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COMPLEX OF ASTRONOMICAL OBSERVATORY IN BELGRADE AND ASTRONOMICAL STATION ON VIDOJEVICA

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Abstract. The Astronomical Observatory in Belgrade (Observatory) is a scientific institution. It consists of a building complex which was proclaimed a cultural monument in 2001 due to its exceptional architectural values. In addition to the unique architectural objects the Observatory possesses a very remarkable and valuable collection of astronomical instruments. Due to chronic lack of finances for the regular maintenance all objects of the Astronomical Observatory were endangered and suffered a rapid perishing. From 2015 the Astronomical Observatory has initiated an integral protection, maintenance and presenting of its both cultural and scientific heritages. The work carried out on conservation and restoration for some objects of the Observatory complex have been finished, whereas for the remaining ones are either still done or foreseen for the future. Concurrently the Observatory has improved the infrastructure at its Astronomical Station Vidojevica, located at the Vidojevica mountain top. During the last five years three new domes were built, the prefabricated pavilion with movable roof, pavilion with rotating dome within which the 1.4 m telescope was mounted and the one for hosting the 40 cm MEADE telescope. Modern radiation detectors have been furnished and the robotisation of observational process is being done.

1. INTRODUCTION

The complex of the Astronomical Observatory in Belgrade (Observatory in further text) was built on its current location in the period between 1929 and 1932, according to the project of Czech architect Jan Dubovy. It is thought that in the beginning of the fourth decade of the XXth century the Observatory complex was the most complicated architectural and urbanistic solution achieved by that time in Belgrade (Mihajlov 2018). Its core is the main building around which the pavilions with telescopes and other objects built for the auxiliary technical staff are distributed (Andonović 2014). The technical staff was in charge of maintaining the instruments and of the entire infrastructure. They had a carpentry and mechanics workshop and an accumulator was hosted in a separate building. The Observatory, as a complex wherein for more than eight decades astronomy has been developed, is among the oldest and most important state institutes of a special significance to scientific, societal and cultural development of Belgrade and Serbia and, as a territory containing special natural, urbanistic and architectural values, it occupies a distinguished place in the Serbian architecture of the XXth century. This was the reason why it became a cultural

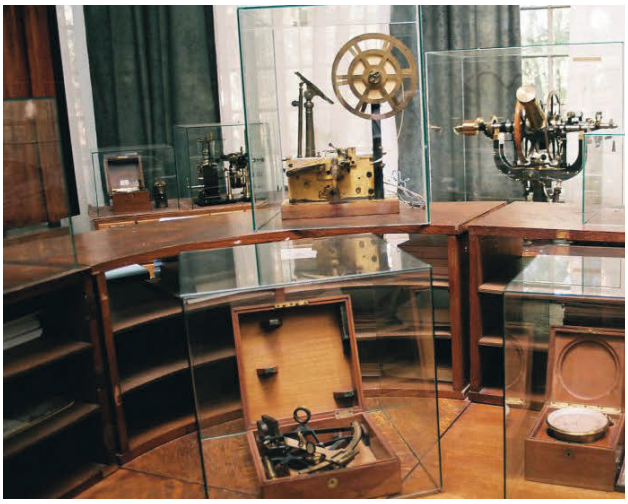

Figure 1: Bust of Milan Nedeljković (left panel) and the Collection of astronomical instruments (right panel).

monument by a decision of the Serbian Government, published in "Službeni glasnik RS" No 32/01 (see N/A 2001).

2. PROTECTION OF THE OBJECTS BELONGING TO THE OBSERVATORY

For a number of years the condition of majority of the Observatory objects was very dilapidated. Due to humidity and leaking very valuable astronomical instruments, which belong to a movable heritage of science, technology and culture, were endangered. In order to preserve the objects (pavilions), but also bearing in mind the necessity of conservation, protection and presentation of the entire astronomical heritage, in 2005 a decision was made to form an Astronomy Museum. The museum would consist of some of the pavilions hosted on the territory of the Observatory at Zvezdara (part of the city where the Observatory is located). The museum area was conceived to incorporate the pavilions no longer used in observational activities. The permanent museum contents would include instruments belonging to astronomical, meteorological, seismic, scientific and cultural heritage of Serbia, from the mere beginning till today.

