The Terskol Observatory in the Northern Caucasus

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Abstract. The telescopes and facilities of the Terskol Observatory, situated 3100 m above the sea level in the Northern Caucasus, are presented briefly. The main instrument is a 2-m RCC telescope, equipped with a UBVRI CCD-based photometric complex, spectrograph and Echelle spectrometer. Two small telescopes are in use, too: a 60-cm photometric telescope and a 65-cm solar telescope. A gallery with 28 color pictures is presented on the site of the journal as an appendix to this paper.
Key words: Observatories, Terskol Observatory

Обсерваторията Терскол в Северен Кавказ

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Представени са кратко телескопите и апаратурите на обсерваторията Терскол, разположена на 3100 м надморска височина. Главният инструмент е 2-м RCC телескоп, съоражен с UBVRI CCD фотометричен комплекс, спектрограф и ешеле спектрометър. Използват се и два малки телескопа - 60-см фотометричен телескоп и 65-см слънчев телескоп. На сайта на журнала е представена галерия от 28 цветни кадъра като апендикс към тази статия.

Fig. 1. A general view of the Terskol Observatory

Introduction

The Terskol Astrophysical Observatory is situated in the Northern Caucasus at an altitude of 3100 m above the sea level, near the Elbrus Mountain (Fig. 1,2,3). Initially the

Fig. 2. The Baksan river, Terskol village (2000 m), the Terskol Observatory (3100 m) and the Elbrus Mountain (5643 m)

Terskol Observatory was equipped in 1970-1991 by the Main Astronomical Observatory of the National Academy of Sciences of Ukraine (MAO NASU) as a high-altitude observing station. Since 1992 this first part of the Observatory has also played the role of a base of the International Center for Astronomical, Medical and Ecological Research of the National Academy of Sciences of Ukraine (ICAMER).

The second part of the observatory, the Terskol Branch of the Institute of Astronomy of the Russian Academy of Sciences (TB INASAN), was created in 2005. After the dissolution of the Soviet Union the organization ICAMER remained a unique scientific center in the Elbrus region. The scientific investigations at the Terskol Observatory successfully go on at the present time due to the existence of ICAMER and TB INASAN.

Fig. 3. A view from the 2-m telescope dome to the old hotel and to the small telescopes

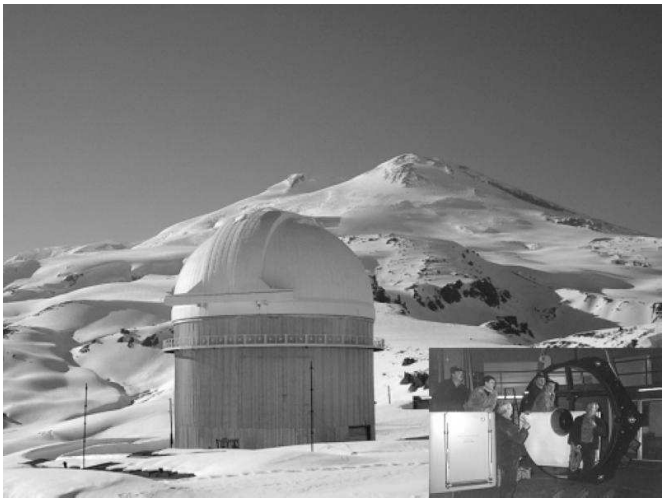

Fig. 4. The dome with a 20 m diameter and the 2-m mirror of the RCC telescope

The four strategic partners of the Terskol Observatory in the field of ground-base astronomy are the Special Astrophysical Observatory (SAO) of the RAS (Zelenchukskaja), MAO NASU (Kyiv), IA RAS (Moscow) and the Centre for Astronomy at the Nicholas Copernicus University (Torun, Poland).

1 Telescopes and facilities

The main instrument of the Terskol Observatory is a 2-m Ritchey-Chretien-Coude (RCC) telescope (Zeiss-2000). It was introduced into operation in 1995 (Fig. 4,5). The focal length of the main hyperbolic mirror is 5.6 m. The equivalent focal lengths of the Richey-Chretien and Coude systems are 16 m and 72 m, respectively. The corresponding fiields of view are 1.18 arcdeg and 5 arcmin.

