

DEVELOPMENT OF ASTRONOMY IN TOPLICA REGION

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Abstract. In this article we present the undertakings connected with astronomy in the Toplica region. Until the end of the 20th century there were not significant endeavours in this area in Toplica, except some amateurish attempts. However, since the year 2000 considerable development started. They are linked mostly to the founding of the Astronomical Society *Magellanic Clouds* and, at the professional level, the rising of Astronomical station at the mountain Vidojevica nearby the town of Prokuplje.

1. INTRODUCTION

Until recently all activities in astronomy in the Toplica district were linked to the popularization and education of astronomy and other mathematical sciences. First attempts in this area rose at the beginning of the 20th century when the Gymnasium in Prokuplje was founded (1908), but they were not so successful. Here should be mentioned attempts in the twenties of Aleksa Savić, the prominent medical doctor, humanist and donator who lived in Prokuplje. First amateur telescopes were brought in Prokuplje in the beginning of seventies, and at the same time started the regular education of astronomy in high-schools. The turning point was 2001 when the amateur astronomical society *Magellanic Clouds* was founded by a group of university professors from Belgrade (Ž. Mijajlović and S. Šegan) and Niš (D. Ćirić) and two students from Prokuplje (A. Valjarević and A. Simonović), enthusiasts in astronomy. Immediately the old idea of rising an astronomical station of the Astronomical observatory in Belgrade (AOB) at the mountain Vidojevica nearby Prokuplje was renewed. Soon the building of the station started due to the efforts of the staff of AOB, first of all Milan Dimitrijević (the previous director of AOB) and Zoran Knežević (the actual director of AOB). The astronomers of the

Chair for astronomy of the Faculty of mathematics of the University of Belgrade contributed much in the beginning of the project, primarily professor Stevo Šegan. The significant role in this mission played the astronomical society *Magellanic clouds* and the administration of the Prokuplje County. Since then, popularization of astronomy was intensified and most prominent Serbian astronomers delivered public lectures there, more than ten every year. Now days, astronomy is popular science in Toplica region. For example, the Gymnasium in Prokuplje is a rare high school in Serbia where astronomy is regularly taught as a separate subject. It also has in it's possession a telescope of Newton type of the aperture 18 cm, while the society *Magellanic clouds* has a telescope (reflector) of the aperture of 23cm. There are also plans to build a small public observatory at the hill Hisar, located in the South of Prokuplje.

2. TOPLICA DISTRICT

Toplica region is located in the southern-central part of Serbia and it occupies about 2230 km² with population about 100.000. Its southwest border is with Serbian province of Kosovo, currently under UN. There are only two mayor towns: Prokuplje (population 30.000) and Kuršumljija (population 14.000). There are a lot of archeological sites, some of them dated 6000 B.C, but also many medieval monasteries and remains.



Figure 1: Pottery old 8000 years found near Prokuplje.



Figure 2: Remains of the Monastery Sv. Bogorodica (St. Madonna), Kuršumljija.

There are also many springs and natural rarities and curiosities. We shall mention two of them. The first one is Đavolja Varoš, meaning "Devil's Town", a geological formation, located by the Radan mountains near Kuršumljija. This geological rarity features exotic formations described as earth pyramids. They have been formed by erosion. Đavolja Varoš is under protection of the state and by a 1995 decision of the Serbian Government, it was proclaimed a natural good of outstanding importance and put under the first-category level of protection.



Figure 3: Đavolja varoš (Devils Town).



Figure 4: Meanders of the river Toplica, satellite view.

The second one is the double-twist of the river Toplica around the town of Prokuplje. At the distance of only several tens of meters, Toplica flows in two opposite directions, making the hill Hisar almost an island.

What make the Toplica region interesting for professional astronomy are astroclimate conditions. According to meteorological measurements, some of them dating from 1900, most of them since 1950, there are on the average about 120 clear nights a year. This region is one of the driest in Serbia, as it only gets 580 mm of accretion an annual basic. In particular, the Vidojevica Mountain nearby of the town of Prokuplje even belongs to semi-arid rain with the total precipitation amount of 533 mm, based on the annual measurement. Measurements in the last two decades show even decreasing of rainfall (the rainfall was above 600 mm until 1980). More details on climate conditions in the Toplica region including temperature, rainfall, relative humidity, insolation, haze, cloudiness and number of days with clear sky can be found in (Valjarević at al., 2008). These data show that this site is advantageous for astronomical observations.

3. DEVELOPMENT OF ASTRONOMY IN TOPLICA REGION SINCE 2000

Almost all activities and projects in astronomy in Toplica district are connected with the town of Prokuplje. The first mayor event was the foundation of the astronomical Society *Magellanic Cloud* in the year 2001. Since it was established, the Society works under supervision of the Faculty of Mathematics (University of Belgrade) and the Astronomical Observatory in Belgrade (AOB). Due to these circumstances, astronomy became rather popular among people of Toplica and many events popularizing astronomy were organized in the town.



