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SERBIAN ASTRONOMICAL SCHOOL UNTIL SECOND WORLD WAR THROUGH MIDDLE AGES MANUSCRIPTS AND LAST TWO CENTURIES BOOKS

Abstract: To save memory of beginning of Serbian Astronomical School, authors give review of the first lecturers, books and publications where some of them, which are most important, are already digitalized by them. Also, most astronomers from the surrounding national schools of that period are mentioned, as well as mutual cooperation of those schools with the Serbian astronomical school.

Key words: Beginning of Astronomy in Serbia, Astronomy in schools and Astronomy in books.

Early Period

In that time in Serbia there were a lot of documents and other types of records about Astrology but the "Горички зборник", "Хришћанска топографија" and "Откровење Барухово" were some of scripts with more astronomy than astrology contents. Interest in the celestial sciences grew as shown by the fact that poet Ljudevit Paskvalic learned Astronomy, Meteorology and Astrology between 1510 and 1520 in Kotor School. Count Ferdinand Marcie Aloysius (Luigi [Aloysius] Ferdinandus Marsigli) (1658–1730) [2] during June and July 1696 in the current Vojvodina (Titel, Вачко Gradište, Žabalj, Senta ...) made observations of the Sun, Jupiter and the Moon and much later in 1726 in Amsterdam he published the results of those observations. Couple of years later in some of Serbian school for the first time appeared some Astronomy contents.

First schools in Serbia with some learning about Astronomy

The first so-called Serbian–Slovenian schools appear in the beginning of XVII century, but in the Serbian–Latin school established in 1730 in Novi Sad some of the best students, among the subjects of Arithmetic and Geography, learned something about Astronomy. In Latin school established in 1749 in Sremski Karlovci, Jovan Rajić (1726–1801) teaches astronomy from 1749 the 1768, and are saved his script for this case. He is also active in monitoring work and saved his description of watching comets from 1769 year. Also his script "Краткоје руководство в познаније земновиднаго круга" from 1726 with 89 pages is conserved [2].

Thanks to director Jovan Gros (1759–1839), Professor Andrija Volin (1759–1827) and Professor Jovan Lazarević (1767–1804) established in Serbian orthodox big gymnasium in

1791 in Sremski Karlovci, the first curriculum, in the Slavonic language, from 1796 had lectures about astronomy. From that time onwards astronomy is increasingly present in curricula of many newly formed schools. Also many books start to be printed with different titles but described usually the same astronomy problems in that time: abstraction of cosmos, about star's light, about Sun and Moon, about time, hour, day, week, month, year, Earth rotating, eclipse, celestial bodies, comets, equatorial, horizontal and ecliptically systems, perturbations and meteorites.

Development from XVIII century until First World War

In addition to the above-mentioned teachers and amateurs astronomers in that period, the largest contribution and trace left Ruđer Bošković (1711–1787). Among his works in Mathematics and Geodesy, he had five Astronomy books about light aberration, telescopes, height of troposphere, Sun rotation, comets motion and different stars. He established astronomy practice and he first suggested about existence of measurement instruments errors. In 1785 he issued his collected works *Opera pertinentia ad circulationem et Astronomiam* (works on optics and astronomy) in five volumes [2].

It is interesting that first "Astronomical" job in Belgrade in 1741 was given to Muvekit, religious officials, who cared about the exact time for prayer and determine the direction of Mecca. In special equipment rooms (Sahatnica) established by rich sultan Governors, the exact time was determined by the height of the Sun by measuring the astrolabe-quadrant (rub'tahta). Interestingly to note that at the time Ruđer Bošković taught astronomy at Roman collegium and a manuscript of lectures held in the academic 1754/55 was preserved and is located in the Central National Library Vittorio Emanuele in Rome.

