



**COMMISSION 46**  
**ASTRONOMY EDUCATION AND DEVELOPMENT**  
*Education et Développement de l'Astronomie*

**Newsletter Supplement**  
**National Liaison Triennial Reports 2006-2008**  
**Part 2 of 2 – Japan to Venezuela)**  
**(Part 1 contains Armenia to Indonesia)**

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**Commission 46 seeks to further the development and improvement of  
astronomical education at all levels throughout the world.**

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## TRIENNIAL REPORTS FROM NATIONAL LIAISONS

The triennial reports from the C46 National Liaisons have been collected into this supplement, and cover the three years up to the end of 2008, though many reports (including my own for the UK!) were prepared several months into 2009, so might contain information straying into 2009. This is not a problem.

Each report has required more or less editing, at the very least to attain a modest uniformity of style, though I've kept editing to a minimum. Several reports were received in plain text in emails, so modifiers of the basic Roman alphabet characters (e.g. á, ç) will have been absent – I hope that I've put all of these back. If there are any mistakes or obscurities please let me know as soon as possible and I will make amends.

To enquire about specific points in a report please contact the National Liaison directly.

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### JAPAN

#### *School Education*

The current National Curriculum Guideline, effective since 2002, is characterized as oriented towards a "relaxed education". It has only a total of 640 hours on science education from elementary school to junior high school. The only astronomical topics taught in elementary schools are, changes in the position of the shade and the state of the Sun and the ground at the 3rd grade (age 9), and observing the Moon and stars, their positions, and the brightness and colors of the stars at 4th grade (age 10). Not even the rotation and revolution of Earth is covered. In junior-high, the topic of the movement of Earth, and increased understanding in the characteristics of the Sun and about the Solar System is taught. Though stars are somewhat covered, neither the Milky Way Galaxy nor the Universe as a whole is covered. In high school, astronomy is taught within the subject of Earth science, but only around 10% of the students take this subject.

A new National Curriculum Guideline for elementary schools and junior high schools has been published in spring 2008. A new version for high school is also planned to be published in spring 2009. Same topics such as the waxing and waning of the Moon have been brought back, and study hours are planned to be increased.

#### *Continued Learning*

The Japanese Museum Act was revised, and there was a large change in the position of continued learning institutions and training of staff. Unfortunately, many continued learning facilities involved in astronomical education (such as planetariums and public observatories) do not meet the requirements set forth in the Museum Act, and are not registered.

In 2006, the three planetarium related organizations that existed in Japan merged and the Japan Planetarium Association (JPA) was founded. Currently, there are more than 350 permanently installed planetarium facilities in Japan. The over 400 public observatories in Japan have founded the Japan Public Observatory Society (JAPOS) on July 2005.

#### *Academic Associations*

In 2008, the Astronomical Society of Japan (ASJ: <http://www.asj.or.jp/index.html.en>) celebrated its 100<sup>th</sup> year from foundation, and many events were held, such as commemorative publications (100

Years of Astronomy in Japan, 17 volumes of Modern Astronomy, etc), and the issuing of commemorative stamps. ASJ is expected to continue to act as a center for astronomy education and popularization. Currently ASJ has 17000 full members, and, adding associate members, corporate members and supporting members, it has a total of about 30000 members.

Also, the Japanese Society for Education and Popularization of Astronomy, which held its 20<sup>th</sup> Astronomy Education Conference in 2006, is starting to play an important role in astronomy education in Japan along with ASJ, JPA, JAPOS, etc.

### ***Topics***

The definition of planets of the Solar System established by the IAU General Assembly in August 2006, gained strong attention from the populace of Japan, and was reported for many days on newspapers and TV.

The Subcommittee for the Consideration of names etc. of Celestial Bodies within the Solar System was established within the Science Council of Japan Physics Committee, IAU Subcommittee, and continued its deliberations until June 2006. Celestial bodies beyond Neptune were to be called Taiyoukei-Gaien-Tentai in Japanese, and dwarf planets jyun-wakusei. It was also decided that a new category of celestial bodies that are both Taiyoukei-Gaien-Tentai and jyun-wakusei should be called meioseu-gata-tentai. A proposal to popularize the new findings about the outer Solar System were also made to various institutions in Japan, and posters and pamphlets were made to provide information to the populace.

### ***International Year of Astronomy***

The IYA 2009 Japan Committee (<http://www.astronomy2009.jp/en/index.html>) was formed under the Science Council of Japan Physics Committee-IAU Subcommittee. The Japan Committee is holding its own projects, such as: You are Galileo; Stars of Asia ([http://www-irc.mtk.nao.ac.jp/~webadm/StarsofAsia\\_E/index.php](http://www-irc.mtk.nao.ac.jp/~webadm/StarsofAsia_E/index.php)): Look up to the Sky! Ten Millions Star Gazing; and Starry Sky Book Fare. Japan Committee is also calling for groups and individuals around the country to hold their own IYA 2009 events and to start a grass roots movement.

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## **LITHUANIA**

### ***General Information***

On the basis of the ISCED scheme the following levels of education are identified in the educational system of Lithuania: preschool education (ISCED level 0), primary education (grades 1-4; ISCED 1), basic education (grades 5-10; ISCED 2), secondary education (grades 11-12; ISCED 3), post-secondary and non-university education (ISCED 4), and tertiary education ((ISCED levels 5 and 6). A compulsory module of education is comprised of primary and basic education. Students who possess certificates of secondary education are admitted to tertiary education. Here is reviewed the status of astronomy teaching in primary, basic, secondary and tertiary education, as well as in non-formal and public education.

### ***Primary education***

Some elements of astronomy are included in the subject discovering nature. These elements cover diurnal motion of the sky, motions of the Earth and the Moon, changes of the seasons, the place of the Earth in the Solar System. However, we should have in mind that teachers of this subject have no special training in astronomy or science in general, and are not capable of getting deep enough into astronomy. Important supplements to these topics are lectures offered by the planetarium of Vilnius for pupils of primary classes. However, very few schools organize excursions to the planetarium, due to their limited financial resources.

### ***Basic education***

There is no separate subject of astronomy in the curriculum of the basic schools. Some astronomical topics are included in the subject of nature and humans (5-6 grades). These topics are aimed at understanding the motions of the Moon and Earth, eclipses, the design of the Solar System, the Earth's location in the Solar System. As a rule, teachers of this subject also have no special training in astronomy or science in general. So, their competence in astronomy solely depends on their self-education. A much larger variety of astronomical topics is included in the course of physics (7-10 grades). Among these topics are gravitational interactions between cosmic bodies in the Universe, the distance scales in the Universe, the structure of the Solar System and the physical properties of its bodies, the properties of the Sun, the structure of the Milky Way galaxy, and an overview of the diversity of stars and galaxies. Evidently, a little astronomy is being taught in the basic schools of Lithuania. However, the volume and profundity of the astronomical lectures varies between various schools and is highly dependent on the competence and interests of the individual teacher. As will be pointed out later, a large number of teachers lecturing physics had no special training in astronomy or took any astronomical or astrophysical courses during their university studies.