Figure 5: First photo of Prokuplje (around 1870).



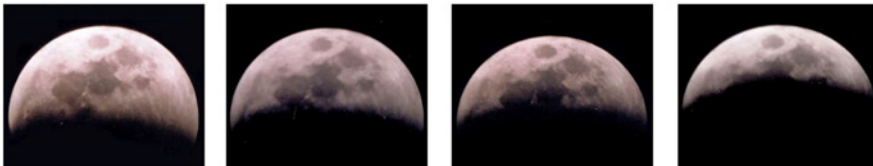
Figure 6: Prokuplje today - the hill Hisar dominates the town.

The Society *Magellanic Cloud* has in possession the reflector of the aperture 23 cm (the present to the Society by Ž. Mijajlović). For many astronomical events were organized watching the sky, not only for the members of the Society, but also for the general public too. The Society has now the rich library of photos of many of these astronomical occurrences. The county of Prokuplje helped much the work of the Society financially, but in other ways, too. For example, in one occasion (2002) during the public gazing of the Sky, the administrators of the County agreed to turn off the street light in part of the town in order to lower the light pollution. However, this decision was accompanied among the people with the somewhat cynic witticism that the County in reality wanted to save the electric power. Namely, at that time was the severe shortage of the electric energy not only in Toplica, but in whole Serbia as well.

Here are photos of partial eclipses of Sun and Moon that occurred recently. Photos are made in Prokuplje and nearby locations using the telescope of the Society *Magellanic Cloud* (Simonović, Valjarević, Mijajlović).



Sun eclipse, May 31, 2003



Moon eclipse, October 28, 2004

Figure 7:

Members of the Society organized many other activities as well. They arranged many public lectures; nearly 50 lectures on astronomy and mathematics were delivered in Prokuplje since the year 2000 up to now. The lecturers were the most prominent Serbian astronomers and mathematicians.



Figure 8: Left photo: Olga Atanacković delivers a lecture in Prokuplje (spring 2004). Right photo: The audience at the lecture.

Members of the Society were often interviewed by local news papers and also participated in many programs of local radio and television stations explaining astronomical phenomena and current astronomical occurrences. Simply saying, astronomy became popular science in Prokuplje and Toplica region. When the Society joined the astronomers Nadežda Pejović (in 2005) and Milan Dimitrijević (in 2006), the activities of the Society even intensified. Mrs. Pejović organised teaching of astronomy in the Gymnasium (the Grammar school) of Prokuplje and started the project of popularization of astronomy and mathematical sciences in Toplica Region, supported by the Ministry of Science of Serbia. Dr. Dimitrijević donated more than 1000 books to the Public library of Prokuplje, to the Grammar school and Museum in Prokuplje. Mijajlović donated the telescope (Newton reflector, 18 cm aperture) to the Gymnasium. The Society organized the expedition (M. S. Dimitrijević, N. Pejović, S. Ninković and Ž. Mijajlović) to Antalya, Turkey, to watch the total Solar eclipse that happened in March 29. 2006.

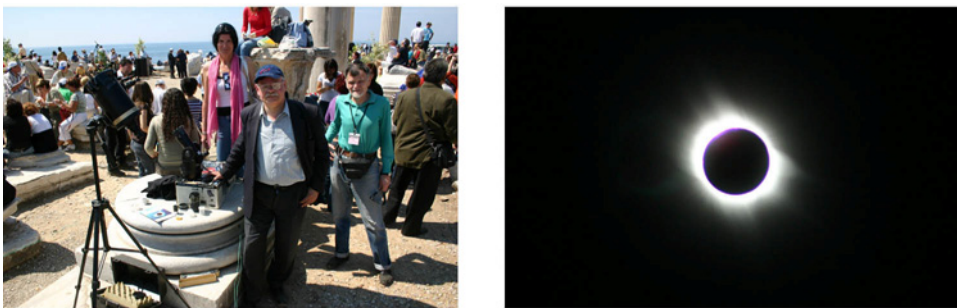


Figure 9: Left photo: N. Pejović, M. Dimitrijević and S. Ninković in Side near Antalya, during Sun eclipse, March 29, 2006. Right photo: Sun eclipse, March 29, 2006.

The Society is planning to build a small public observatory at the hill Hisar in near future. However, probably the most important activity of the Society *Magellanic Cloud* was its engagement in rising of the Astronomical station at the mountain Vidojevica nearby Prokuplje.

