

## ASTRONOMY EDUCATION IN FR YUGOSLAVIA 1996-1999

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**Abstract.** This report contains a review of changes introduced in astronomy education in Yugoslavia within the last three years and the facts collected within this period and not known to the author at the time the previous report was written.

### 1. GENERAL INFORMATION

Astronomy education in Yugoslavia follows the pattern of education in general: it is a subject upon which each republic may decide independently. A serious astronomy education exists only in Serbia.

Unless stated otherwise, the period concerned covers the interval from the 1st of June 1996 till the 1st of June 1999.

### 2. ELEMENTARY SCHOOLS

No substantial changes have occurred in programs concerning astronomical topics.

### 3. SECONDARY SCHOOLS

No changes occurred in programs of secondary schools within the last three years. Astronomy topics are still incorporated in Physics and partly in Geography, according to the law passed in 1990.

The program is the same for normal secondary schools in Serbia and Montenegro. The situation concerning teaching is more difficult in Montenegro because there are no graduated astronomers working in education.

The situation with astronomy is slightly better in the special Mathematical High School (Matematička gimnazija), and equivalent classes attached to *gimnazija* type of schools. They have astronomy as a separate course with one lesson per week, and pupils get separate marks.

The textbook for the secondary school program was written by Milan S. Dimitrijević and Aleksandar Tomić. The third edition was printed in 1998. The translation into albanian language was printed in the same year by the same publisher ” (Zavod za udžbenike i nastavna sredstva, Beograd).

The same book was published by Jugoreklam and the Macedonian Astronomical Society, as a monography, in Skopje, in 1998.

In order to help secondary school teachers to keep in touch with new achievements in astronomy and with ways of teaching astronomy, special lectures were presented at regular yearly meetings of teachers. Altogether six lectures by seven astronomers had been held since the previous report. They cover 30 pages in the Publications of lectures. Eleven books and one video tape, which can be used in astronomical education, were reviewed in the Publications, on 14 pages.

#### 4. UNIVERSITY EDUCATION

There are 8 universities in Yugoslavia; seven are state universities while one is private (The University "Braća Karić"). Only six universities have natural sciences (and mathematics). The seventh state university is The University of Arts, in Belgrade.

The University of Beograd is the only one with a Department of Astronomy. Within the past three years, there were no changes in the program of studies. Fourteen students graduated in the astrophysical division and three in the astronomical one; 17 altogether. Three postgraduate students obtained M. Sc. degrees and one candidate obtained a Ph.D. degree.

The course "Astrophysics and Astronomy" at the University of Novi Sad has not been changed since the last report. Neither did the course "Fundamentals of Astrophysics" at the Department of Physics of the University of Niš.

A course of "Astrophysics and Astronomy" was introduced at the IIIrd year of the studies of Physics, at the University of Kragujevac, as one semester course (the VIth semester), with two 45 minutes lectures and exercises (2+2) per week. The official decision dates from 1997 and the lectures started in the spring 1999.

The University of Priština had a course "Fundamentals of Astronomy", with two 45 minutes lectures per week (2+0), in the IIIrd semester, at the Department of Physics, since 1990.

The professors of astronomical courses in Novi Sad, Niš and Kragujevac are plasma physicists while the professor in Priština is a nuclear physicist.

The University of Podgorica has no courses related to astronomy.

Four university text books were recently published; "Fundamentals of Astronomy" by Bajram Jakupi, in 1996, in Priština, "Celestial Mechanics" and "History of Astronomy from its Beginings till 1727", both by late Milutin Milanković, in 1997, and "Astronomy" by Robin Green (translated from English), in 1998, all three in Beograd.

#### 5. PUBLIC EDUCATION

Public astronomy education in Yugoslavia had been realized through lectures at popular universities, on Radio and TV programs, in popular journals and books, in the Planetarium, in popular observatories and astronomical societies.

Kolarčev Popular University in Beograd organized two sets of lectures: "Astronomy at the end of the XXth century" (4 lectures) in spring 1998 and "The Total Solar Eclipse of the 11th of August 1999" (two lectures) in February 1999.

The Astronomical Society (AS) "Ruder Bošković" in Beograd organized courses each autumn and spring (22 per season), with total of 9007 participants×lecture in



the last three years. The course in spring 1999 was not carried to the end. There have been 23 participants who passed the final examination, within the same period. At the beginning of the spring 1997, the lecture about the constellations attracted an absolute record of 300 visitors. The total number of visitors at the Public Observatory of the Astronomical Society "Ruđer Bošković" within the period concerned was 25 997. The members of the Society having free entrance are not included in this number. It is estimated to be about one quarter of the total. The comet Hale-Bopp attracted 3105 visitors. The telescope itself and its functioning were demonstrated to 875 visitors. The number of pupils who visited the Planetarium and had 360 lectures was 15 541.