### ***Secondary education***

Essentials of astronomy and astrophysics are also integrated into the course of physics of the last grade (12) of the secondary school. Astronomical topics covered include the nature of the electromagnetic spectrum, elements of the theory of relativity, basics of stellar structure and evolution, the physical properties of galaxies, and elements of the structure and evolution of the Universe. Again, for the same reasons as for basic education, we note that the volume and quality of astronomical lectures is highly variable between various schools, and is highly dependent on the competence and interests of the individual teacher. In addition, many teachers deliberately increase the number of lessons for pure physics at the expense of astronomical lessons, arguing that the total number of lessons is too small for the large and diverse course of physics.

### ***Tertiary education***

Two universities offer undergraduate (BSc), graduate (MSc), and postgraduate (PhD) degree studies in astronomy: Vilnius University, and Vilnius Pedagogical University. However, the annual number of graduates is small and it hardly meets the need for professional astronomers in the country. Five universities (including the two mentioned) offer studies in physics. However, in the past decade, astronomy courses have not been included in the undergraduate curricula of physics in some universities. The situation changed in 2006 when a new subject benchmark statement for physics has been adopted by the Ministry of Education and Science of Lithuania. According to this statement astrophysics is a compulsory course in the undergraduate curriculum of physics. It should be noted that schoolteachers of physics are mainly graduates from Vilnius Pedagogical University and have appropriate qualifications for teaching astronomy. However, this cannot be stated for graduates of physics from other universities. Comparing the appropriate curricula of the basic schools with those of the universities we observe some inadequacies in presenting astronomy. We are obliged to attempt to improve the status of astronomy in the teacher training curricula.

### ***Education conferences***

Seminars devoted to various problems of teaching astronomy in schools were periodically organized by two centres: the Lithuanian Youth Information and Technical Creativity Centre (LYITCC), and the Teachers' Professional Development Centre.

### ***Non-formal education***

Hobby groups of pupils interested in astronomy are being organized at the LYITCC, and at a few schools. Activities of these groups are mainly focused on self-education seminars, astronomical observations with available instrumentation, and training for Astronomy Olympiads. National Astronomy Olympiads are being organized every year by the LYITCC) with the active participation of professional astronomers from

universities. Lithuanian teams of pupils are being prepared to participate in International Astronomy Olympiads (starting 2003) and in International Olympiads of Astronomy and Astrophysics (starting 2007). It should be noted that Astronomy Olympiads stimulate the interest of pupils in astronomy and they are one of the important ways to attract young people towards a scientific career.

### ***Observatories, planetariums, and museums***

Moletai Astronomical Observatory of the Institute of Physics and Astronomy continued its professional and educational activities in the past triennium. Several times per year the observatory organized various public campaigns, such as Starry Night, or Researchers' Night, devoted to the dissemination of astronomy with popular lectures and observations of the sky objects with telescopes. The observatory also received several hundreds of excursions annually from various regions of Lithuania.

Occasional astronomical campaigns for the public, such as observations of partial solar eclipses or Researchers' Night, were also organized by the Astronomical Observatory of Vilnius University, which is located in the city. These campaigns attracted hundreds of visitors of various ages from schoolchildren to seniors.

Vilnius Planetarium of the Institute of Physics and Astronomy offered a lot of popular lectures and other activities for schoolchildren and the general public, disseminating scientific knowledge in various fields of natural sciences. About 40000 visitors attended lectures and other events of Vilnius Planetarium annually. Among the most successful, the following events should be mentioned: Saturday at the Planetarium! Earth – Life – Space, and Science, Scientists, and the General Public. However, the equipment of the planetarium is quite obsolete and needs renovation.

The Lithuanian Museum of Ethnocosmology is the exceptional kind of the museum declaring its commitment to the investigation and demonstration of relationships between cultural heritage and the development of astronomical knowledge of humanity. In 2008 it was reopened after considerable reconstruction. At the present time it has two telescopes, 40 cm and 80 cm reflectors, which are used for amateur observations and demonstrations. The Museum offers a variety of cultural and astronomical activities and public observing nights for visitors all the year round. More than 25000 visitors are received by the museum every year.

### ***Amateur astronomy***

The Lithuanian Astronomical Society unites the professional and amateur astronomers of Lithuania. During the past three years it was active in organization of various nationwide astronomical events. There are several astronomical clubs and private amateur astronomical observatories in the country. Activities of astronomical clubs were noticeable by their public demonstrations of celestial objects with telescopes in the open squares of Lithuanian towns.

### ***Public education and outreach***

It may be concluded from previous sections that all astronomical institutions, societies and clubs participate in the dissemination of astronomy among the general public. Many of them have their Internet pages devoted to popular astronomy. Many TV and radio channels broadcast occasional short reviews or interviews with professional astronomers on various topics of astronomy. The popular astronomical calendar Lietuvos Dangus (Lithuanian Sky) is being published by the Institute of Theoretical Physics and Astronomy every year. It includes not only descriptions of astronomical phenomena of the coming year, but also reviews of the most important astronomical achievements of the past years. A lot of popular articles by astronomers have been published in various national magazines and newspapers.

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## MEXICO

**Overview** Mexico is a country where only 70 % of the young population enrolls in secondary education. It has 110 million inhabitants and there are less than 200 professional astronomers.

**Elementary (primary) school** Throughout the country, astronomy education at elementary school level is not very satisfactory, in that only very basic concepts are presented, and mostly they lack practical examples for illustration.

**Secondary school** The same conditions apply to secondary school education. Programs have been updated, but it means reducing the science courses and consequently reducing the importance of astronomy even at the very basic level. Upper high school is the last opportunity to receive overall education, and in some schools it is possible to teach astronomy.

**College level** College education in Mexico is already highly specialized, so that only in some physics programs can astronomy be learned as part of the optional courses.

**Graduate programs in astronomy** There are three well established graduate programs in astronomy, and a couple more that are starting activities.

**Education conferences** This activity is well established and in the large cities there are well established education conferences programs.

**Observatories and planetaria** There are two large optical observatories, three small optical observatories and a large microwave telescope under construction. There are 38 planetaria in Mexico, distributed over the whole country. In these planetaria there are also public lectures and other astronomical activities.

