

ASTRONOMY EDUCATION IN FR YUGOSLAVIA 1999-2002

J. MILOGRADOV-TURIN

Department of Astronomy, Faculty of Mathematics, University of Belgrade

Studentski Trg 16, 11000 Belgrade, P.O.Box 550, Yugoslavia

E-mail jelenam@matf.bg.ac.yu

Abstract. This review presents the state of astronomy education in Yugoslavia. Special attention is paid to changes introduced from June 1, 1999 to June 1, 2002.

1. GENERAL INFORMATION

Astronomy education in FRY follows the pattern of education in general, viz. it is a subject upon which each republic decides independently. A serious astronomy education exists only in Serbia. The previous period was covered in other papers.

2. ELEMENTARY SCHOOLS

Astronomy topics are still included in Natural History, Geography and Physics.

3. SECONDARY SCHOOLS

Astronomy topics are linked to Physics and partly to Geography, according to the law passed in 1990. The programme is the same for normal secondary schools in both Serbia and Montenegro. Most of the teachers are physicists. Only nine graduated astrophysicists/astronomers taught astronomy in schools in Serbia and none in Montenegro.

Astronomy is taught as a separate course, with one lesson per week, in the last (i.e. the fourth) year in the special Mathematical High School (Matematička gimnazija) in Belgrade. Equivalent grades exist in some other secondary schools in Serbia, with the same programme as in the Mathematical High School; the number of schools with such grades has increased to seven by now (Novi Sad, Niš, Kragujevac, Kruševac, Kraljevo, Valjevo and Leskovac). However, there are no astronomy courses (in such grades) in the Podgorica High School (Montenegro).

The current astronomy textbook had its fourth edition in 2001.

In order to help secondary school teachers keep pace with achievements in astronomy and ways of teaching astronomy, special lectures are delivered at regular annual meetings of physics and astronomy teachers. Ten lectures on subjects related to astronomy have been delivered so far, four lectures by four astronomers and six by

seven physicists, within the period concerned. Proceedings of these meetings contain astronomical topics on 61 pages. Ten new books were reviewed, on two pages.

4. UNIVERSITY EDUCATION

There is a total of 11 universities in Yugoslavia. Seven are state universities and they are located in Belgrade (2), Novi Sad, Niš, Kragujevac, Priština and Podgorica, whereas four universities are private, in Belgrade (3) and Novi Pazar. Only six universities, all of them the state ones, encompass natural sciences. Astronomy topics are taught at five of them, mostly as courses for students of physics.

The University of Belgrade is the only one having the Department of Astronomy. Within the past three years, there were no changes in the programme. Twenty five students graduated in the Astrophysical Division and three in the Astronomical one, i.e. 28 altogether. Eleven postgraduate students obtained M.Sc. degrees and two candidates obtained Ph.D. degrees.

The University of Novi Sad, its Institute of Physics, has introduced a "credit" system thanks to which it is possible to graduate as a teacher of physics and astronomy after three years and as a physicist or an astronomer after four years of study.

The course "Astrophysics and Astronomy" in Kragujevac remained the same.

The change at the University of Niš was effectuated by shifting the one-semester course "Fundamentals of Astrophysics" at the Department of Physics to the VI semester of physics studies. Similarly the one-semester course "Fundamentals of Astronomy" at the University of Priština in Serbian (since academic year 2002/2003 working in Kosovska Mitrovica) was shifted to the IV semester.

It became more frequent now, at the universities of Belgrade, Niš and Kragujevac, that the students of physics take astronomical subjects for their diploma theses.

An auxiliary university textbook was published in 1999; it was Dragan Gajić's "Udarni talasi u kosmosu" ("Shock Waves in Cosmos").

5. PUBLIC EDUCATION

Public astronomy education in Yugoslavia is being realized by way of lectures at open public universities, on radio and TV programmes, in popular journals and books, in the Planetaria, at public observatories and astronomical societies.

Kolarčev People's University in Belgrade organized two sets of lectures: "Frontiers of Modern Cosmology" (4 lectures) in winter 2000 and "Odyssey 2001 – Reality and Fantasy" (4 lectures) in autumn 2001. The development of astronomy and astrophysics in Serbia was presented in a special lecture within a lectures series devoted to the development of mathematical sciences in Serbia, in autumn 1999.

