**Publ. Astron. Obs. Belgrade No. 91 (2012), 267 - 271** *Contributed paper*

# ASTRONOMICAL BOOKS IN VIRTUAL LIBRARY OF FACULTY OF MATHEMATICS IN BELGRADE

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**Abstract.** The Virtual Library of the Faculty of Mathematics in Belgrade, at the address http://elibrary.matf.bg.ac.rs, contains about 100 digitized books related to astronomy. These books are written mostly by Serbian scientists but there are also translations into Serbian by foreign authors. This article presents a list of books written by the following authors: Rudjer Bošković, Zaharije Orfelin, Atanasije Stojković, Djordje Stanojević, Milan Andonović, Kosta Stojanović, Nikolai Tsinger, Milutin Milanković, Milan Nedeljković, Pavle Vujević, Vojislav Miković, Zaharije Brkić, Branislav Ševarlić, Jovan Simovljević and Sergei Blažko. Some of these books had the great influence on the development of astronomy, geodesy and mathematical geography in Serbia. The full list of these books is given and a selection of them is presented and commented.

## 1. INTRODUCTION

In the last decade, mainly due to the development of the broad band Internet, many kinds of digital databases are freely available on the WWW. In particular, there are several important projects related to building digital repositories of retro-digitized books. This kind of digital databases are called digital, or virtual libraries. We found in Wikipedia probably the best explanation of the essence of the idea of digital library:

*Virtual Library means library without walls. The resources are available in digital format, there is no paper, microforms etc. The resources are locally held or accessed through computer networks.*

Some of the large world digital libraries are: Project Gutenberg, at the address http://www.gutenberg.org, Europeana, http://www.europeana.eu and arXiv at the address http://arxiv.org. We started our project a decade ago, but we intensified it in the last three years As a result we have now the fully functional Virtual Library of the Faculty of Mathematics which contains a collection of about 2000 digital copies of books.

## 2. VIRTUAL LIBRARY

The overall aim of our digital library is to create a comprehensive and interconnected collection of retro-digitized books and other digital documents. Objectives of the

project include electronic archiving first of all the old manuscripts and their publishing in electronic photo-type form and presentation to the general audience. Our proposal was at the beginning mathematically inclined, but since 2009 we started to include the books from other areas of science and literature. However, the preference will be still given to Serbian authors and works related to South-East European (Balkan) area.

Some of the books in the Virtual library are rather rare and it is known that there are left only few copies of them in the printed form. We think that it is very important to preserve them in some form. Not only as a cultural or scientific heritage important for our local community but also as a part of the World heritage. We decided to preserve and present them to the wide audience in the electronic - digitized form. Virtual library of the Mathematical Faculty of the University of Belgrade is the largest digital depository of digitized texts in Serbia available to the general public. At this moment it contains about 1600 digitized books. In the last two years more than 1000 digital copies of books were uploaded in the library. There are several important collections, including 360 doctoral dissertations in mathematical sciences (mathematics, astronomy, mechanics, theoretical physics and mathematical geography) most of them obtained at the University of Belgrade. There is also the collection of old Serbian books dating the XVIII and XIX century. Most of these books are rare and some of them are left only in one known printed copy and they are not easily accessible.

Digitization is heavily based on information technologies. On the other side information technologies are one of the fastest changing parts of the contemporary world. For example, since the appearance of disk and tape based digital storage in the 1960s, there occurred more than 200 different storage formats. Therefore digital libraries and information archives face a continuing challenge in maintaining files on currently supported storage hardware and media in supported file formats. We had in mind all these issues in considering the following aspects of the this project:

1. Rules for choosing preferential books and manuscripts to be digitized.
2. The mathematics of information storage (database architecture, data manipulation, data forms, etc.).
3. Information retrieval.
4. Metadata and rules for handling metadata.
5. Distribution of informations to the wide audience using Internet.
6. The ability to search electronic files efficiently and retrieve information quickly.
7. The ability to reuse information in other documents and other formats.
8. Fast retrieving of digitized material through electronic transactions and data downloading.
9. The proper choice of data format and resolution.

There are many standards for the database architecture, distributions of information and information retrieval. Common practice in Database Projecting is usage

of Data Base Management Systems (DBMS) and particularly Relational DBMS, for example ORDBMS or Oracle RDBMS. These systems include variety of tools which allow users to create, update, and extract information from their databases. However, some procedures for data description that are independent from hardware and software-platforms were proposed more or less recently. We also note that metadata for digitized documents may differ significantly from data for printed books obeying some of the existent standards (e.g. "Unimarc"). For example, metadata for a digitized document should include the following items, ordinary not found in the mentioned standards: name of the editor who made decision for digitization, then resolution, file type, revision number and date, etc. In developing our Virtual library we relied on the Dublin core metadata initiative which concerns developing metadata standards and disciplinary-specific metadata sets and frameworks for the interoperation of metadata sets. The Virtual Library is implemented in open source software Dspace, http://www.dspace.org.