**Other public events** There is an Astronomical Olympiad that is in its fifth offering. It has attracted the attention of young people and it has been attracting growing interest.

**The International Year of Astronomy 2009** All professional and amateur astronomers have been very active in this celebration. There have been conferences, radio programs, TV programs, exhibition of movies accompanied by a debate, and star parties to mark this event. The most significant has been a collective star party held simultaneously in more than 20 archaeological and historical sites that set a record of large crowds involved in astronomy related activities.

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## MOROCCO

*A lengthy report has been submitted, summarizing the astronomy activities and achievements realized since the signing of the agreement between the IAU and Al Akhawayn University in Ifrane (AUI) in 2004. It is too long and too detailed to be included here. The report Teaching for Astronomy Development (TAD) – Morocco (Activity Report 2004-2008) can be obtained from Dr Chamcham. Editor*

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## NETHERLANDS

The Netherlands Research School for Astronomy (NOVA), incorporating the astronomy departments of the universities in Amsterdam, Groningen, Leiden, Nijmegen and Utrecht, and the Netherlands Astronomical Society (NAC) are actively engaged in promoting astronomy in primary as well as secondary education. NOVA is operating the national Dutch astronomy outreach center NIC (NOVA Information Center), which employs since 2008 also an education officer in addition to the general outreach/press officer.

The NOVA Outreach website (<http://www.astronomie.nl>) has been updated and has seen an increasing popularity. Target groups are primary and secondary schools, the press, and the general public. Lots of education materials such as the ESA/ESO practical exercises (<http://www.astroex.org>) are available through this website; there's also an image bank, a semi-popular encyclopedia, a newly developed educational game for elementary schools Kids in Space, and a prize-winning interactive black hole website. Teachers can subscribe to the NOVA electronic newsletter.

Following a successful observing contest for high school students in 2005, three rounds of a national Dutch Astronomy Olympiad were organized in three successive years, by the departments in Leiden, Utrecht, and Groningen respectively.

Astronomers in Groningen won a national science communication contest in 2008. In their winning project Discover the Invisible Universe they aim to “edutain” schools and the general public on the issues of infrared radiation and infrared astronomy, focussing on William Herschel and the Herschel Space Observatory in the year of its launch – the International Year of Astronomy, 2009. A truck full of hands-on infrared experiments is part of the activities: this truck was also present at the kick-off of IYA2009, at UNESCO in Paris.

Following up on the astronomy and physics outreach and education events connected to the 2005 World Year of Physics, many more outreach and education events are being prepared for the International Year of Astronomy, 2009.

All astronomy and space related education efforts are coordinated at the national level by the Spacelink office, set up with money from the Ministry of Education. Spacelink also involves the Dutch efforts within the UNAWE (Universe Awareness) program, the Dutch Delta schools, science museums, public observatories, ESA education in The Netherlands, and so on. Many of these parties were involved in the organization of a second national teachers’ day in 2008, introducing astronomical techniques to a large group of interested high school teachers.

High school physics is currently going through major revision. Set up by the Ministry of Education, the relevant steering committee is preparing challenging astronomy/astrophysics within the high school curriculum. This curriculum is currently being tested in a number of schools; the aim is to introduce it nationally in 2012.

The Dutch government is investing in the quality and quantity of science education at all levels, from preschool to university. Professionalization of the teachers is an important element in this effort. This includes general science for elementary school teachers as well as astrophysics for mathematics and physics teachers in secondary education. Several staff astronomers are actively engaged in these efforts.

Concerning primary education, a small dedicated working group within the astronomy, biology, geography and meteorology disciplines has designed and tested at 35 schools practical exercises and materials dealing with basic nature education. Roll-out is currently being investigated as part of the governmental efforts dealt with above. The project aims to reach (eventually) all primary schools in the country.

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## **NORWAY**

### ***Overview***

Norway has a population of 4.6 million people, including approximately 600 000 students in primary schools, 200 000 in secondary schools and 200 000 in colleges and universities. School starts at age 6. The official languages are Norwegian (two official dialects, Bokmål and Nynorsk) and Sami.

### ***Elementary school***

The curriculum for primary schools has changed several times recently (1997 and 2006). At present astronomy has a prominent place in the science curriculum for grades 1 through 10, covering subjects like planets, the Sun and stars, galaxies at the introductory level.

### ***Secondary school***

The curriculum for secondary schools has also seen several changes recently (1994 and 2007). Again astronomy and astrophysics has at the present time a prominent part in the curriculum, this time as part of physics. In the first year radiation from the Universe is covered, for the two remaining years topics like stars, galaxies and cosmology are covered.

### ***College and university***

Norway has at the present time 7 universities and in addition a larger number of regional colleges. At the universities new bachelor, master and PhD programs in accordance with the Bologna declaration were introduced in 2003. A full education in astronomy and astrophysics at all levels only exists at the Institute of Theoretical Astrophysics at the University of Oslo. The number of students enrolled in master and PhD programs varies from year to year. Typical numbers are 10-15 and 10, respectively.

### ***Observatories and planetaria***

Norway has a good handful of Science Centers, most publicly financed but also some privately financed. Two of these have professional quality planetaria (Tromsø with 90 seats and the newest one at Jæren with 60 seats). In addition a number of smaller or mobile planetaria exist at the other centers. Two of the Science Centers (Horten and Hamar) have 0.5 m telescopes used for educational purposes. In addition several minor telescope sites offer services to school classes and the general public.

### ***Other public events***

Public interest in astronomy is generally high and increasing in Norway. The Norwegian Astronomical Society, which is an organization for amateurs and other interested people, has more than 3000 members, and is the largest astronomy organization in Scandinavia. The Society issues a bimonthly magazine *Astronomi*. The Society has an information service for its members and the general public.

The Institute of Theoretical Astrophysics is maintaining a website intended for the general public. The website is well visited. An annual Astro-Festival in Oslo has over the last years attracted 10 000–20 000 people.

Other arrangements in Oslo, related to special astronomical events (occultations), have been able to attract audiences in the 5000 to 10 000 range. Astronomical topics have been regularly presented every week in radio and television during the triennium.

The Institute of Theoretical Astrophysics with the sponsorship of the Norwegian Research Council is actively participating in events related to the International Year of Astronomy 2009. This includes for instance the free distribution of class sets of Galileoscopes to 1000 schools in Norway, and an astronomical photo exhibition to be displayed at different locations during 2009.