The Astronomical Society (AS) "Ruđer Bošković" in Belgrade has organized courses each autumn and spring, with a total of about 9000 participant×lecture in the last three years. There have been 44 participants who passed a final exam, within the same period. The total number of visitors to the Public Observatory of the AS "Ruđer Bošković" within the above mentioned period was 46 524. The members of the Society, who have free entrance, are not included in the above figure; their visits are estimated to be about one quarter of the above total. The AS' telescope itself and its functioning were demonstrated to 889 visitors. The number of secondary school pupils, who visited the Planetarium and attended 136 lectures, was 8218.

The AS "Ruđer Bošković" organized the Belgrade Astronomical Weekends (BAW) in June 1999 (the XVII), 2000 (the XVIII) and 2001 (the XIX). They were devoted to various astronomical subjects: eclipses, Milanković, Milky Way, accretion discs in AGN, gravitational lenses, extraterrestrial life, solar physics, spectra, atoms, Mach principle, meteorites, and Atanasije Stojković. All three BAW meetings were followed by visits to observatories and included observations.

The major astronomical event was the solar eclipse of the 11th of August 1999, seen as total from the north of Yugoslavia. Before the eclipse, the population of the FRY was informed about it on almost 300 occasions. As an example, the first day of the XVII BAW was devoted to total solar eclipses: facts about the forthcoming eclipse were presented, techniques available to amateurs for its monitoring were discussed, and the astronomers who observed the total solar eclipse seen in Yugoslavia in 1961 gave accounts of their impressions. The results of the expeditions to the 11th of August 1999 eclipse were reviewed on the XVIII BAW.

The AS "Ruđer Bošković" continued "Summer Astronomical Meetings". The topic in 1999 was "Life and Mind Outside the Earth" (8 lectures), in 2000 it was "Astronomy at the End of the XX Century" (6 lectures), and "The Influence of Cosmical Surroundings on the Earth and the Solar System" (6 lectures) in 2001. These lectures attracted about 300 listeners.

The courses were given by the staff of the Public Observatory and Planetarium, professional astronomers from the Astronomical Observatory and the University of Belgrade, astronomy students, and partly by amateur astronomers.

The AS "Ruđer Bošković" published 16 issues of its non-profit astronomical review "Vasiona" ("Universe") in the period concerned. Two of the issues were double (one devoted to the forthcoming total solar eclipse) and one was triple (devoted to results of the eclipse observations). Five papers were written by the students as a part of their teaching practice. The year 2001 was a jubilee year for "Vasiona", namely its fiftieth anniversary.

A big news was the opening of the AS "Novi Sad" (ADNOS) planetarium on February 1, 2001. It is ZKP-1 of Karl Zeiss, Jena. It is placed within the Petrovaradin fortress and is used for lectures to secondary school students. Four of the lecturers were students, members of "ADNOS", who previously obtained special training and passed the tests. The fifth was the secretary of the "ADNOS". Two courses for the school teachers were organized, one in the spring and the other in the autumn 2001. There have been about 11 000 visitors to the Planetarium. The standard two-semester "ADNOS" courses were delivered within the premises of the University of Novi Sad during the academic years 1999/00 and 2000/01. The Planetarium was used at the end of the last course. Six lectures, followed by discussion, were held within the premises of the University in the years 2001-2002, in the period concerned. Several public demonstrations of the celestial bodies were organized in the same period, with several thousand visitors. The Planetarium was also used for art happenings (EXIT, painting exhibition and multimedia performance).

The number of members of the AS "Alpha" in Niš increased to 150. During the last three years the "Alpha" organized about 30 lectures. Average number of visitors was about 80 per lecture. The AS "Alpha" obtained a "Vixen" refractor 102x1200mm, equatorial, with automatic drive. The Society organized public observations of all major astronomical events. Average number of participants was about 200.

The astronomical section of the "Vladimir Mandić-Manda" Organization of Young Researchers in Valjevo has advanced its work. It has had courses and educational camps. They performed an ethnoastronomical investigation in the surrounding area. One member won a golden medal in 2000 and a silver medal in 2001 in the competition "Nauku mladima" ("Science to the Young") in astronomy, for work on solar activity.

The AS "Belerofont" ("Bellerophon"), founded in August 1995 in Kragujevac, mainly used the telescope and the premises of the Faculty of Sciences in Kragujevac. Several hundred visitors were received. Also several outdoor expeditions were organized to obtain photographs of comets.