## 3. AUTHORS

In this section we present the collection of astronomical books of Virtual Library printed through XVIII to the first half of XX century. The Virtual Library, contains about 100 digitized books related to astronomy. These books are written mostly by Serbian scientists but there are also translations into Serbian by foreign authors. Some of these books had the great influence on the development of astronomy, mechanics, geodesy and mathematical geography in Serbia. The full list of these books is given in the appendix.

It should be noted the following general feature of first Serbian scientists, particularly those from the XVIII and XIX century. They were universal in their research interest and in other respects as well, so astronomy was not their only specialty. They were successful in other sciences, too: in mathematics, physics or philosophy, for example. For them, science mostly was the view of a unique being - Nature. The language of science was used by them to describe the nature of this being. Besides, they were often successful politicians, artists, travellers and writers of novels and poems. Their importance for the development of Serbian culture, language and science is enormous. Therefore, in addition to their contributions to astronomy, they should be studied in other respects as well, their life and their contribution to science and history of Serbian people. The oldest books cited in this article are the first Serbian astronomical books, and we can freely say that they are the first scientific works of Serbian authors.

In this section we list the names of all authors whose books are retro-digitized and deposited in the Virtual Library. They are also presented by one or two of their most important books. There are many articles about these books and their authors. The bibliography at the end of this article is just a short choice of recent references (in most cases with self explained titles).

1. Rudjer Bošković(1711–1787), *Elementorum Universae Matheseos* - tomus I-III, 1757,Venetis (the hard copy of the book has the Mathematical Institute in Belgrade). Latin–English edition *Theoria Pholosophiae Naturalis – A theory of Natural Philosophy*, transl. of Venetian edition (1763), translated by James-Mark Child, with an introduction *Life of Roger Joseph Boscovich* by Branislav Petronijević, London 1922 (the printed copy of the book has the Astronomical Observatory in Belgrade).

2. Zaharije Orfelin (1726–1785), *Eternal Calendar*, 1783, Vienna (the printed copy of the book has the Astronomical Observatory in Belgrade).

3. Atanasije Stojković (1773–1832), *Physics*, three volumes, 1810, Budapest.

4. Djordje Stanojević(1858–1921), most of his books, eight of them are digitized including *The starry sky of independent Serbia*.

5. Milan Andonović, (1849–1926), *Cosmography*, 1888, Belgrade.

6. Kosta Stojanović, (1867–1921), *Atomistics by Rudjer Bošković*, 1892, Niš.

   Besides books from the XVIII and XIX century there are also the following astronomical books printed in the XX century:

7. Nikolai J. Zinger, (1842–1918), *Lectures on Astronomy*, 1925, Belgrade (translated by S. P. Bošković, the general and professor of geodesy at the Serbian Military Academy, edition 1899).

8. Milutin Milanković (1879–1958), most of his books, ten, are digitized, including *Celestial Mechanics*, Belgrade, 1935 and *Kanon Der Erdbestrahlung*, Belgrade, 1941.

9. Pavle Vujević (1881–1966), *Fundamentals of the mathematical and physical geography*, 1924, Belgrade.

10. Vojislav Mišković (1892–1976), most of his books, ten of them are digitized, including *Cosmography*, 1931, Belgrade and *Collection solved problems in general astronomy*, Part I, 1956, Belgrade; Part II, electronic edition, Virtual Library, 2009.

11. Tatomir Andjelić (1903–1993), *Astrodynamics*, 1983, Belgrade.

12. Zaharije Brkić (1910–1979), *General astronomy*, 1971, Belgrade.

13. Branislav Ševarlić ( 1914–2001 ), *General astronomy*, 1971, Belgrade.

14. Jovan Simovljević (1929–2007), *Collected works*, electronic edition, Virtual Library, 2010.

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Dačić, M.: Reduction of astrogeodetic determinations on the unique system, Proc. IV Serb.-Bulg. Astron. Conf., Belgrade 21-24 April 2004, eds. M. S. Dimitrijević et al.
Milovanović, M.: 2007, Digitization of the book the Eternal Calender written by Zacharius Orphelin, *NCD Review*, vol. **11**, 43-47.
Pejović, N, Mijajlović, Ž.: 2008, Fundamentals of mathematical and physical geography by Pavle Vujević, *NCD Review*, **13**, 74-90.
Djordjević, R., Milogradov-Turin, J.: 2008, Views of Djordje Stanojević on History and Progress of Science, Proc. Conf. Djordje Stanojević – Life and Work, Novi Sad, 10-11. Oct 2008, ed. V. Marić, 85-90.
Pejović, N.: The Starry Sky of Independent Serbia, Proc. Conf. Djordje Stanojević – Life and Work, Novi Sad, 10-11. Oct 2008, ed. V. Marić, 163-171.
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Ogrizović: 2009, A construction of an advanced measuring system for astro-geodetic determinations, *Publ. Astron. Obs. Belgrade*, No. **86**, 145-150.
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Virtual Library, http://elib.matf.bg.ac.rs, editor in chief Ž. Mijajlović.