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## **POLAND**

### ***Overview***

The Polish school system remains the same as three years ago. It consists of six years of elementary school and two secondary school levels: three years' gymnasium followed by three years of high school, or lyceum. Further education can then continue at universities (usually for five years), engineering colleges (e.g. geodesy, 5-5.5 years), teacher-training colleges (three or five years), etc. Neither elementary nor secondary school levels include astronomy as a separate subject.

### ***Elementary schools***

Some astronomical information is presented to pupils in grades 4-6 (about 10-12 years old), as part of a subject called the environment. Only general information on the Sun, the Moon and planets is presented.

### ***Secondary Schools (gymnasium & lyceum)***

Astronomical and astrophysical concepts are included in two subjects: physics and astronomy; and geography. The first includes such topics as: telescopes; the kinematical and physical properties of the Solar System; stars and their evolution; the principles of cosmology, and so on. The second subject deals with the celestial sphere, coordinates of celestial bodies, time, the problem of determination of latitude and longitude, the Earth as a planet, and similar topics. In addition, some topics from the history of astronomy (Copernicus, Brahe, Galileo) appear on the syllabus of history classes.

Teachers are graduates of physics (or geography, as appropriate) and usually are not specialists in astronomy or astrophysics.

### ***College and University***

Unlike other countries, six Polish universities (Krakow, Poznan, Torun, Warszawa, Wroclaw and Zielona Gora) have dedicated five year master degree studies in astronomy. These are very similar to those for physics, with the differences appearing in the 4<sup>th</sup> and 5<sup>th</sup> year courses. Graduates who wish to stay in the field of astronomy may find jobs at astronomical observatories, planetariums, or move on to PhD courses. Some of them also find jobs at primary and secondary schools, as teachers of physics, computer sciences or mathematics.

### ***Education and conferences, public events***

Several astronomical institutes (for example, the Astronomical Center of the Polish Academy of Sciences) continue to organise special 2 to 3 day seminars for teachers.

Since 2007, dedicated conferences for teachers have been organized by the Młodzieżowe Obserwatorium Astronomiczne (Youth Astronomical Observatory) in the small town of Niepolomice, near Krakow. The conferences include: lectures given by research scientists; laboratory exercises; and astronomical observations.

Teachers and their pupils at a number of schools are very active in the international Hands-on Universe project, both using the opportunities and materials provided by the project, and creating new material which is then shared with the rest of the community.

The Astronomical Center of the Polish Academy of Sciences in Warsaw, as well other Polish astronomical observatories (e.g. Poznan University Observatory), have periodical public lectures through the year, given by members of staff. These are usually very popular. There are also annual science festivals in a number of cities organized by the universities and institutes in those cities (Warsaw, Krakow, Poznan and others). During these festivals public lectures, seminars, observing opportunities, experiments, and demonstrations are presented to the general public, and also attract wide popular interest.

Finally, public events are often organized for occasional but spectacular astronomical events. For example, special public observations were performed in institutes across the country during the partial solar eclipse on 01 August 2008, as well as public demonstration of sunspots, observations of the Moon and bright planets, and so forth.

### ***Observatories and planetariums***

Almost all Polish astronomical observatories are still open to the general public, usually once a week or once a month. During these open days astronomical observations may be performed depending on conditions, and short lectures and tours are given.

There are also approximately 10 planetariums in Poland, the largest of which are in Chorzow (in Silesia), Olsztyn and Torun. They organize daily performances, often with a topical theme.

The Chorzow planetarium is also one of the main organizers of the annual Astronomy Olympiad for high-school students. The Olympiad consists of three levels of competition. During the first, elimination, stage the pupils solve 8 astronomical problems at home and send the solutions to the organizers. The second and third parts of the competition are performed under controlled conditions, during which the pupils have to solve usually six astronomical or astrophysical problems. The winners of the national Olympiad were selected to take compete in the International Olympiads on Astronomy and Astrophysics (IOAA) in Thailand (2007) and Indonesia (2008).

### ***Amateur Astronomy***

The Polish Amateur Astronomical Society (PTMA) was founded in 1921. Currently it has approximately 950 members. Many are interested in astronomical observations, particularly the occultation of stars by the Moon and planets, variable stars, sunspots, etc. Some specialise in astrophotography, with very good results. Since 1922 *Urania* has been the official journal of the Society. Currently published six times a year, it contains articles and notes on astronomy, as well as information on current events in the sky. Many of the contributors are professional astronomers and astrophysicists, writing about their own areas of research.

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## **PORTUGAL**

### ***Overview***

In the period covered by the present Report, the activities in astronomy continue to increase in all the areas: school education at the different levels, promotion of astronomy through several strategies, research projects and research programmes and active participation of professional astronomers in the more advanced international organizations. The good conditions for a direct contact between astronomers, both professionals and amateurs, and students, teachers, and the public in general were maintained, with a large increase in the number of opportunities for such contacts. This is due not only to the introduction of new astronomical topics in school curricula and of astronomy teaching at more universities, but also to the organization of new amateur astronomical groups and to the activity of the Portuguese Astronomical Society, all strongly devoted to the dissemination of knowledge.

### ***Elementary school***

At this level, astronomy is included in the disciplinary areas of environmental studies (1st cycle) and physical and natural sciences (3rd cycle). It is associated with the subject the Earth in space, with the aim to allow young students to understand the position of the Earth in the Universe and its relation to the Solar System, as well as the phenomena depending upon the Earth motions and the way they interfere with life on the planet. More and more school teachers are looking for advanced education and updating in astronomy, including participation in specific postgraduate university programmes for astronomy.

### ***Secondary school***

At the secondary school level, astronomy is included in the curricula of chemistry and geology. In *From the Stars to the Atom – From Where are the Chemical Elements Coming?*, the program starts from the Big Bang to reach the updated model of the atom. It is intended that the students, in an integrated approach, understand the planet where they are living, and from where the elements are coming. In the geology component, the aim is to study the relation of the Earth to the Solar System, by comparing its special characteristics to those of other planets, and pointing out its vulnerabilities in terms of the environment. Several elementary and secondary schools were directly involved in projects and activities related to Astronomy, in cooperation with universities and research centres, or within the framework of *Ciência Viva* Centres. As a result, the interest of school teachers in astronomy continues to increase, with resulting visits to astronomical centres, invited lectures, demonstrations, and night sky observations. Also, more and more schools are getting their own telescopes and, as was said before, more teachers are looking for postgraduate education in astronomy.

### ***University***

In the academic year 2007/2008, all the BS and MSc degree-courses in Portuguese universities were adapted to the principles of Bologna agreement: 1<sup>st</sup> cycle (3 years), for BSc degrees; 2<sup>nd</sup> cycle (2 years), for MSc degrees; 3<sup>rd</sup> cycle (3 to 4 years), for PhD.

