the lunar telescope. The housing with a cooling system will maintain the CMOS image sensor at the specified operating temperature. Due to the rapid development of new radiation receivers, it is to select a working CMOS image sensor now prematurely. It will be selected during the development of the overall design of SOTR-300VM no earlier than 2030.

Monitoring throughout the celestial sphere is carried out over the broad working field of view 4.84 square degrees with a resolution of ~1″/pixel. The very slow axial rotation of the Moon will allow significantly increase length the time of exposure what will make it possible significantly increase the number of used fainter stars and asteroids and comets. The continuous survey of stellar field of the entire sky will also make it possible for the first-time to simultaneously continuously search supernovae and novae. The telescopes, replacing each other, will provide a complete survey of the stellar field with an exposure of 60 s and more for less than 360 hours. A survey of the sky area around the Sun at an angular distance of 15° and more will be carried out periodically every 48 hours. Large volumes of scientific and service data (order 100 gigabits per day) obtained from the telescopes, after primary processing, will be transmitted operatively in during breaks between observations directly to the Earth via stable communication channels of each telescope since the Earth is always in their field of view. New technologies in the second half of the 2030s will allow transmitting this data to Earth at a very high speed – more than a thousand megabits (Mb) per second.

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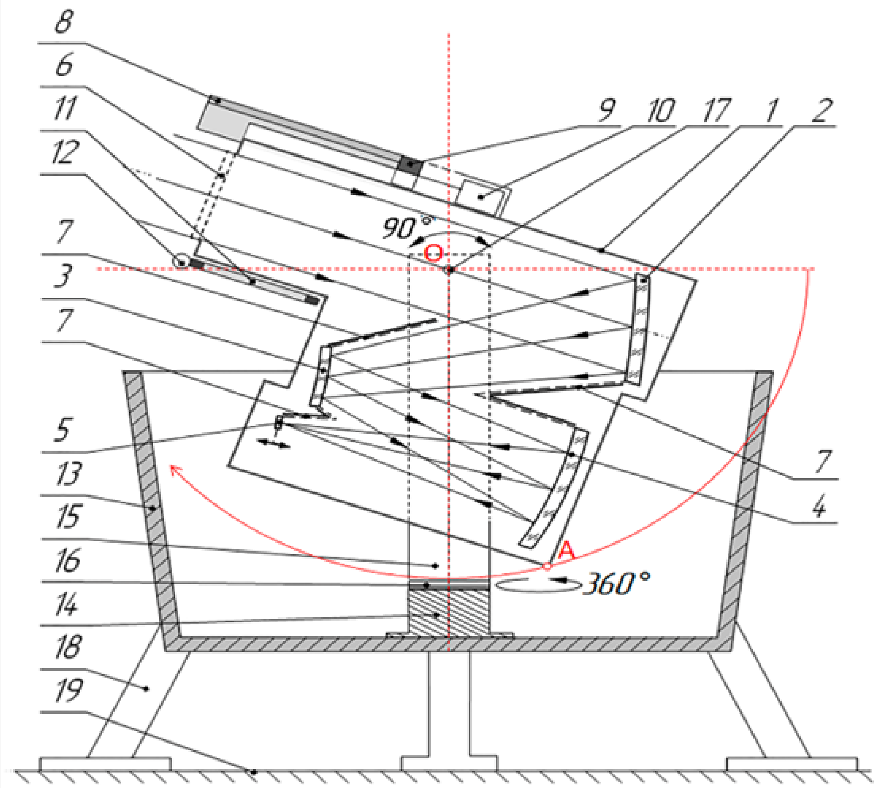

Figure 2: Optical design and the general view of SOTR-300VM in the dust-protecting bowl in the longitudinal section (the telescope sun lens hood and sun shield of the telescope tube are not specified).