The Serbian Orthodox large gymnasium in Sremski Karlovci had lessons about Astronomy from 1798 to 1825. The Valhov textbook from the 1794 year, written in German, were used because it contained elements of Astronomy, Mathematical geography and Physics. Besides other books and scripts, astronomical facilities were located in the calendars when the Serbian language began to be printed in the second half Eighteenth century. Starting from 1765 to the end of the eighteenth century, there were barely a dozen, but until the mid-nineteenth century, just in a year were printed same amount. Certainly in this period and later there were many educators of Astronomy among others the most important were: Vuk Marinković (1807–1859) professor of Physics on Licej in Kragujevac. He printed book "Начела физике" (1851) with some astronomical content. Kosta Alković (1834–1909) was professor of Physics and Mechanics in Big school and his student Milan Nedeljković (1857–1950), later graduated Astronomy and Meteorology faculty in France with education in Astronomy practice at Paris observatory. He became a professor of Astronomy and Meteorology on Astronomy department in Grand school in 1886.

Main contribution in campaign for Cosmography in Serbia in the last decades in XIX century were given from: Milan Andonović (1849–1926) Geodesy professor at Big school on Belgrade University who wrote first Astronomy book "Kosmografija"¹ in 1888th; Jovan Dragašević (1836–1915) Geography and Cosmography professor on the Military Academy and Djordje Stanojević (1858–1921) a physics teacher in Grand school, a man with a great observation experience abroad (Potsdam, Hamburg, Medon, Grinič, Kju, Pulkovo) and with first official publications in Astronomy among Serbs [4].

¹ <http://elibrary.matf.bg.ac.rs/handle/123456789/500>

Astronomical and Meteorological observatory

After returning from France to Serbia, Professor M. Nedeljković was trying to make interest in the school and the state government to raise astronomical, meteorological, Geomagnetic and seismological observatory. His efforts were ultimately successful. On the first of July 1887 started temporary Astronomical and Meteorological Observatory of the Grand School in private house of Ernest Gajzler in Belgrade. From 01. 05. 1891 it became permanent, in his own building on the Western Vračar [1]. Among others we have to say that the work of this new institution of the High School and later the University was only meteorology. It is disposed of, as far as we know today, with six smaller instruments, positional astronomy and two clocks, but, apart from the occasional and rare determination of the time, astronomical work was not in it. Manager Observatory since its inception, Professor M. Nedeljković, devoted exclusively to meteorology, and his attempts to obtain a permanent staff establishment of astronomy, never led to positive results.



Picture 1. First Astronomy book in Serbia



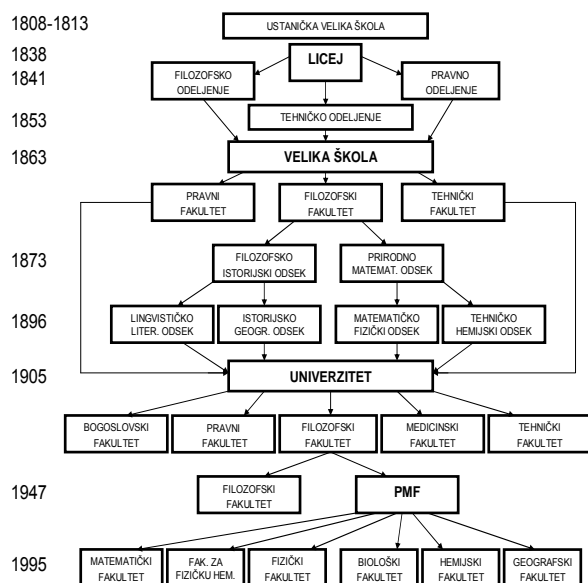
Picture 2. Astronomical and Meteorological observatory 1891–1924

History of Astronomical Department at Mathematical Faculty in Belgrade and first Astronomy Diploma