Some of the Portuguese universities offer specific MSc degrees and have special programmes for PhD degrees in astronomy. In the period covered by the present report, within not only in the present structure but also in that mentioned in previous reports (until 2007), the number of students with a diploma in astronomy continue to increase. Many of them proceed to higher education in universities, both in the country or abroad. Several go to international centres, through organizations of which Portugal is a member, to get specialization. As a consequence, the number of people with PhD degrees in astronomy is still increasing greatly. Some other universities teach astronomical subjects within the curricula of their degree courses and have been active in their promotion. All of them cooperate actively with elementary and secondary schools to develop the interest of the students in astronomy. Finally, astronomy continues to be taught in military schools.

### ***Education conferences***

During the period covered by the present report, conferences were organized on a regular basis, by some of the universities, observatories, research centres, *ciência viva* centres, planetaria, and the Portuguese Astronomical Society. The topics belong to different areas of astronomy and related sciences, from physics and Earth sciences to galactic astronomy and cosmology, including modern observation techniques.

### ***Observatories and planetaria***

Astronomical observatories, research centres and planetaria provide, all through the year, regular activities for the promotion of astronomy among the public in general, to support schools and teachers, and to contact the press. These activities are carried out in different ways: regular presentations, mini-courses, publications, observation of celestial bodies, etc. Such organizations also provide some services through the Internet, including some services on-line.

## *Amateur astronomy*

Amateur astronomical groups continue to be organized all over the country. Some have their own means for astronomical observations, sometimes by building small observatories, and all are very active in organizing special events for the promotion of astronomy. They also cooperate with schools and professional astronomers.

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## **RUSSIA**

### *Important editions of books and multimedia productions*

- 1) Kulikovskiy P G. The Amateur Textbook of Astronomy. Editor V G Surdin. The 6<sup>th</sup> edition, corrected and completed, 2009, 704 pages.
- 2) Astronomy: The 21<sup>st</sup> Century. (2<sup>nd</sup> edition corrected and enlarged). Editor V G Surdin. Friasino: The Century 2, 2008, 626 pages.
- 3) A V Zasov and E V Kononovich, Astronomy. A school textbook. Moscow, Fizmatlit, 2008, 256 pages.
- 3) V G Surdin has initiated a new series of educational books on astronomy and astrophysics. Among them are
  - The Sky and Telescope, M Fizmatlit, 2008, 424 pages.
  - Solar System, M Fizmatlit. 2008, 400 pages.
  - Stars. M Fizmatlit, 2008, 428 pages.
- 4) N N Gomulina and V G Surdin elaborated a special CD course, The Opened Astronomy for the middle school, edited by FYZYCON (Dolgoprudnyj, a region of Moscow)
- 5) A group of authors. RedShift 5.1 (in Russian) CD planetarium Maris Multimedia, 2 CD discs.
- 6) A V Zasov and E V Kononovich, Astronomy. A school textbook, 256 pages. Moscow, Fizmatlit 2008.

### *Teaching*

Petersburg astronomers have succeeded in entering the astronomy course in the obligatory city program of the high schools. But really the astronomy is taught only in several schools. In the other ones neither the teachers, nor the pupils of the senior classes have the time to acknowledge the cosmic problems.

V G Surdin from Moscow Sternberg Astronomical Institute in August 2008 has delivered several lectures in astronomy in South Korea for the senior schoolchildren at Pentek, and edited the book Lectures on Cosmography in the Korean language (Pentek, South Korea, 2008, 110 pages).

### *Olympiads on astronomy for schoolchildren*

There are a lot of astronomical olympiads organized in Russia: regional, district, city, local, All-Russian (internal, correspondence and so forth), local international, general and regional, (for example, the Asian Pacific Astronomical Olympiad). In October 2008 in the International Olympiad in Trieste the Russian team gained the second place. South Korea gained the first place evidently due to the special lectures delivered by professor V V Surdin from Moscow University Sternberg Astronomical Institute. Evidently these August lectures helped the team obtain such good results. Traditions in this area are rather strong: the Moscow Astronomical Olympiads have been organized without breaks since 1947. The St Petersburg Olympiads are also very successful.

Detailed information (in Russian and English) about astronomical olympiads, including details about the opportunity to participate, can be found at <http://www.issp.ac.ru/iao/>. Information on the Russian Astronomical Olympiad is available at <http://www.astroolymp.ru>.

## *Universities*

Students graduate at the Faculty of Astronomy and Geodesy of the Physical Faculty of the Ural University, which is equipped with modern astronomical and geodetic equipment and computer facilities. Reception is conducted in the daytime, and in a speciality, Information Systems and Technologies, in the daytime and the evening.

The students training in astronomy, receive education on general and spherical astronomy, celestial mechanics, theoretical and practical astrophysics. They also get acquainted with modern space physics, study the newest methods of storing and processing observational data, and take part in basic scientific subjects in the Faculty and the Astronomical Observatory. Topics include physics of the Galaxy, physics of the Sun, star clusters, evolution of stars, physics of the interstellar environment, astrometry and celestial mechanics.

Students specializing in astronomical geodesy get acquainted with the modern methods of constructing the coordinate system over the Earth and in space, definitions of the external gravitational potential, surfaces of the the Earth and planets, learn how to work with modern geodetic equipment, study the modern satellite technologies used in geodesy, and master modern computer technologies.

There are social pressures to change the style of management of the modern geo-information control system. Students studying the information systems and technologies of knowledge and skills in creating the digital maps, cadastre information systems, and banks of geographical and topographical data and geo-information control systems, get acquainted with the global information resources and networks needed to protect and maintain the information by the methods of reception and use of the results of remote sounding of the Earth.

Students graduating from the Faculties of Astronomy and Geodesy can work practically in all astronomical establishments of Russia: the Institute of Astronomy of the Russian Academy of Science; the Shternberg Astronomical Institute in Moscow; the Special Astrophysical Observatory of the Russian Academy of Science; the Radio-Astronomical Observatory of the Physical Institute of the Russian Academy of Science; the Institute of Applied Astronomy of the Russian Academy of Science; the Pulkovo Main Astronomical Observatory of the Russian Academy of Science; the Astronomical Institute of the St Petersburg State University; the Kourov Astronomical Observatory in the Urals; the Institute of Geophysics; and many other institutes.

## *Conferences*

At conferences it is planned to discuss both the fundamental and applied value of astronomy, problems of interaction of astronomers with the public and with bodies of the government and mass-media people including a lot of amateurs of the astronomy. Survey lectures delivered by well known astronomers are included in the program of conferences on popular problems, such as the search for life in the Universe, searches of new forms of matter, comet danger, and so forth.