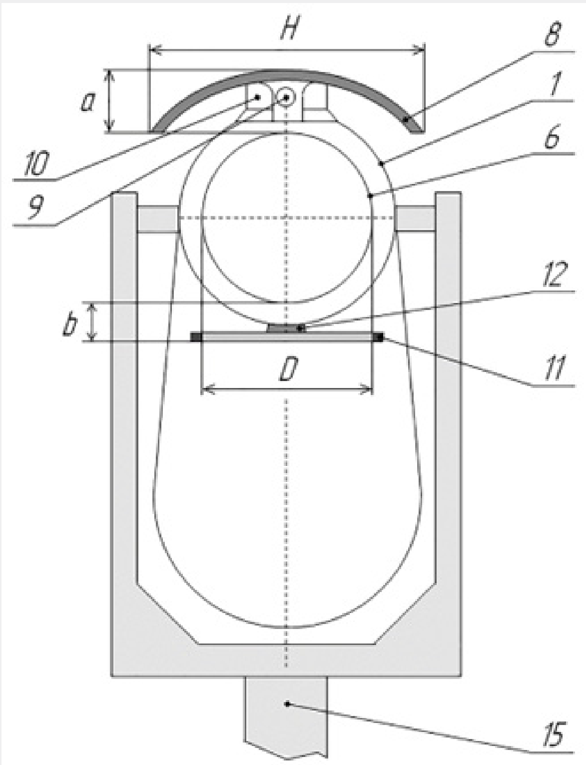

Figure 3: View of the SOTR-300VM from the entrance pupil with a diameter of D = 230 mm.

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Approximate estimate of the maximum stellar magnitude of asteroids as observed by the SOTR-300VM telescope from the surface of the Moon. Obviously, the stellar magnitude of an asteroid is greatest when its phase angle is zero, when the Moon is between the Earth and the Sun, and the asteroid approaches from the side opposite the Sun, when by analogy with a "full Moon" can be called a "full asteroid". However, in most cases there is the configuration with a phase angle of the asteroid of about 90°, when the Moon is near a square with the Sun (the view from the Moon to the Earth and the asteroid as if "from the side"). An estimate of the change in the stellar magnitude of an asteroid with a phase angle can be performed using the "H, G" formalism accepted in asteroid science [26]. In this case, we assume the most frequently used value of the phase dependence slope parameter G = 0.15. Then the correction to the stellar magnitude of the asteroid will be 3.2^m. The expected values of the stellar magnitude of asteroids with changes in their diameter and albedo, taking this correction into account, are given in table 2.

When the distance R from the telescope to the asteroid changes, the value will be added to these values $5\lg\frac{R}{384399\text{ km}}$.

Approximate estimates of the penetrating power of a lunar telescope with an aperture of 300 mm for different exposure times provides in the Table 3. The calculations are made under the following assumptions. The signal-to-noise ratio required to detect an asteroid image in a frame must be at least 2. The parameters of the CMOS image sensor receiver of SOTR-300VM will significantly better to those CCD used in ground-based observations [27,28]. The background level is assumed to be 21^m per square arcsec.

At the same time, using the ZA-320M telescope with an aperture of 320 mm at the Pulkovo Observatory, successful observations of 18th magnitude asteroids were conducted under ground conditions (with an exposure of 180-300 sec and SBIG ST-6 and FLI IMG-1001E CCD matrices) [27]. Experiments conducted using the Crimean Sintez telescope showed that in good atmospheric conditions, a penetration of $19\text{-}20^m$ was achieved on a single frame with an exposure of 2 min [28]. In this case, an increase in the penetrating power by 1^m was achieved with an increase in the number of frames by 6.3 times, i.e., with an equivalent increase in the shutter speed by 6 times [28]. Ground-based experimental data [27,28] allow us to conclude that SOTR-300VM can achieve a penetration of $19\text{-}20^m$ in the lunar space conditions with an exposure time increase up to 6 minutes. From Table 2 & 3 it is evident that the SOTR-300VM telescope with increased exposure is capable of detecting asteroids larger than 10 meters when they have a high albedo and relatively low angular velocity. In most cases, we should expect to detect objects several times larger. However, the very slow axial rotation of the Moon will allow increase the exposure time up to 6 minutes, which can ensure the detection of asteroids with a relatively slow angular velocity and a size of up to 10-20 m in the integral range of 0.2-1.1 micron. Only discovered asteroids will be further studied in three broad spectral bands in the range of 0.2-1.1 micron with greater exposure. Thereby, the system of SOTR-300VM will be able to detect bodies with the diameter above 10 m and will become a professional "Asteroid Patrol" [18]. There are no other ways or alternative "non-lunar" methods or ways for long-term (in the future of constant) continuous high precision coordinate-photometric monitoring throughout the celestial sphere for study of these most important problem. At the same time, during the lunar night, these same twin telescopes simultaneously also solve the second important problem monitoring of the Earth's energy imbalance and climate: measurements of energy flows emanating from the Earth in the ranges of 0.2-4, 4-50 and 8-13 micron continuously for more than 94% of the lunar day with an error of ≈0.1% [14,16,17]. Break less than 6% in the observations of the night and near-night carries of the Earth energy will not affect the high accuracy of the round-the-clock measurements.