4. ASTRONOMICAL STATION ASV

There are already several papers written about the project of building the astronomical station at the mountain Vidojevica nearby the town of Prokuplje (see Ninković *et al.*, 2006; Pejović and Mijajlović, 2006, Mijajlović, 2006). Therefore, we shall present here just few facts about this project.

The idea of building an astronomical station at Vidojevica is 30 years old. The project was postponed, almost forgotten, due to the circumstances that appeared in the former Yugoslavia during the last two decades. Two institutions, Faculty of Mathematics and Astronomical Observatory in Belgrade (AOB) renewed the project in 2002. and helped by the Serbian Ministry of Science began the building of ASV in 2003. The project is carried out by AOB. The site was chosen according to good astronomical criteria. The peak of the mountain of Vidojevica was the best observing site even in the former Yugoslavia, with the clearest sky and very good atmospheric conditions, as it was already explained in this paper (see also Valjarević *et al.*, 2008 and Mijajlović *et al.*, 2006).

ASV is located at the peak (1155m, N $43^{\circ} 08.706'$, E $21^{\circ} 33.982'$) of the mountain of Vidojevica and it is about 20 km far by road from the town of Prokuplje. The peak is almost flat and occupies about 1000 m². The infrastructure at the site is good. There are no significant obstacles on the horizon. The sky is open, particularly to the south. The light pollution is negligible. There are only some traces of light pollution to the north, coming from the town of Prokuplje.



Figure 10: Many expeditions were organized to Vidojevica before and during building it. Left photo: Yang astronomers from AOB at Vidojevica (2003). Right photo: N. Pejović, Z. Knežević, local man and A. Valjarević (2005).

The mayor equipment for ASV is already obtained. It includes one telescope and the stellar spectrograph.



Figure 11: Photo of M 104 (Sombrero galaxy) made with the telescope that will be situated at ASV.

The accessories include a reducer (0.6x for an effective focal length of 2500mm), field corrector, of axis guider and high-accuracy encoders (Heidenhain ERA 780 C Encoders with a very large diameter [473mm] and a very high resolution in both axes [0.2" accuracy per axis]).

Stellar spectrograph SpectraPro 750. This spectrograph is intended for use primarily at ASV telescope. The spectrograph is planned for the recording of low resolution spectra of relatively faint stars and asteroids, medium-resolution spectra of relatively bright stars and studies of the variations in highly broadened spectral line profiles. It can be used also for determination of gas movements in circumstellar disks and radial velocity measurements of close binary stars. In short, the spectrograph is intended for spectral recording and analysis in spectral regions from violet to infrared. The spectrograph is of the Czerny-Turner type and it is produced by the Action Research Company. It has the focal length 750 mm, the aperture ratio f/9.7, resolution 0.023 nm at 435.8 nm, 10 μm slits, dispersion 1.1 nm/mm (nom.) and accuracy 0.1 nm.



Figure 12: Left photo: Dome ASV1. Right photo: The living pavilion.

More details on planned scientific programs at the ASV the reader can find in Ninković *et al.* (2006); Pejović and Mijajlović (2006); Mijajlović (2006) and Pejović and Mijajlović (2007). It is expected that the Astronomical station at the mountain Vidojevica will be finished in near future.

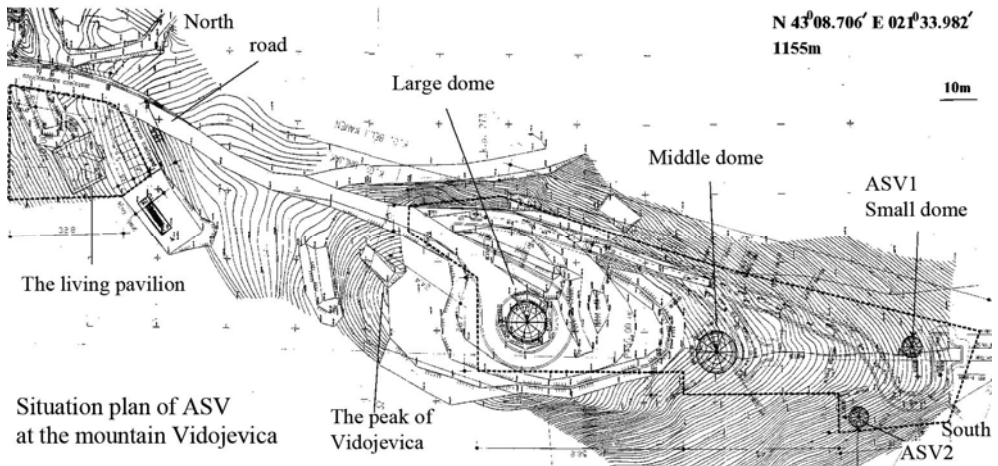


Figure 13:

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