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## **SERBIA**

### *Overview*

In the last three years there were a lot of activities in astronomy education at all levels. After 17 years of efforts to re-introduce astronomy as a compulsory course in secondary school curricula, in 2008 the goal was finally achieved and the return of astronomy in the schools announced. A system of academic degrees introduced by the Bologna process and the new European Credit Transfer System (ECTS) are now implemented at all universities in Serbia. In this report due attention is also paid to the activities of numerous

amateur astronomical societies (four new amateur associations were founded), as well as to the success of the Serbian team at the International Astronomy Olympiad in the past three years.

### *Elementary (primary) school*

Astronomy topics in elementary schools are incorporated in other subjects (natural history, geography and physics). Within the current reform of primary school education, two astronomy supplementary lectures: Interesting Things in Astronomy and Kepler's Laws and the Solar System, have been added to the 7<sup>th</sup> year physics course curriculum.

### *Secondary school*

Astronomy is included in the secondary school curricula, but neither as a separate nor as a compulsory subject. From 1969 to 1990 astronomy in secondary schools was taught as a fourth year, one hour per week, course. After 1990 astronomy topics became part of the fourth year physics courses. Astronomy is being taught as a separate course only at the Belgrade Mathematical High School and at seven other high schools throughout Serbia.

Within the current reform of secondary school education, astronomy is expected to be reintroduced in the 4<sup>th</sup> year of secondary schools as a separate and required, one hour per week course.

In order to assist secondary school teachers to keep up with achievements in astronomy and methods of teaching astronomy, lectures on subjects related to astronomy are given at regular annual meetings of physics and astronomy teachers.

### *Petnica Science Center*

Special emphasis should be put on the activities of the Petnica Science Center (PSC) for talented students interested in science (<http://www.psc.ac.yu>, <http://pi.petnica.rs>). This is the largest independent and non-profit organization (founded in 1982) for extramural scientific education in south eastern Europe. The majority of programs are dedicated to secondary school students, but there are programs for elementary school pupils, undergraduate students, and high school teachers as well. The PSC is also very active in the preparation of the Serbian team for the International Astronomy Olympiad, particularly in the practical training activities.

For secondary school students the PSC organizes two cycles of seminars in astronomy. Each cycle consists of 4 seminars (winter, spring, summer, and autumn) per year, lasting for an average of 7-8 days with about 25 participants. The first cycle is of an educational character. The students learn about various astronomy topics, observational techniques and methods of research, data analysis, the use of astronomical instruments and data presentation. Participants of the second cycle complete their independent observational/research projects. The seminars within the second cycle are intended to support their work. Selected research projects are presented at conferences of the PSC participants, A Step into Science, each December, and published in Petnica Notebooks. In the last three years the PSC published three volumes of Petnica Notebooks with 12 papers related to astronomy.

The participants and young collaborators of the PSC attend the International Meteor Conferences, the Summer Schools of Astronomy in Visnjan (Croatia), Summer Schools X Lab in Germany, the Weizmann Institute in Israel, etc. In the last three years the Petnica meteor group organized 15 camps and various observational activities.

### *International Astronomy Olympiad*

The participation of Serbia in the International Astronomical Olympiad (IAO) was initiated in 2002 by Prof J Milogradov-Turin, then the president of the Society of Astronomers of Serbia (SAS). Members of the National Astronomical Olympic Committee (NAOC) do the training, testing and selection of the

participants. In the last three years the senior and junior team won four gold, four silver, eight bronze medals and one special prize.

### ***University***

Astronomy topics are taught at all five state universities (Belgrade, Novi Sad, Niš, Kragujevac and Kosovska Mitrovica). The Universities of Belgrade and Novi Sad offer graduate studies in astronomy.

The University of Belgrade is still the only university in Serbia with a separate Department of Astronomy (in the Faculty of Mathematics). Students can choose to major in astronomy or in astrophysics starting with the first year of study. In the previous three years, 20 students graduated in astrophysics and 3 in astronomy (61% of the graduated students in the last three years are women). Ten postgraduate students received their MSc degree and four students the PhD degree. A new study program for astronomy and astrophysics that includes the ECTS has been introduced starting from the 2006/2007 academic year. The model 4+1 for the first two degrees (bachelor and master) was accepted. The PhD studies consist of compulsory and optional courses taken during the first two years and PhD thesis work starting in the third year.

At the University of Belgrade astronomy courses are also taught as: (1) a compulsory one-semester course Fundamentals of Astrophysics for the 3<sup>rd</sup> year physics students of the Faculty of Physics (physics teachers division), (2) a compulsory course Geodetic Astronomy (4<sup>th</sup> year of study) at the Faculty of Civil Engineering, and (3) a one-semester optional course Fundamentals of Astronomy for the 4<sup>th</sup> year students of mathematics at the Faculty of Mathematics.

The Department of Astronomy continues to organize regular seminars on different topics in astronomy every second Tuesday during the academic year. Seminars are also held on Wednesdays at the Astronomical Observatory in Belgrade.

The Department of Physics at the Faculty of Natural Sciences of the University of Novi Sad founded an astronomy study group in the 2002/2003 academic year. They introduced the new ECTS and accepted the model 3+2. So far, 6 students have graduated from the Department of Physics at the University of Novi Sad (three with the diploma Teacher of Physics and Astronomy, and three with the diploma Physicist - Astronomer).

The Faculty of Natural Sciences' Institute of Physics at the University of Kragujevac offers a one-semester compulsory course Astrophysics and Astronomy for the third year students of physics. These students use a Carl Zeiss Telescope 150/2250 and a 200/1000 Newton telescope at the Astronomical Observatory that belongs to the Faculty.

The Faculty of Natural Sciences' Department of Physics at the University of Niš offers a one-semester compulsory course Fundamentals of Astrophysics in the third year of study. A new optional course Fundamentals of Astrophysics with Astrobiology has been introduced to the third semester undergraduate students at the Department of Biology.

At the University of Priština (since the academic year 2002/2003 in Kosovska Mitrovica) a one-semester 2-hour per week course Fundamentals of Astronomy and Astrophysics is taught to the second year students of physics.

A university textbook Theoretical Bases of Radio astronomy by Dejan Urošević and Jelena Milogradov-Turin was published in 2007.

### ***Education conferences***

School teachers can learn about advances in astronomy and new way of teaching astronomy in lectures presented at annual meetings of physics and astronomy teachers organized by the Society of Physicists of Serbia. A regular section dedicated to astronomy education is included in the National Conferences of Astronomers organized by the Belgrade Astronomical Observatory and the Department of Astronomy at the

University of Belgrade. The staff of AS Rudjer Bošković took part in the Festival of Education with several lectures held in the Planetarium.