The AS "Ruđer Bošković" organized the Beograd Astronomical Weekend (BAV) in June 1996, 1997 and 1998. The XIVth BAV (1996) was devoted to various subjects: observations of the comet Hyakutake, evolution of galaxies, brown dwarfs, planets around other stars, concept and measurements of time, radiation transfer and Internet in astronomy. The XVth BAV (1997) subjects were: Stonehenge, demonstration of influence of precession on visibility of constellations, connection of astronomy with archeology, observations of the comet Hale-Bopp from Yugoslavia, origin of the Moon, center of the Milky Way, Hubble deep field and the problem of solar neutrinos. The main themes of the XVIth BAV (1998) were: chemistry of the cosmos and meteorites as cosmic samples, starry sky of Van Gogh, stars as seen from "Titanic" and stars without twinkling – adaptive optics. It was accompanied by the exhibition of pictures with astronomical motives painted by one of the staff members. All three BAV meetings were followed by visits to observatories and by observations.

The AS "Ruđer Bošković" organized the first summer lecture in August 1997. Since this pilot program was successful, a set of four lectures named "Summer Astronomical Meetings" started in 1998. The subject in 1998 were the processes in galaxies. The set was extended in September with an extra lecture on the harmony between stars and planets. Those lectures attracted about 300 listeners.

The courses were run by the staff of the Public Observatory and Planetarium, professional astronomers from the Astronomical Observatory and the University in Beograd, students of astronomy and partly by astronomers amateurs.

The AS "Ruđer Bošković" published 14 issues of its non profit journal for popularization of astronomy "Vasiona", in the period concerned. Two issues were double. Five articles were written by students as a part of their teaching practice.

The AS in Novi Sad "ADNOS" organized courses every autumn and spring (except in 1999) with 12 lectures per season, with about 1250 participants. The ADNOS organized regular public observations called "Astronomical Evenings", each summer, once a week. There were about 2000 visitors within the period concerned. The Society was active in photographical observation of all major events during these years.

The Astronomical Society named "Niš" founded in 1996 changed its name into "Alpha" in 1997. During the last three years they organized 35 lectures, presented either by members of the Society or invited lecturers. Average number of visitors was about 80. The Society organized public observations of all major events during this period. The peak number of visitors – about 200 was achieved for observations of the comet Hale-Bopp within the fortress of Niš where the instruments were installed. The Society took part in observations of Leonids from Mongolia as well.



The organization of young researchers in Valjevo "Vladimir Mandić-Manda" has celebrated 25 years of the astronomy section in 1998. Presently it has 53 active members. The group was particularly active within the period concerned. Its members were observing and demonstrating celestial bodies to the public with their modest instruments and used those in Petnica for more serious work. The group started yearly astronomical meetings in Valjevo in 1997.

The AS "Belerofont", founded in August 1995, in Kragujevac was working in the period concerned mainly using the telescope and premises (the Belerofont observatory) of the Faculty of Sciences in Kragujevac. Several hundreds visitors were served. In the first phase primary schools were the main clients. Nevertheless, several outdoor expeditions were made as for obtaining the photographs of the comet Hale-Bopp. The number of members varies; it was about 30 in 1997 while it is 15 presently.

A group of enthusiasts founded in January 1996 the AS "Milutin Milanković" in Zrenjanin. It was active in public astronomical education within last three years. They were using school telescopes for demonstration of celestial objects. The Society has about 50 members.

The Petnica Science Center (PSC) deserves a special place in review of such a type. Its main activity is educating the young who are ambitious enough to start research projects. The participants are chosen through collaboration with schools. In the period concerned the PSC continued with the two-years education astronomy program which according to its experience gives expected results. There were 23 regular seminars, lasting 8 days on average, with about 20 participants. The projects cover a wide range of subjects.

The PSC published two issues of "Papers of participants in educational programs" within "Petničke sveske" (Petnica Notes), in the period concerned. There were six astronomical papers in the 1996 and 1997 issues (12 in total) and two in the 1998 issue. They are of a quite high level and were related to solar physics, radio astronomy, practical astrophysics, stellar photometry, calculations of orbits, numerical simulations, astronomical instruments and accessories and astronomical software. The PSC also published the booklet on observation of Perseids "Perseidi '97".

The PSC mounted within the period concerned a f/9 Meade 178 mm APO refractor in its cupola (3m diameter). Observations with it started in 1997. The PSC possesses two CCD cameras. Presently the PSC has 7 different telescopes in total.

The PSC section for observation of meteors was very active. It organized 17 meteor camps and took part in the expedition to Mongolia for the Leonids of 1998.

The PSC was the host of the ninth conference of International Meteor Organization – "International Meteor Conference '97".

The PSC organized a three days seminar for secondary school teachers of physics on physical and astronomical topics, in April 1998.

The PSC collaborates with practically all Yugoslav professional astronomers. They have been acting as lecturers, supervisors or advisors.

The astronomy courses and camps organized by the PSC had even eight participants from abroad within the period concerned.

The organization "Nauku mladima" (Science to the Young) had, during 35 years of its existence, about 13 500 pupils participating in competitions by tests. About a



hundred of the best pupils participated in higher level competitions by doing projects, some of them several times. Twenty of them got medals. Three projects were published. From June 1996 till June 1999 about 500 pupils competed by tests and about 70 pupils participated doing projects. During these years the organization changed in a formal way but not in the essential activity.

The Astronomical Observatory in Beograd was also acting in the field of education being occasionally open for visitors and their members active in university and public education. The Universities have provided a considerable help to the AS.

The mentioned societies, institutions and individual amateurs have been participating in observations of all important astronomical events of these years and have undertaken extensive preparations for observation of the solar eclipse of the 11th of August 1999, total on the north of Yugoslavia.

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