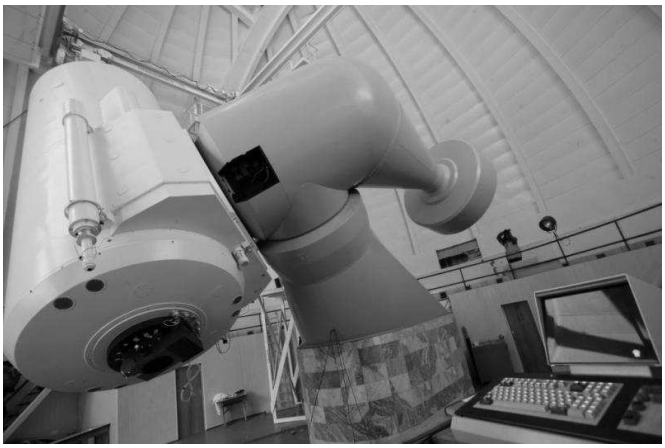

Fig. 5. A general view of the 2-m telescope

The instrumentation of the Terskol Station consists also of a 60-cm Cassegrain telescope (Zeiss-600, Fig. 6) and a 65-cm solar telescope Atsu-26. The focal length of the 60-cm telescope is 7.5 m. Depending on the CCD camera the field of view is 9 x 8 or 4 x 3 arcmin. This telescope is used for astrometric observations with timing not less than 1 ms and for photometric observations with B, V, G or R filters. The observing programs of the 60-cm telescope embraces mainly investigations of asteroides and variable stars.

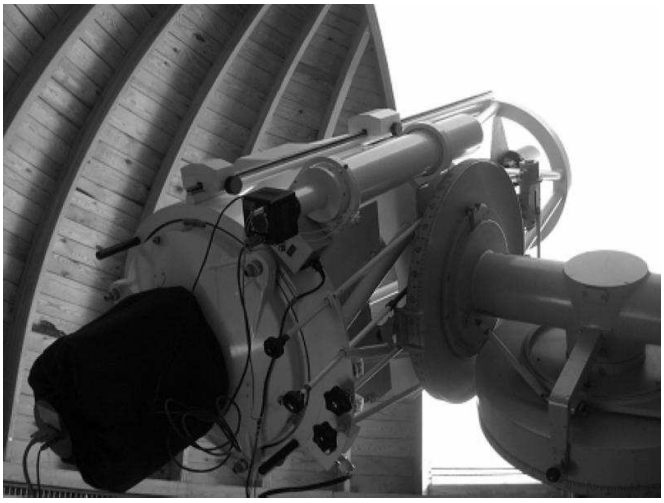

Fig. 6. A general view of the 60-cm telescope

The 2-m telescope is equipped with an Echelle Spectrometer. This instrument is created as a joint project of the four strategic partners of the Terskol Observatory. It is located in an isolated and temperature stable Coude-room. The spectral resolutions achieved by means of three Schmidt cameras with focal lengths of 450 mm, 875 mm and 1960 mm are 45000, 120000, 210000 and 500000, respectively. The Spectrometer was designed for achieving maximal resolution up to Rz=500000, as well as for low-resolution observations of faint objects. These possibilities are based on two key components. First, mosaic of 2 or 3 gratings is used. Second, the echelle mosaic of gratings is used at a small blase angle. The Echelle Spectrometer gives an opportunity to perform investigations of extrasolar planets, studies of diffuse interstellar bands, etc. The limiting magnitude of the Spectrometer is about 10.5 mag.

The photometric complex of the 2-m telescope includes a two-channel high-speed photometer with cooled photo-multipliers, UBVRI filters and a CCD guiding system (Fig. 7). This complex has a precise timing and synchronization system based on the GPS smart antenna Acutime-2000. The accuracy of the timing and synchronization is less than $1\mu s$. This high-speed photometer is a part of the Synchronous Network of Telescopes (SNT) based on agreements between MAO NASU, the Crimean Astrophysical Observatory, the Institute of Astronomy of the Bulgarian Academy of Sciences and the Aristoteleion University of Thessaloniki.

The two-channel focal reducer of the former Max Planck Institut fur Aeronomie in Lindau (now Max Planck Institute for Solar System Research) was brought to the Terskol Observatory in the period 1996 - 2005. The scientific collaborations involved photometry and astrometry of inner satellites of Jupiter and Saturn, imaging of Io torus with tunable Fabry-Perot interferometer, photometry and polarimetry of asteroids, imaging photometry and polarimetry of cometary dust, and imaging photometry of

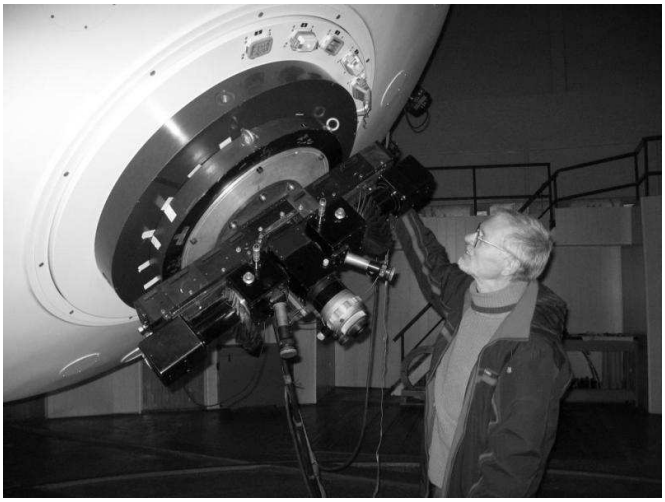

Fig. 7. The high speed two-channel UBVRI photometer with photo-multipliers

ions and neutral molecules in comets. In the recent years, based on the original Meinel camera, new focal reducer has been constructed (Fig. 8).