Table 2: Estimates of the stellar magnitude of asteroids at a phase angle of φ = 90° at a distance of 384,399 km, carried out using the formulas of [26].

Diameter (m) Albedo	10	20	50	100
0.05	19.5^m	18.0^m	16.0^m	14.5^m
0.12	18.1	16.6	14.6	13.1
0.5	16.6	15.1	13.1	11.6

Table 3: Approximate estimates of the maximum detectable stellar magnitude in observations by a space telescope with an aperture of 300 mm for different exposure times.

t (sec)	60	120	300	600
m	18.5	19	19.5	20

Major Problems to be Solved by the Lunar Observatory

The SOTR-300VM LO system, as a single telescope, sequentially, continuously replacing each other, will solve a complex of the most important scientific and applied problems:

a) For the first time, the system's telescopes will consistently implement coordinate-photometric monitoring of asteroid-comet hazards throughout the entire celestial sphere in the lunar daytime over the entire spectral range 0.2-1.1 micron and in its three individual broad bands continuously for 100% of the lunar day [17,18];

b) Implementation of early warning of an impending threat;

c) More accurate determination of the orbits of asteroids and comets approaching into the Earth;

d) For the first time will creation of a professional survey system "Asteroid Patrol" for early detection of near-Earth asteroids and comets;

e) Determination of possible countermeasures to counter this threat;

f) For the first time, continuous monitoring and study of nascent supernovae and novae across the entire celestial sphere;

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g) Monitoring of the energy fluxes emanating from the Earth within the ranges of 0.2-4, 4-50 and 8-13 microns, as well as the Earth's climate, will be carried out for the first time continuously during more than 94% of the lunar day with an error of ≈0.1% during in the lunar night [16,17];

h) For the first time, will a study of the meridional heat transfer, which have been based on monitoring the latitudinal distribution of the flow of radiative energy and the dynamics of its ratio between low and high latitudes;

i) For the first time, creation of a missing, extremely necessary, and most important long-term fundamental base of high-precision data on EEI and its components [13,14,16];

j) For the first time, will establishment of reliable physical mechanisms for the formation, causes and patterns of climate change, the direction and depth of its changes [13,14,16].

Configuration of the Special Robotic Optical Telescope SOTR-300VM

The automatic SOTR-300VM telescopes do not require the creation of a lunar base and the participation of cosmonauts during their installation on the lunar surface, its adjustment and maintenance in the future, i.e., maintenances and modernization of the telescopes is not provided. The service life and resource of the telescopes is calculated for approximately 15 years, more than the 11-year cycle of the Sun. However, given the exceptional importance of ensuring the continuity of research on the most important scientific and applied problems being solved, the telescopes can be replaced approximately every 15 years with more modernized systems with expanded additional scientific tasks. The SOTR-300VM with lightweight mirrors in the dust-protecting bowl, without the solar panels, batteries and soft-landing engines will have mass of one set less than 100kg, and the dimensions – less than 1500×1500×1500 mm (Figure 4). Main optical characteristics of the telescope are reflected in quantitative in Table 1. The sealed telescope tube, thermally insulated from the rest of the complex, will have an external, thermally insulated, highly reflective sun shield to protect it from heating (solar radiation).