Therefore, aimed at protecting valuable instruments the Observatory in cooperation with the Museum of Science and Technology in 2015 registered a museum collection of astronomical instruments (Figure 1). This collection contains optical instruments (with complete auxiliary equipment) which once were used in observations. It is important for the history of development of science and technology in Serbia and based on Decision No 176/1-2015 of the Museum of Science and Technology it was established as a cultural heritage of technological culture.

The building complex of Astronomical Observatory in Belgrade is also an ambient entity. Its area is 10 ha, it is situated inside the Zvezdara forest which based on an

official decision became a natural heritage (see N/A 2013). As a unique and specific entity, according to the experience acquired during organising manifestation *Days of Open Doors*, the observatory complex attracts a significant interest of the citizens. The objectives concerning the project of Astronomy Museum were formulated in accordance with this. There are ongoing conservation and protection works of all objects and instruments. The pavilions, which are no longer used for observations, are being adopted and converted into museum rooms. Functional revitalisation of the telescopes for educative purposes, dissemination and promotion of the Serbian astronomical heritage is being carried out. All this work is contributing to the advancement of the cultural and technological heritage in the city of Belgrade.

3. CONSERVATION, RESTORATION AND REDEMPTION INVESTMENT WORKS

In order to improve the protection of its complex the leadership of the Observatory, starting in 2015, has intensified its collaboration with the Cultural Monument Protection Institute of the city of Belgrade. This collaboration resulted in a rapid formation of the technical documentation needed for the restoration projects. On the basis of these projects a complete or partial renovation of individual objects and complex rooms has been done.

With the consent and recommendation of the Cultural Monument Protection Institute of the city of Belgrade the pavilion of the Large Transit instrument was renovated in 2015 (Figure 2). The pavilion hosting the Askania 19/258 cm instrument was brought back to its original condition. In its original form, with a proper illumination, this room was prepared to be presented and used for the museum purposes. The pavilion of the Large Transit Instrument is only one of the rooms foreseen for the permanent museum exhibition.

In 2016 the heating system in the main building was replaced. New heating boilers were mounted and the new fuel, pellet, was started to be used. Its use meets the ecological needs and requirements.

In 2017 and 2018 most of activities of the Observatory on protecting and presenting the cultural-scientific heritage were directed to the formation of projects concerning technical documentation, as well as to the construction and erecting of the bust of Milan Nedeljković, founder of Astronomical Observatory in Belgrade (Figure 1). This bust is located inside the entrance hall of the main building, between the main entrance and that to the library. The author of the bronze bust on a marble pedestal is the sculptor Vladislava Krstić.

One of the completed projects of technical documentation was materialised in 2019. Then conservation-restoration works on the dome, facade and inside the pavilion of the Small Refractor (Figure 3) were carried out. The pavilion hosting the Zeiss 20/302 telescope, that has two photo cameras of 16 cm in diameter, was completely renovated and equipped with internet installations and connections.

Up to now the most comprehensive works which prevented the perishing and collapse of the existing objects of the observatory complex were carried out in 2020. Thanks to the finances provided by the Cultural Monument Protection Institute of the city of Belgrade from the Ministry of Information and Culture the works on the dome, facade and roof terraces of the Large Refractor pavilion (Figure 4) were finished. The documentation needed for the implementation of the project were financed by

Figure 2: Photographs of the Large Transit Instrument: before remediation - left panel; after remediation - right panel.

Figure 3: Photographs of the Small Refractor: before remediation - left panel; after remediation - right panel.

Figure 4: Photographs of the Large Refractor: before remediation - left panel; after remediation - right panel.