The AS "Milutin Milanković" in Zrenjanin was active in public astronomical education. The AS started the Summer Schools for Physics and Astronomy on the lake Palić in 2000; the first of these lasted five days.

The Petnica Science Center (PSC) became a true center for initiation of the young into science. Regular seminars, lasting 8 days on the average, with about 20 participants were organized. The projects covered a wide range of subjects.

The PSC published two issues of "Petničke sveske" ("Petnica notebooks") within the period concerned with papers related to astronomy: in 1999 on polarization of the white-light corona during the total solar eclipse of the 11th of August 1999 monitored by the expedition to Bulgaria and in 2000 on the brightness distribution across the lunar disc as a function of phase. In 2001 the PSC published a booklet "Perseidi '01 – Godišnjak za meteore i mala tela" ("Perseids '01 – Almanac of Meteors and Small Bodies"). Major articles were: modelling shapes and characteristics of asteroids from optical brightness data, time distribution of meteor events, search for meteorites, and Geminids as meteors of uncertain origin. There were also two papers on observations. The booklet also included three reviews of the IX Conference of the International Meteor Organization ("International Meteor Conference '97").

The PSC was active in observations: the CCD pictures of the occultation of Saturn on the 3rd of November 2001 and of the comets were very good. Even aurora, an event unusual for Yugoslavia, was photographed on the night of the 7th of April 2000.

The PSC organized a four days' seminar on astronomical image processing ESO MIDAS held by two German astronomers to about 30 participants in November 2000.

Inspired by the total solar eclipse, a new astronomical group was founded in August 1999 within the Natural History Society "Gea" in Vršac. It was very active.

The AS "Magelanov oblak" ("Magellanic Cloud") was founded in May 2001 in Prokuplje. They are using a 23 cm f/8 Newtonian reflector and have big plans.

The AS "Kraljevo" was founded in 2001, starting with lectures.

The first radio astronomical club was founded in December 2000 in Bor. In February 2002 it was renamed the Society for Radio Astronomy Research "Aurora". It held a radio astronomy school for 12 participants and observed reflections from meteors.

Three groups that were active, but have not yet been registered, are the AS "Lira" ("Lyra") in Novi Sad, the AS "Vlašići" ("Pleiades") in Leskovac and the Belgrade Radio Astronomical Society "Tesla".

After years of rather successful work, the organization "Nauku mladima" has stopped the competitions in astronomy for the academic year 2001/2002. The participants working in astronomy were directed to the competition in physics.

Astronomy has also been popularized by the "Mladi fizičar" ("Young Physicist"), a quarterly magazine for the elementary and secondary school students, during its 25

years of existence. Within the last five years a guide to the sky had been printed.

The Society of Astronomers of Serbia (SAS) initiated the participation of Yugoslav competitors in the International Astronomical Olympiad 2002.

The use of Internet is rather widely spread. Many of the organizations mentioned above have web sites and all can be approached by e-mail. The first Yugoslav electronic astronomical magazine exists already for several years.