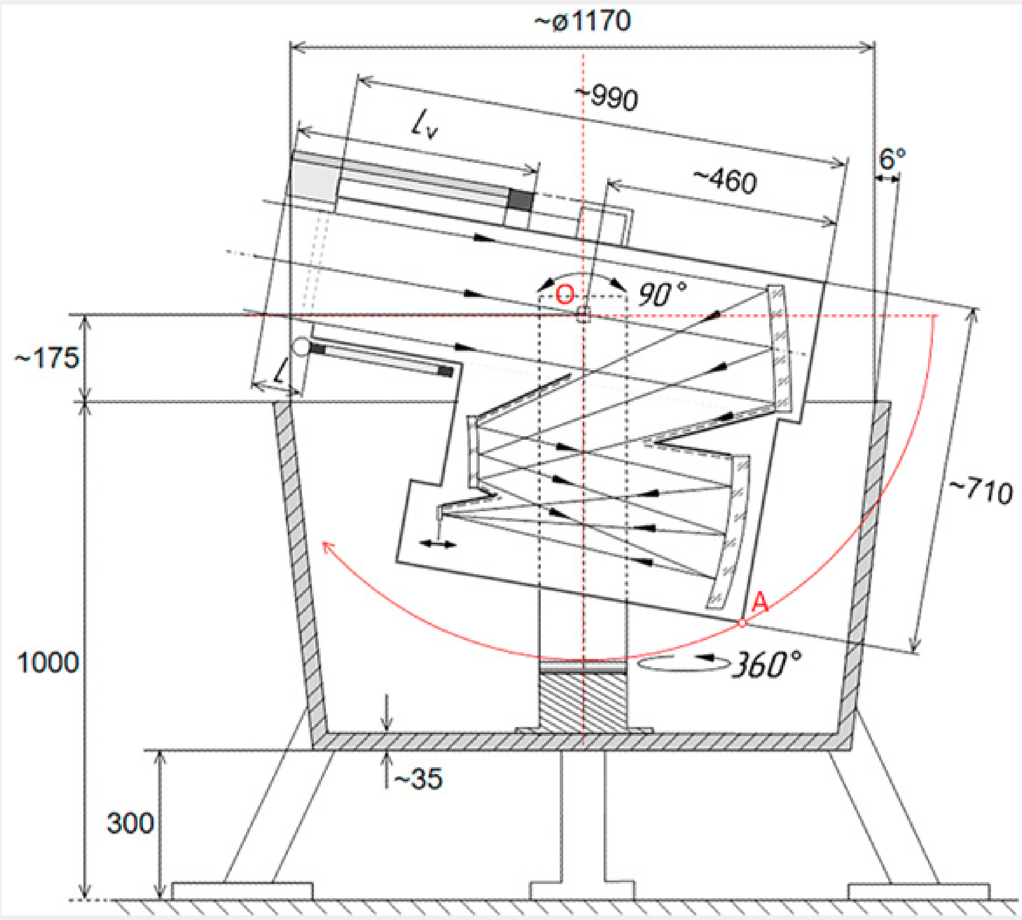

Figure 4: Longitudinal section of SOTR-300VM in a dustproof bowl and its overall dimensions (the telescope sun lens hood and sun shield of the telescope tube are not specified).

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Such sun shield of the telescope tube can continuously throw out the generated heat by several buses (tyres) into outer space, which will be located on the side of the telescope that is never illuminated by the Sun. A stable supply of electric power to the telescopes in daytime conditions on the Moon is provided by the corresponding solar panels, which also charge the telescope batteries. According to preliminary data, power consumption of order 200 W is sufficient for stable operation of the telescope, will created in the 2030s, in lunar conditions additionally using only sensor cooling to maintain a stable temperature to minimize thermal noise [16,17]. The specialized dustproof bowl of SOTR-300VM will simultaneously serve as a landing module to install the telescope on a required area of the lunar surface. In this case will take into account the successful experience of mounting similar Chinese Lunar Ultraviolet Telescope (LUT) with an aperture of 150 mm in 2013 [29] and also a robotic Blue Ghost Mission 1 by USA Firefly Aerospace on the Moon's surface in March 2, 2025 [30]. The view of developing SOTR-300VM telescope on the Moon's surface is shown in Figure 5.