### ***Observatories and planetariums***

The Astronomical Observatory in Belgrade, founded in 1887, is one of the oldest scientific institutions in Serbia. Building of a new astronomical station at the Belgrade Astronomical Observatory on the mountain Vidojevica near Prokuplje at an altitude of 1155 m is nearly completed. Initially, the station will be equipped with the Astro Optik (60 cm aperture) reflector, and later hopefully with a bigger, more powerful instrument.

There are also several small public observatories that belong to amateur astronomical societies in Belgrade, Novi Sad and Kragujevac.

There are two planetariums in Serbia: the planetarium of the AS Rudjer Bošković in Belgrade (opened in 1970) and the planetarium of the AS ADNOS in Novi Sad (opened in 2001). Planetariums are visited mainly by the students of elementary and secondary schools. The number of visitors in the years 2006-2008 was fairly constant with roughly 100 000 people per year.

### ***Public outreach and amateur astronomy***

Public astronomy education in Serbia is realized through various lectures, radio and TV programs, popular journals and books, lectures in two planetariums, in public observatories, and by means of various activities (public observations of major events, courses, conferences, schools and camps) of 17 amateur astronomical societies (two in Belgrade, two in Novi Sad, Valjevo, Kragujevac, Niš, Zrenjanin, Vršac, Bor, Prokuplje, Loznica, Knjaževac, Novi Pazar, Ivanjica, Pančevo, Bačka Palanka). Within the last three years, four amateur societies were founded. All the societies offer educational programmes for the general public, ranging from star parties to classes on how to use a telescopes and public lectures.

The largest and the oldest society of amateur astronomers is the AS Rudjer Bošković of Belgrade, founded in 1934. The non-profit astronomical journal Vasiona (The Universe), published by the Society, has a 56 year long tradition. The Society organizes Astronomy Courses for Beginners each autumn and spring, the Belgrade Astronomical Weekend (BAW) every June, a special topics meeting tSummer Astronomical Meeting, and summer schools of astronomy, lasting 7 to 8 days. The Society has an important role in several projects related to the IYA2009.

Since 1998 the largest astronomical web site in Serbia, Internet magazine Astronomical Magazine (<http://www.astronomija.co.rs>), has been maintained by the AS Lyra of Novi Sad. The AS Lyra is also involved with publishing of the magazine Astronomija since 2003. The Society organizes the Messier marathon as well as astronomical camps (on Fruška Gora mountain) lasting three days. Participants come from Serbia, Macedonia, Bosnia and Herzegovina and Croatia.

The astronomical group within the Natural History Society, Gea, founded in 1999 in Vršac organizes the astronomical meetings of Vršac (AMV) every year.

The AS Andromeda in Knjaževac, founded in 2003, organizes autumn and spring Schools of Astronomy. The 2nd Spring School (March-May 2006) was dedicated to the 150<sup>th</sup> anniversary of Nikola Tesla. Within this School an inter-regional quiz Think like Tesla was held in May 2006.

The AS Univerzum in Bačka Palanka, founded in 2006, was the only astronomical society from Serbia that took part in the international Sidewalk Astronomers events (in honor of John Dobson) in 2007 and 2008.

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

Due attention should be paid to numerous lectures that are often given in Kolarac Foundation in Belgrade on the latest news in astronomy.

### ***Other public events***

In 2006 the activities of the societies focused on the total solar eclipse of 29 March. Every society arranged public viewings, and several societies organized expeditions to Antalya (Turkey). Other major events observed were the partial lunar eclipse on 07 September 2006, the occultation of Venus on 18 June 2007, the eruption on the comet 17P/Holmes on 03 November 2007 and the total lunar eclipse on 21 February 22008.

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## **SPAIN**

### ***General information***

Outreach and informal education has been increasing in Spain in the last few years. In general, within the strategic plans for the years to come of the majority of scientific institutions and universities, there exists a programme for informing society about what they are doing. Of course this situation is also reflected in the astronomical institutions, observatories and planetariums that are developing an important task in this area. In particular the opportunity created by the International Year of Astronomy 2009 has helped to promote this new approach to astronomy topics.

### ***School education***

The situation in secondary and primary schools is similar to that in the last report. Astronomy appears briefly and is distributed throughout several subjects. Sometimes teachers go to a planetarium with the students in order to cover the astronomical lessons. There are some planetariums that offer very interesting material for teachers in order for them to prepare the visit previously in the school, and in this case the visit is more advantageous for the pupils.

Education of teachers does not exist as a coordinated structure. Normally teachers do not have special knowledge in astronomy and if the teachers have problems in finishing the syllabus, the simplest solution is to reduce the astronomy parts to a minimum. A teacher does not like to teach something that he/she does not feel sure about, and astronomy is a case in point.

However, children and teenagers are interested in knowing more about astronomy. The contests *Adopta una Estrella* organised by the Spanish National Research Council CSIC, the Spanish Foundation for Science and Technology, the Royal Spanish Physics Society RSEF, the Royal Spanish Mathematical Society RSME and the Spanish Open University UNED, are increasing in importance every year. This competition began as a national project and is now an international event for all Spanish and Portuguese speaking countries. The number of participants and countries involved increases every year and the quality of the reports has been excellent, in general. This project is coordinated jointly with the European program *Catch a Star*.

The first prize is a trip to one of the astronomical centres of CSIC in Spain for all the members of the winning team. Also, several telescopes and astronomical material are given to the participating teams.

The Spanish Association for Teaching Astronomy ApEA continues its activities organising a national conference every two years. Since the last report ApEA has organised the 7<sup>th</sup> edition in La Laguna in Tenerife (Canaries Islands) in the Museo de la Ciencia y del Cosmos. Currently, they are preparing the meeting for 2009 in Cuenca.



Connecting young people to astronomy: Adopt a Star (Adopta una Estrella)



Discovering astronomy through Adopt a Star (Adopta una Estrella)

### ***University and other higher education***

In Spanish universities astronomy appears as a speciality in physics or mathematical degrees. It is also possible to study astronomy in other degrees, for instance in engineering as an optional subject, generally in the final years of the degree courses. At present, the interest in science degrees is decreasing in percentage terms in our country. It looks as though events are going in a similar way in neighbouring countries; young people are now more inclined to study humanities or social sciences instead of science degrees.