References

- ***: 2001, Hronika PMG, *Perseidi '01 – godišnjak za meteore i mala tela* (ed. B. Savić), br. 4, 101-106.
- ***: 2002, Zajednički konkurs za upis studenata u prvu godinu osnovnih studija na fakultetima čiji je osnivač Republika za školsku 2002/2003 godinu *Prosvetni pregled* sp. br.
- Aničin, I. V.: 2001, Nuklearna fizika i evolucija materije, *Zbornik predavanja sa Republičkog seminara o nastavi fizike, Arandelovac*, 23-34.
- Atanacković-Vukmanović, O.: 2001, Rastojanja do nebeskih tela, *Zbornik predavanja sa Republičkog seminara o nastavi fizike, Arandelovac*, 35-42.
- Brčić, M.: 2002, Report on Astronomy Education in Zrenjanin.
- Božinović, N., Milutinović, N.: 1999, Polarization Of White-Light Corona During Solar Eclipse On August 11, 1999, *Petničke sveske* No. 49, 5-11.
- Božić, N.: 1999, XVII BAV, *Vasiona* br. 4, 110-111.
- Božić, N.: 2000, Astronomski magazin, *Vasiona* br. 5, 121-122.
- Božić, N.: 2000, Astronomsko leto, *Vasiona* br.5, 123-124.
- Božić, N.: 2002, Report of the Astronomical Section of the Society "Vladimir Mandić-Manda".
- Čubrović, M.: 2001, Modeliranje oblika i karakteristika površine asteroida na osnovu krivih sjaja, *Perseidi '01 – godišnjak za meteore i mala tela* (ed. B. Savić), br. 4, 9-40.
- Gajić, D. Ž.: 1999, *Udarni talasi u kosmosu*, Klub NT, Beograd, 140 strana.
- Gajić, D. Ž.: 2002, Report on Astronomy Education in Niš.
- Dačić, M.: 2000, Geografski i nebeski ekvatorski sistem, *Zbornik predavanja sa Republičkog seminara o nastavi fizike, Vrnjačka Banja*, 94-97.
- Dimitrijević, M.S.: 2000, Kosmologija na razmeđi milenijuma, *Zbornik predavanja sa Republičkog seminara o nastavi fizike, Vrnjačka Banja*, 18-25.
- Dimitrijević, M.S., Tomić, A.: 2001, *Astronomija za četvrti razred gimnazije*, Zavod za udžbenike i nastavna sredstva, Beograd.
- Disterlo, Ž.: 2002, Report of the Society for Radio Astronomy Research "Aurora" in Bor.
- Ekpa "Belerofont" opservatorije: 2002, Okultacija Saturn-Mesec, *Vasiona* br. 1, 24.
- Francisti, J.: 2001, Planetarijum na Petrovaradinskoj tvrđavi, *Vasiona* br. 4, 80-83.
- Francisti, J.: 2002, Report on Astronomy Education in Novi Sad.
- Jakupi, B.: 2002, Report on Astronomy Education in Serbian on the University of Priština.
- Jeličić, M.: 2001, II letnji astronomski susreti, *Vasiona* br. 1-2, 41.
- Jeličić, M.: Astronomsko društvo "Kraljevo", submitted to *Vasiona* No 1-2, for 2003.
- Jokić, S.: 2001, Eksperimentalne opservacije astrofizičkih fenomena, *Zbornik predavanja sa Republičkog seminara o nastavi fizike, Arandelovac*, 17-22.
- Josović, D., Simić, S.: 2002, Posmatranje komete Ikeja-Džang, *Vasiona* br. 2, 63-64.
- Lujić, V.: 2002, Kretanje zvezda, *Zbornik predavanja sa Republičkog seminara o nastavi fizike, Vrnjačka Banja*, 20-27.
- Lukić, S.: 2002, List of Activities of the AS "Novi Sad" in 2001 and 2002.
- Lukić, V.: 2001, Vremenska raspodela meteorskih pojava, *Perseidi '01 godišnjak za meteore i mala tela* (ed. B. Savić), br. 4, 41-50.
- Maksimović, D.: 2000, Prirodnačko društvo "Gea" – Vršac, *Vasiona* br. 5, 122.
- Maksimović, D.: 2002, Astronomical Activities of the Natural History Society "Gea".
- Markušev, D.: 2000, 200 godina od otkrića infracrvenog zračenja, *Zbornik predavanja sa Republičkog seminara o nastavi fizike, Vrnjačka Banja*, 26-33.
- Mekbit, A.: 2001, Alisterova priča, *Perseidi '01 – godišnjak za meteore i mala tela* (ed. B. Savić), br. 4, 92-96.