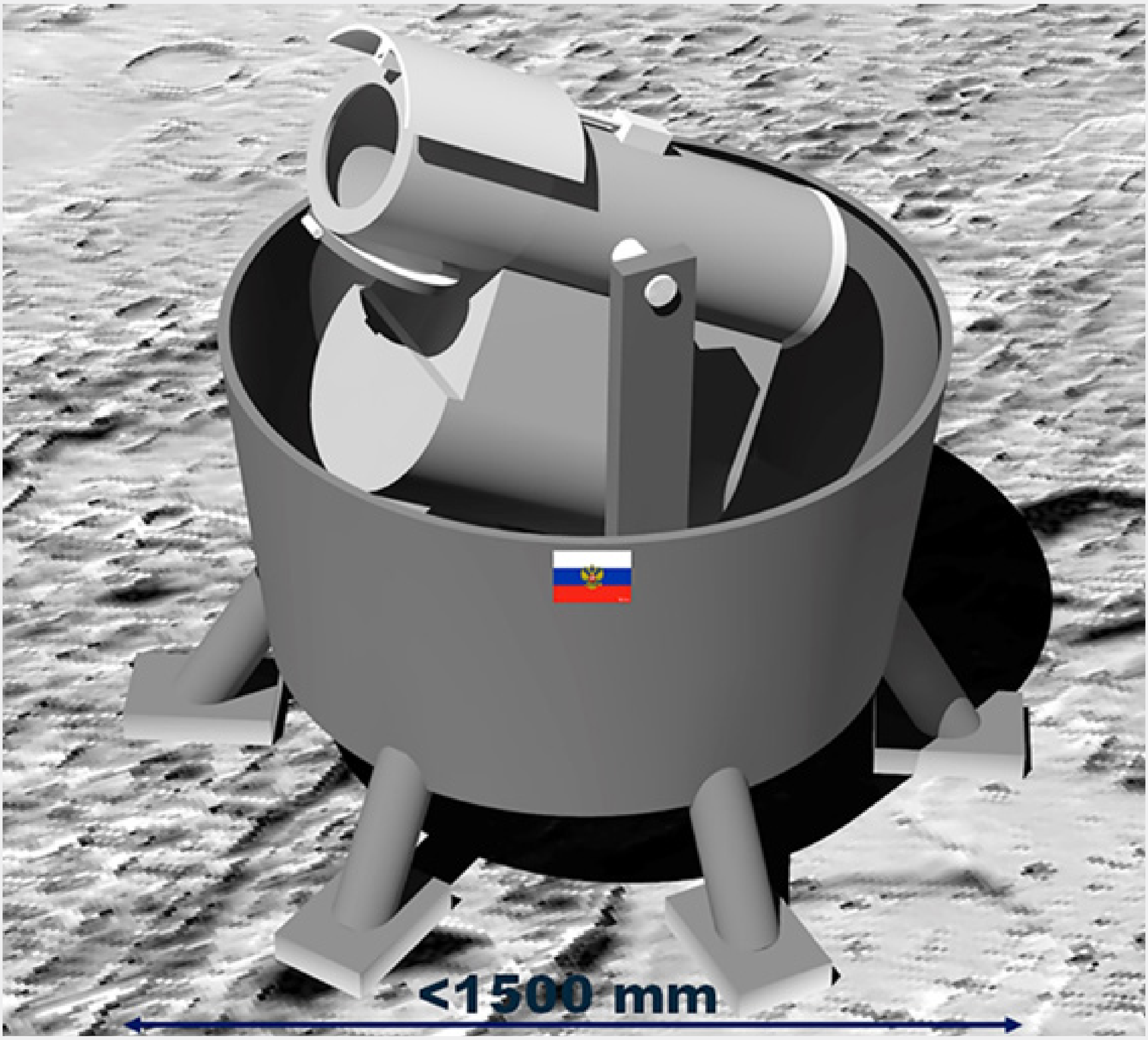

Figure 5: General view of the SOTR-300VM complex on the Moon surface (solar panels, soft landing thrusters, and sun lens hood not listed).