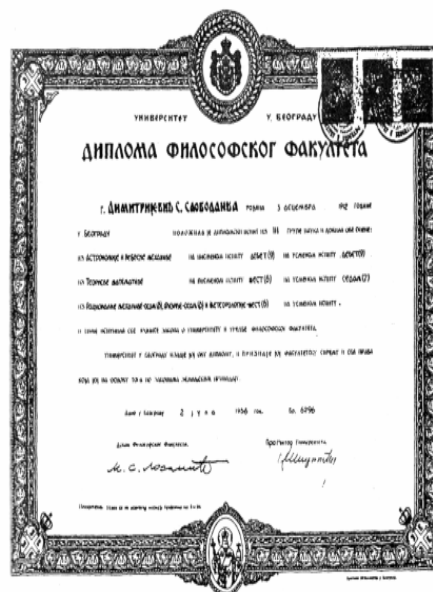
Astronomy is emerging as a professional subject to mathematical and physical departments of the Grand School, written by decree from 1896th, and the regulations since 1900. Astronomy is one of the auxiliary subjects and the study group (Mathematics, Theoretical Physics and Mechanics). In 1905 Belgrade University was established and Astronomy department was held by M. Nedeljkovic. In 1909 the call was elected associate professor of applied mathematics, civil engineer from Vienna, Dr. Milutin Milanković (1879–1958). He taught Rational Mechanics, various chapters of Theoretical Physics and the first in our private instruction in celestial mechanics.

But soon after the first Balkan, and after World War I completely broke from the University teaching and research work of its teachers. In 1927 it was accomplished new organization of teaching on Belgrade University where Astronomy was represented in four study groups: Theoretical and Practical Mathematics, Astronomy and Physics. In 1936 student Slobodanka Dimitrijević graduated from the Faculty of Astronomy and she received first Astronomy Diploma in Serbia. It is also interesting that among a majority of the male

students this was the first time that an Astronomy Diploma was granted to a female student [3].



Picture 3. Development schema



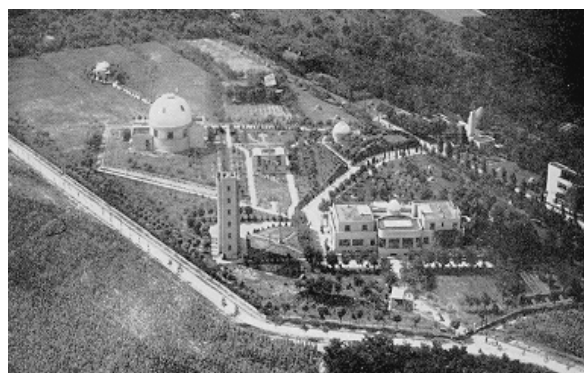
Picture 4. First Astronomy Diploma, July 2nd 1936

New Astronomical Observatory in Belgrade

World War I did not only stop teaching and scientific research at the University, but also heavily damaged, and destroyed, many material goods. Observatory of the University also suffered damage, and its director, Professor M. Nedeljković, stand very strongly by this action to recover damages reparations from Germany. M. Nedeljković finally received in May 1922, approved in Germany selected astronomical, meteorological, magnetic and other physical instrument accessories. But next, in 1923 the ordered instruments and supplies began to arrive to Belgrade and it was delivered a total of about thirty astronomical instruments.



Picture 5. Main building and meridian pavilion of AOB



Picture 6. General view of AOB

During 1924 Observatory was divided into 2 institutions: Meteorological and Astronomical observatory. In October 1926, prof. Vojislav Mišković Astronomer at the

Observatory of Nice, invited the elected associate professor at the Faculty of Philosophy, for the newly established Department of Theoretical and Practical Astronomy became a director of Observatory. It was the beginning of development of Astronomy in Serbia. In October 1929 Mišković managed to obtain funds to build a new observatory, 6 km southeast from Terazije, an area of 4.5 ha, at an altitude of 253 m, above sea level on the hill of Veliki Vračar, which since then, as well as a part of the city, was called Zvezdara.

Among many observations and education activity until World War II AOB published: 6 books of "Annuaire", 5 booklets of "Bulletin" and "Mémoires", 8 books of "Nautical almanac" and 11 books of "Godišnjak našeg neba"². Most of these publications V. Mišković signed as editor and he remained in office of Director by March 1946.