Figure 5: Photographs of the School Pavilion: before remediation - left panel; after remediation - right panel.

the Astronomical Observatory in Belgrade. In this way the Zeiss 65/1055 refractor telescope was also protected from perishing. In general, this pavilion has been planned to be the central object of Astronomy Museum. Almost concurrently with the works on the Large Refractor those on the School pavilion were also carried out. Due to the worn out roof and destroyed facade of this object the universal astronomical instrument Askania Bamberwerk was dismounted from the pedestal and because of being endangered was temporarily displaced to the library. In late 2020 the works on the roof and facade of the School pavilion (Figure 5) were completed, whereas the conservation and restoration works inside will be carried out in 2021. During 2020, in the framework of the regular remediation-investment maintenance the offices at the place of the old entrance to the complex were remediated and adapted for the office rooms. The project of technical documentation for the reconstruction and renovation of the Large Vertical Circle pavilion was completed in December of 2020 whereby the prerequisites for carrying out the works on this object were made.

In the main building of the Observatory the library cellar was remediated, whereas the third cellar was adapted to become a cluster hall.

4. ENLARGING INFRASTRUCTURE AT THE ASTRONOMICAL STATION VIDOJEVICA

Because of the necessity of renovation and increasing the scope of observational activities it has been necessary to provide new instruments and radiation detectors which has also required enlarging the infrastructure at the Astronomical Station of Vidojevica (ASV). The subject of this paper part is the construction of objects at ASV and equipment providing from 2015 to 2021.

The main reason for enlarging the infrastructure was the implementation and finishing of project BELISSIMA (BELgrade Initiative for Space Science, Instrumentation and Modelling in Astrophysics), an FP7 infrastructural project of Astronomical Observatory in Belgrade. The project started on July 1, 2010 and was originally foreseen to last three years, but because of problems concerning the providing of the telescope and its mirror was continued two times, by June 30, 2016. The project implementation comprised providing a robotic telescope of 1.4 m main-mirror diameter so that it was necessary to construct a pavilion for it. Because of lack of money in 2015/2016 a prefabricated pavilion with movable roof was built (Figure 6) wherein 1.4 m telescope "Milanković" was mounted in late April 2016.

In 2017/2018 a professional pavilion (Figure 6) for telescope "Milanković" was built, with a rotating dome of 7 m diameter which was purchased from Italian firm Gambato. The complete robotisations of both the telescope and the pavilion became possible, which meant that the presence of observers in the pavilion was no longer required. All observations can be performed remotely, via Internet. In the mid-September of 2018 telescope "Milanković" was moved from the prefabricated pavilion to the one with rotating dome.

A 40 cm MEADE telescope was moved from the Observatory in Belgrade to ASV in 2019. It was for the purpose of observing asteroids at Astronomical Observatory in Belgrade while it was stationed there. A rotating dome pavilion for this telescope was constructed in the first half of 2020. The dome diameter is 3 m, it was purchased from Polish firm Scope Dome (Figure 6). The 40 cm MEADE telescope is planned to be mounted and installed in its final pavilion during the first half of 2021.

Figure 6: Pavilions wherein ASV telescopes are situated: left panel photograph - from left to right: pavilion with 6 m dome, pavilion with movable roof, pavilion with 3 m dome; right panel photograph - pavilion with 7 m dome where is 1.4 m telescope.

Between 2015 and 2020 an Andor iXon 897 Ultra CCD camera was obtained, also three CCD cameras, an Andor iKon-L and two SBIG STXL-8303e ones, as well as a selector instrument, were purchased from the funds of the Observatory via the mediation of the "Jedinica za upravljanje projektom – JUP" of the Serbian government.

The corresponding Ministry, at first that of Science and Technological Development of Serbia, then the one of Education, Science and Technological Development of the Republic of Serbia financed the construction of all objects and gave money for purchasing the 1.4 m telescope.

5. CONCLUSIONS

From the erecting and construction of the Observatory Complex no significant investment in its infrastructure had occurred. Due to this real danger of complete destruction and perishing for all objects with astronomical instruments, telescopes menaced. The period from 2015 till today may be regarded as the time of its complete renovation and revitalisation. Over this period the infrastructure at ASV was significantly enlarged and new instruments and radiation detectors were furnished.

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