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Protecting Telescope Mirrors from Charged Particles of Lunar Dust

Installing the SOTR-300VM telescope in a special bowl, which has the shape of an inverted truncated cone, will protect its mirrors from charged particles of lunar dust falling on their surface [17,20,21] (Figure 2 & 4). Its upper level having a diameter of 1,170 mm is located at the height exceeding 1,000 mm above the surface. The support struts of the dustproof bowl, designed taking into account the total mass of the kit and the possible overweight when landing the SOTR-300VM complex on the lunar surface, have a height of about 300 mm. However, it should be borne in mind that the surface layer of the Moon is covered with charged dust particles, since on the sunlit side of the Moon, mainly the ultraviolet part of the solar radiation spectrum and solar wind flows interact with the upper layer of regolith, charging its surface. The electric field generated in this layer and the fluctuations in the charge of particles on the surface create conditions in which the electrical forces can exceed the force of gravity and the Van der Waals force of adhesion. As a result, micron- and submicron-sized regolith particles can break away from the surface and levitate above it [21,31]. Data obtained from the Surveyor spacecraft indicate that micron-sized dust particles can hang at a height of about 100-300 mm from the lunar surface [32,33]. At the same time, there is currently new direct experimental data on the absence of the influence of near-surface charged lunar dust particles on the optical elements of the telescope during its 18-month operation on the lunar surface during the daytime at an altitude significantly greater than 300 mm [29].

The active operation of the unprotected from lunar dust Chinese Lunar-based Ultraviolet Telescope (LUT), launched on December 2, 2013, during the daytime on the lunar surface shows a fairly high stability of its photometric characteristics and the absence of any change in their readings during the 18-month lunar experiment, i.e., the absence of any adhesion of lunar dust to the telescope mirrors [29]. The preservation of highly stable photometric characteristics of the LUT during its 18-month successful operation directly on the lunar surface during the daytime allows us to state that its mirrors were not damaged due to the location of the LUT mirrors above the surface at a height of more than 700 mm, i.e., charged micron and submicron near-surface lunar dust particles will not be able to rise above the surface to such a height. The absence of any dust particles deposited on the telescope mirrors and the maintenance of high photometric efficiency of the reflectivity of the LUT mirrors during 1.5 years of active operation during the lunar daytime indicate the practical absence of any dust particles at the altitude of the LUT installation (significantly more than 300 mm) above the lunar surface and confirm the conclusions of Norton et al. [32], Popel' [33] and Zakharov et al. [31]. That's why the entrance pupil of SOTR-300VM will be located at a height of more than 1,000 mm above the lunar surface, which will safe it mirrors from charged near-surface lunar dust particles. Nonetheless, the LO twin telescope additionally provides a safety system for insurance protecting their mirrors from possible penetration charged micron and submicron near-surface lunar dust particles. Therefore, the outer surfaces of the dust-protecting bowl and entrance pupil, as well as the mirrors surface of the telescope, will be covered with electrically insulated conductive shells connected to the power supply unit located in this bowl. The power unit displays an electric charge with a given polarity inversion frequency, which repels and throws off particles of micron and submicron lunar dust from the mirrors in the conditions of low gravity and vacuum of the Moon [17,19,20,21]. The given frequency of polarity inversion of the electric charge of the electrically insulated conductive shells of the outer surfaces of the dustproof bowl and entrance pupil, as well as the surface of the mirrors, will provide protection of the telescope mirrors from particles of charged lunar dust. Self-cleaning of glass from charged lunar dust particles using an analogy electrostatic method is also used in NASA's Firefly Blue Ghost Mission 1, launched on January 15, 2025 and landed on March 2, 2025, with a system to repel and remove charged lunar dust using electricity by through of Electrodynamic Dust Shield [30].