Big achievement of Milutin Milankovic

The thirties were the time of very active scientific work of Professor M. Milanković. His astronomical chronology of the ice age caused a great deal of attention in scientific circles and eventually gained more supporters. At the same time Professor M. Milanković turned around and an old and very difficult problem, the problem of moving of the Earth's poles. He with contribution of prof. A. Bilimović (1879–1970) and prof. V. Žardecki successfully set up, on modern astronomy base, secular changes of the Earth climate theory.



Picture 7. Front page of 'Kanon' from M. Milanković



Picture 8. Front page of first Croatian Astronomy book from O. Kučera

Professor M. Milanković in 1935 published his book "Nebeska Mehanika"³, and all the major results of their work is summarized in an extensive part of "Kanon der Erdbestrahlung und seine Anwendung auf das Eiszeitenproblem"⁴, published by the Serbian Royal Academy. Printing completed, as it were before the war 1941.

During the four years of war Professor M. Milanković succeeded to send outside the country only three or four copies. The first postwar years in Europe were worse to continue the scientific work. So this significant scientific work experienced its first year in the worst time for scientific discussion and scientific work. A general world approval came much later.

² <http://elibrary.matf.bg.ac.rs/submit?workspaceID=1116>

³ <http://elibrary.matf.bg.ac.rs/handle/123456789/506>

⁴ <http://elibrary.matf.bg.ac.rs/handle/123456789/702>

Croatian astronomers works in AOB publications "Godišnjak našeg neba" and collaboration in "Nautical Almanac"

When we talk about the cooperation between Serbian Astronomy School and nearby national schools in the period from its founding until the beginning of World War II, then it could only refer to the cooperation with the Croatian astronomers of the time. As such it was based in two forms. The first is works in AOB publications "Godišnjak našeg neba" and second form is collaboration in "Nautical Almanac". In first of them next Croatian astronomers had articles:

1. Prof. Dr Oton Kučera (1857–1931), Zagreb University - article in 1930, "Endeavour about Astronomy among Croatians".
2. Dr Stjepan Skreb (1879–1952), Zagreb University - article in 1936, "Moon ashen light".
3. Dr Josip Goldberg (1885–1960), Zagreb University - two articles in 1936, "Atmospheric waves from Siberian meteor 30.06.1908. " and "About one way to demonstrate Earth rotating influence for drooping"
4. Dr Stjepan Mohorovičić (1890–1980), Zagreb University - two articles in 1937, "Observation of meteoric appearance" and "About Sun and Earth path size determination by measuring apparent size of the Solar diameter". In 1938 he had article "Appendix of Ptolemy Celestial Mechanics and building the world geocentric mechanism". In 1939 again, "Observation of meteoric appearance". In 1940 "New canon in The sola system".

Demand of Yugoslav Royal Navy, to the Hydrographical Institute of Yugoslav Military Navy in Split (Croatia) for nautical tables for ship navigation resulted that they published, "Nautical Almanac". From 1934 to 1938 battleship lieutenant Petar Mardešić from Croatia and V. Mišković from Serbia were editors. In the end it is important and interesting to say that the first Croatian Astronomy book "Naše Nebo"⁵ of Oton Kučera was published in 1888, just as the first Serbian Astronomy book of Milan Andonović "Kosmografija".

Conclusion

The main development of Practical Astronomy and observations in Serbia started after First World War when the most Astronomical instruments from Germany war complementary were installed and started to be use. Collaboration and connection of Serbian Astronomy School with adjacent national schools was small and in author's opinion insufficient. Despite everything, among others, thanks to the authors because the most of the available astronomical material is digitized and saved as part of the national cultural heritage. All the above indicates that the process of digitization of books, scripts and publications is in progress and we are given the opportunity to contribute through the processing of some of the very important. Moreover in future authors have a plan to digitize the rest of available lecturers, books, publications and relevant documents with astronomy content which is published in this period.

⁵ <http://elibrary.matf.bg.ac.rs/submit?workspaceID=1115>

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