- Mijajlović, Ž.: 2002, Amatersko astronomsko društvo "Magelanov oblak", *Vasiona* br. 1, 26-28.
- Miljković, J.: 2001, U izgledu osnivanje Astronomskog društva u Leskovcu, *Vasiona* 4, 99.
- Milogradov-Turin, J.: 1991, Astronomy Education in Yugoslavia, National Report 1988-1990, *Newsletter IAU Commission No. 46: The Teaching of Astronomy*, No. 31, 56-59.
- Milogradov-Turin, J.: 1993, Yugoslavia, National Report 1990-1993, *Newsletter IAU Commission 46: The Teaching of Astronomy*, issue 37, 27-30.
- Milogradov-Turin, J.: 1993, Astronomy Education in FR Yugoslavia, *Proceedings of the X National Conference of Yugoslav Astronomers, Belgrade, September 22-24, 1993, Publ. Astron. Obs. Belgrade No. 44*, 89-93.
- Milogradov-Turin, J.: 1996, Yugoslavia, National Report 1993-1996, *Newsletter IAU Commission 46: The Teaching of Astronomy*, issue 45, 59-61.
- Milogradov-Turin, J.: 1996, Astronomy Education in FR Yugoslavia, *Proceedings of the XI National Conference of Yugoslav Astronomers, Belgrade, September 9-11, 1996, Publ. Astron. Obs. Belgrade No. 54*, 165-169.
- Milogradov-Turin, J.: 1999, Astronomy Education in FR Yugoslavia, *Proceedings of the XII National Conference of Yugoslav Astronomers and International Workshop on the Development of Astronomical Data bases, Belgrade, November 19-21, 1999, Publ. Astr. Obs. Belgrade No. 65*, p. 185-190.
- Milogradov-Turin, J.: 2000, Yugoslavia, National Report 1996-1999, *Newsletter IAU Commission 46: The Teaching of Astronomy*, issue 52, 8-10.
- Milogradov-Turin, J.: 2002, Yugoslavia, *IAU Commission 46; Astronomy Education and Development; Newsletter Supplement; National Liaison Triennial Reports 2002*.
- Miović, V.: 2001, Vjerina priča, *Perseidi '01 – godišnjak za meteore i mala tela* (ed. B. Savić), br. 4, 97-100.
- Mitranić, Lj.: 2000, Zemlja kao referentni sistem, *Zbornik predavanja sa Republičkog seminara o nastavi fizike, Vrnjačka Banja*, 131-134.
- Naumovski, K.: 2000, *Sazvežđa severnog neba*, Zmaj, Novi Sad, 240 strana.
- Obadović, D., Kapor, D.: 2001, Prikaz novih knjiga i udžbenika, *Zbornik predavanja sa Republičkog seminara o nastavi fizike, Arandelovac*, 114-121.
- Okolić, D.: 2001, Potraga za meteoritom, *Perseidi '01 – godišnjak za meteore i mala tela* (ed. B. Savić), br. 4, 51-57.
- Nenezić, V., Trajković, N.: 2002, Okultacija Saturna 3. 11. 2001, *Vasiona* br. 1, 25.
- Nešić, Lj., Obradović, S.: 2001, O prostoru i vremenu u kvantnoj kosmologiji, *Zbornik predavanja sa Republičkog seminara o nastavi fizike, Arandelovac*, 122-129.
- saradnici: 2001, 18. beogradski astronomski vikend, *Vasiona* br. 3, 73.
- Savić, B.: 2000, Polarna svetlost, *Vasiona* br. 5, naslovna strana.
- Savić, B.: 2001, Geminidi – meteori sumnjivog porekla, *Perseidi '01 – godišnjak za meteore i mala tela* (ed. B. Savić), br. 4, 58-64.
- Sekulić, M., Aćimović, D., Banković, A., Savić, B.: 2001, Photo Story, *Perseidi '01 – godišnjak za meteore i mala tela* (ed. B. Savić), br. 4.
- Simić, S.: 2002, Report on Astronomy Education in Kragujevac.
- Smolić, I.: 2001, Kometa C/2000 WM1 (Linear) – analiza naravi jedne repatice, *Perseidi '01 – godišnjak za meteore i mala tela* (ed. B. Savić), br. 4, 77-78.
- Smolić, I.: 2002, Report on Astronomy in the PSC.
- Stančić, N.: 2000, Fraunhoferove linije na kompaktnom disku, *Zbornik predavanja sa Republičkog seminara o nastavi fizike, Vrnjačka Banja*, 110-113.
- Vidojević, S.: 2001, XIX beogradski astronomski vikend, *Vasiona* br. 5, 135-136.
- Vucelja, M., Žeravčić, Z., Veljković, K.: 2001, Rezultati vizuelnih posmatranja meteora PMG od jula 1997. do septembra 2001. godine, *Perseidi '01 – godišnjak za meteore i mala tela* (ed. B. Savić), br. 4, 67-76.
- Vucelja, M.: 2001, Vatromet u Bronzanom kotlu, *Perseidi '01 – godišnjak za meteore i mala tela* (ed. B. Savić), br. 4, 81-88.
- Žeravčić, Z.: 2000, Zavisnost raspodele sjaja po Mesečevom disku od faze, *Petničke sveske*, br. 51, 5-9.
- Žeravčić, Z.: 2001, Višnjan – opservatorija mala ali poznata, *Perseidi '01 – godišnjak za meteore i mala tela* (ed. B. Savić), br. 4, 89-91.