Conclusion

a) The twin-telescope system of the Lunar Observatory as a single telescope consistently replacing each other depending on the change of lunar day and night at the installation site of each telescope will for the first time will provide: simultaneous continuous observations all astronomical objects throughout the celestial sphere by a telescope located on the day side of the Moon and observe the Earth by a telescope located on the night side of the Moon;

b) SOTR-300VM telescopes will installed at a height of more than 1,000 mm above the surface in the central zone of a special dustproof bowl to protect the mirrors from charged particles of lunar dust falling onto their surface. Additional insurance against possible impact of charged particles of lunar dust is provided by a continuous inversion of the polarity of the charge of electrically insulated shells of the mirrors, entrance pupil and dust-protecting bowl with a given frequency, protected by three Russian patents [19-21];

c) As a single telescope the system of twin telescopes at daytime at the installation site of each telescope will be for the first time continuously carrying out coordinate-photometric monitoring and study of potentially dangerous near-Earth asteroids and comets, and also supernovae and novae throughout the celestial sphere during 100% of the lunar day within the spectral range of 0.2-1.1 micron;

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d) The SOTR-300VM telescopes of the Lunar Observatory will be able for the first time to detect bodies with a diameter of more than 10 m across the entire celestial sphere with a relatively low angular velocity while increasing their exposure time to several minutes;

e) Simultaneously at lunar nighttime – the telescopes system as a single telescope for the first time a consistently will observe the Earth within the spectral ranges of 0.2-4, 4-50 and 8-13 micron continuously during more than 94% of the lunar day;

f) These received long-term climatically data after calibrate the dependence of the value of the annual average EEI on corresponding cyclical TSI variations since 1978 will make it possible for the first time will establishment of reliable physical mechanisms for the formation, causes and patterns of climate change, the direction and depth of its changes [34,35];

g) A study of the most important climate-forming physical process and meridional heat transfer for the first time will have based on monitoring the latitudinal distribution of the flow of radiative energy and the dynamics of its ratio between low and high latitudes;

h) For the first time will be created of a missing, extremely necessary, and most important fundamental base of high-precision data on EEI and its components.

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References

1. Wheeler L, Dotson J, Aftosmis M, Coates A, Chomette G, et al. (2024) Risk assessment for asteroid impact threat scenarios. Acta Astronautica 216: 468-487.
2. Trigo-Rodríguez JM (2022) Asteroid impact risk: impact hazard from asteroids and comets. ISBN: 978-3-030-95124-5. Impact Studies Series, Springer.
3. Rumpf CM, Lewis HG, Atkinsonr PM (2017) Asteroid impact effects and their immediate hazards for human populations. Geophysical Research Letters 44(8): 3433-3440.
4. Shustov BM, Rykhlova LV (Eds.), (2010) 'Asteroidno-kometnaya opasnost' (Asteroid-comet hazard) (Moscow: Fizmatlit, 2010).
5. Shustov BM (2011) Asteroid and comet hazards: the role of physical sciences in solving the problem. Physics-Uspekhi 54(10): 1068-1071.
6. Shustov BM (2019) The role of science in the study and prevention of space hazards. Herald of the Russian Academy of Sciences 89(4): 311-324.
7. Popova OP, Jenniskens P, Emelyanenko V, Kartashova A, Biryukov E, et al. (2013) Chelyabinsk airburst, damage assessment, meteorite recovery, and characterization. Science 342(6162): 1069-1073.
8. Khazins VM, Shuvalov VV, Svettsov VV (2018) The seismic efficiency of space body impacts. Sol Syst Res 52(6): 547-556.
9. Svetsov V, Shuvalov V (2019) Thermal radiation from impact plumes. Meteoritics and Planetary Science 54(1): 126-141.
10. Svetsov V, Shuvalov V (2019) Tunguska catastrophe of 30 June 1908. In: Adushkin V, Nemtchinov I (Eds.), Catastrophic events caused by cosmic objects. N.Y.: Springer Verlag, pp. 227-267.
11. Chapman CR (2004) The hazard of near-Earth asteroid impacts on earth. Earth and Planetary Science Letters 222(1): 1-15.
12. Abdussamatov HI (2016) A method for studying changes in the Earth's climate and a system for its implementation. Patent of Russia no. 2591263.
13. Abdussamatov HI (2016) Lunnaya Observatoriya dlya issledovanii otkloneniya energeticheskogo balansa Zemli ot ravnovesnogo sostoyaniya i prichin klimaticheskikh izmenenii (Lunar Observatory to study the deviation of the Earth's energy balance from the equilibrium state and the causes of climatic changes). Issled Zemli iz Kosmosa, No. 5, pp. 79-88 (in Russian).
14. Abdussamatov HI (2018) Comparative analysis of errors in monitoring the Earth's global energy budget by the Lunar Observatory and orbiters. Izv Atmos Ocean Phys 54: 1341-1352.
15. Abdussamatov HI (2022) Lunar Observatory for monitoring the radiation balance of the Earth and climate. IOP Conf Ser: Earth Environ Sci 1040: 012001.
16. Abdussamatov HI (2022) A study of climate from the lunar surface and the energy imbalance between the Earth and space. Geomagn Aeron 62(7): 952-959.
17. Abdussamatov HI (2024) Moon-based monitoring of the Earth's energy imbalance and climate, near-Earth asteroids and comets, potentially habitable exoplanets, supernovae and novae. J Indian Society of Remote Sensing 52(11): 2593-2608.
18. Abdussamatov HI (2024) Moon-based continuous coordinate-photometric monitoring of the asteroid-comet hazard throughout the celestial sphere, The fifteenth Moscow solar system symposium 15M-S3, October 21-25, 2024. Symposium Program and Abstract Book, 2024, pp. 169-172.
19. Abdussamatov HI (2015) Optical telescope, patent of Russia no 155044.
20. Abdussamatov HI (2016) Device for protecting an optical telescope from charged lunar dust, patent of Russia no 164303.
21. Abdussamatov HI (2017) Optical telescope, patent of Russia no 2613048.
22. Morbidelli A, Bottke WF Jr, Froeschlé Ch, Michel P (2002) Origin and Evolution of Near-Earth Objects, Asteroids III. In: Bottke WF Jr, Cellino A, Paolicchi P, Binzel RP (Eds.), University of Arizona Press, Tucson, 2002, pp. 409-422
23. National preparedness strategy and action plan for near-Earth objects hazards and planetary defense. A product of the planetary defense interagency working group of the national science and technology council, April (2023).
24. Zolotarev RV, Shustov BM (2024) On the distribution of NEOs approaches to Earth, Proceedings of the 22nd International Conference. Modern Problems of Remote Sensing of the Earth from Space, Moscow, IKI RAS, 2024, p. 470.
25. CMOS image sensor (2024).