The 65-cm solar telescope is equipped with a 5-camera spectrograph. The diameter of the main spherical mirror is 650 mm and its focal length is 17.75 m. The diameter of the collimator and the cameras is 300 mm with a focal length of 8 m. The grating size is 250 x 200 mm with 600 lines/mm. The dispersions in the fourth order are 21.9 mm/nm at 395.0 nm, and 33.0 mm/nm at 650.0 nm. The width at half intensity of the typical instrumental profile of the spectrograph is 18 mA.

More information about the telescopes and facilities of the Terskol Observatory is presented as a Terskol Gallery in the site of the journal.

2 Special topics of the astronomical investigations in the Terskol Observatory

Today the Terskol Observatory proposes unique possibilities for combined researches of Solar System minor bodies. The most important of them are the Near Earth Objects (NEOs) with decameter sizes. They pass close to the Earth and potentially threaten the civilization. The contemporary methods for searching, applied in the Terskol Observatory, allow revealing of decameter bodies at some million kilometers from the Earth. The bodies found and the NEOs selected from the Minor Planet Center are studied with a spectrometer. As a result catalogues of orbital elements, spectra and taxonomic types are created and maintained. These opportunities became possible as a result of the close cooperation of ICAMER, MAO NASU, IASAN and SAO RAS.

In recent years, considerable progress has been achieved in producing resolved images of Mercury with short exposures at Earth-based telescopes for the purpose of obtaining images of the unknown portion of Mercury (Fig. 9). Such observations with the 2-m telescope started recently in collaboration with the Space Research Institute in Moskow.

At the moment the Terskol Observatory provides the opportunity for scientific investigations to the scientists from the Russian Federation, Ukraine and foreign countries in the following fields:

· The human-environment-space interaction;
· Kinematical and physical characteristics of celestial bodies;

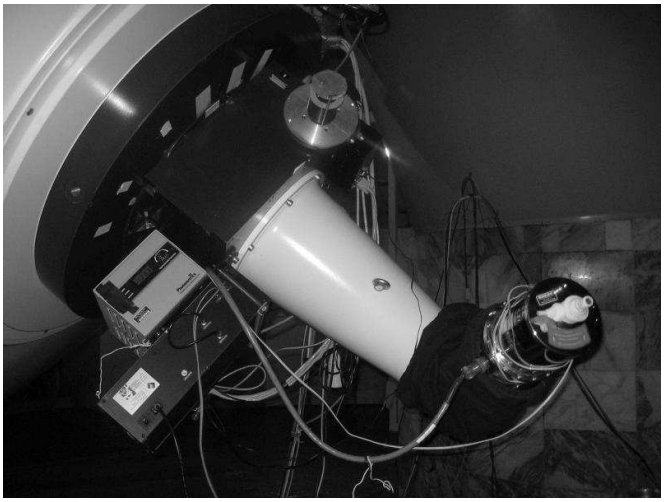

Fig. 8. The focal reducer of the 2-m telescope with TV guiding system

· Geodynamical and ecological monitoring of the Northern Caucasus region (tectonic movements, disastrous earthquake forecasts, etc.);
· Development and implementation of methods for rehabilitation of survivors of man-caused disasters;
· Scientific and technical support for investigations, including the creation and equipping of scientific complexes and stations.

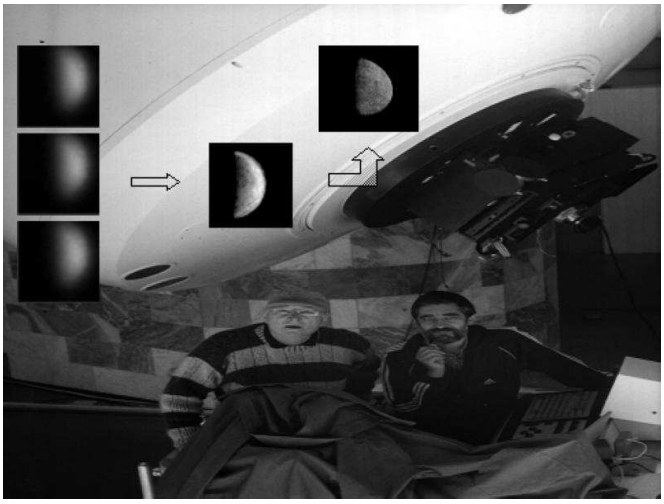

Fig. 9. Earth-based optical imaging of Mercury

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