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26. Lagerkvist CI, Williams IP (1987) Physical studies of asteroids. XV. Determination of slope parameters and absolute magnitudes of 51 asteroids. Astron Astrophys Suppl Ser 68: 295-315.

27. Devyatkin AV, Gorshanov DL, Yershov VN, Melnikov AV, Martyusheva, et al. (2016) A study of the asteroid (367943) Duende at Pulkovo Observatory. Monthly Notices of the Royal Astronomical Society 459(4): 3986-3997.

28. Nazarov SV (2024) Searching for asteroids with a "Sintez" telescope in Crimean astrophysical observatory. Physics of Space. Proceedings of the 51st All-Russian with International Participation Student Scientific Conference. Yekaterinburg, pp. 279-282.

29. Wang J, Meng XM, Han XH, Cai HB, Cao L, et al. (2015) 18-months operation of lunar-based ultraviolet telescope: A highly stable photometric performance. Astrophys & Space Sci 360: 1-5.

30. Blue Ghost Mission 1 – Firefly Aerospace (2025); Blue Ghost Mission 1 to Deliver NASA Electric Moon Dust Shield | AIAA

31. Zakharov AV, Zelenyi LM, Popel SI (2020) Lunar dust: properties and potential hazards. Sol Syst Res 54(6): 455-476.

32. Norton RH, Guinn JE, Livingston WC, Newkirk GA, Zirin H (1967) Surveyor 1 observations of the solar corona. J Geophys Res 72(2): 815-817.

33. Popel' SI (2018) Moon dust, Chemistry and Life 5: 5-9.

34. Abdussamatov HI (2025) The increase in the water vapor concentration in the course of warming leads to the decline climate sensitivity to a growth in the abundance of carbon dioxide. Int J Environ Sci Nat Res 34(4): 1-11.

35. Abdussamatov HI (2024) Most of the long-term solar radiation forcing on the climate is due to the strong feedback mechanisms. Journal of Environmental & Earth Sciences 6(3): 1-24.

DOI: 10.19080/IJESNR.2025.35.556411

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