Astronomy research in Spanish universities is proceeding on similar lines to that in previous decades and the majority of astronomers active in research in Spain are still mainly found in the universities. The astronomers' research at the university has been traditionally centred on basic science but there is a clear trend pointing towards the implication of Spanish universities in technological projects, both national and international, both ground-based and space-borne.

## ***Education for the General Public***

Public education in astronomy is mainly carried out by planetariums and science museums. But all the entities related to science have their strategic plans for the future and these plans include outreach and informal education to general audience.

During 2008 the plans for 2009 were produced in a positive manner in order to prepare for this important event at all levels. It has created a National Node integrated in the IYA2009 of the IAU that is working in a very active way.

## ***Science outreach***

Astronomy has a strong appeal among the general public and during recent years a significant shift in public interest can be perceived, in favour of bio-medical matters. In spite of this, astronomy keeps its standing in the forefront in terms of the number of publications on popular science, mass media coverage and presence in science museums. The number of amateur astronomers in Spain seems to be currently stalled, but their activity on the Internet is growing. Astronomy news in the Spanish media is dominated by sources and agencies from the USA. This situation brings about some problems because this situation fails to show the relevance of other institutions, organizations and observatories in which Spain is participating (ESA, ESO, IAC, and others).

In 2008 the main project for astronomy communication is the future IYA2009. The Spanish Node has been organised by a Coordinating Committee and the National Working Group. Also, more than 80 representatives from different institutions related to research and communication in Spain are involved. These groups of representatives have generated a network to cooperate with the Spanish Node in the programme. Also a set of 132 institutions are supporting the work of the Spanish node. The President of the Committee of Honour is HRH Felipe de Borbon, Principe de Asturias. This Node is organising and promoting a big number of different activities to carry out in 2009 in Spain.

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## **TURKEY**

### ***Overview***

Four universities in Turkey provide undergraduate and graduate courses in astronomy and six more universities offer graduate studies in astronomy and astrophysics within physics departments. Public interest and amateur activities in astronomy, as well as teaching in schools, is growing fast, especially after the establishment of the Turkish National Observatory in 1997.

### ***Turkish Astronomical Society***

The Turkish Astronomical Society (TAD), which has over 100 members, was re-organized in 2006 to deal with the promotion of astronomy and public outreach. The main aim of TAD during the last three years has been training of school teachers at national and local levels. TAD has collaborated with universities in holding the professional bi-annual astronomy meetings, with separate sessions for amateur astronomy. TAD organized, in collaboration with the IAU, the 30<sup>th</sup> International School for Young Astronomers, 01-22 Temmuz 2008, Istanbul.

TAD has begun planning for the 2009 International Year of Astronomy.

### ***Primary and Secondary Schools***

In the Turkish school curriculum, astronomy was taught on its own at the secondary level (high school or lycée) (age 15-18 years) before 1974. Since then, until 2006, astronomy was taught in primary school as topics in geography and the elementary science course, and in the secondary school the basics were included in the physics course. Beginning with 2006, all the astronomy topics previously taught in the primary education as parts of other subjects are collected under The Earth and the Universe in a new program called Science and Technology Course. The work on the secondary school program is continuing.

Additionally, some advanced topics in mathematics and physics are taught in the so-called science lycée program, including elementary calculus, Doppler effect, black body radiation, constituents of matter, special relativity.

By the end of 2008, 7 schools had their own observatories or telescopes, used for teaching astronomy to their pupils. The number will certainly increase in the future.

### ***Special programs for school teachers***

The Turkish National Observatory (TUG) organized a special meeting aimed at in-service training of school teachers (120 teachers from all over Turkey) during the total solar eclipse of 29 March 2006, called Teaching Astronomy and Using Astronomy to Teach Physics. (An account of the meeting is given in Z Aslan and Z Tunca, Innovation in Teaching/ Learning Astronomy, IAU Special Session (SPS2), Cambridge University Press, ed. J Pasachoff, chapter 38, pages 272-275.)

This has been a starting point for similar teacher training programs in three universities, Ege University (Izmir), Sabanci University (Istanbul), and Istanbul Kultur University (Istanbul), partly supported by the Science and Society Project of TUBITAK (Scientific and Technological Research Council of Turkey). A communication network among more than 500 school teachers has now been established. This will continue.

### ***Undergraduate and graduate education***

Four universities in Turkey (Ankara, Istanbul, Ege, and Erciyes Universities) have astronomy departments providing both undergraduate and graduate education leading to a degree in astronomy. Six other universities offer fundamental astronomy courses in undergraduate level and graduate programs within physics departments. The graduate education (MSc and PhD) programmes consist of a syllabus mainly parallel to the topics of the research areas of the staff members. Several universities also offer courses in introductory astronomy, usually planned for non-science students.

Both undergraduate and graduate students in Ankara, Istanbul, Izmir, and Canakkale universities have access to telescopes and observing facilities at their university observatories. The graduate students have access also to the advanced facilities of TUG.

There was no teaching or research in radio astronomy in Turkish universities until 2006, when Erciyes University (Kayseri) started a course in radio astronomy. A small radio astronomy observatory is being established in the university campus and site selection work was started in 2008 for a national radio astronomy observatory.

### ***Observatories and planetaria***

In Turkey, there are several university observatories which offer access to the public and to school students. The observatories of the Ege University, Ankara University, Canakkale University, and TUG are the main observatories. The first three perform intensive educational programs both for the schools and the public (see the section *Public education and outreach* below).

For example, the number of schools visiting the Ankara University Observatory during the interval 2006-2008 is 179, and the total number of pupils is 15052. An educational support activity to science classes of primary and mid-schools is organized on demand in an appointment scheme. Ege University Observatory also produces special programs for hundreds of elementary and secondary school teachers and students.

There are also similar activities open to the public, but on a smaller scale, by a few schools with an observatory, or other groups with a telescope or a planetarium, such as Maritime Lycée, Izmir Space Camp.

### ***Amateur Astronomy***

Amateur astronomy in Turkey is growing fast in recent years. Many universities have amateur astronomy groups composed of students with an academic advisor. Some are endowed with telescopes up to 0.4 metre aperture, some with CCD detectors. An amateur group in Bursa is developing skills in telescope making. Several groups of amateur astronomers have developed experiences for scientific outreach using web sites. Istanbul Kultur University organized an Amateur Telescope Making Workshop 10-14 July 2007, with the participation of an expert, Mr Dick Parker, followed by an Amateur Astronomy Symposium, 15-17 July 2007.

### ***Public Education and Outreach***

The Turkish National Observatory (TUG) and Bilim ve Teknik (a popular science magazine) jointly started a National Night Sky Festivity in 1998, soon after the inauguration of TUG. This is held every summer in a pre-selected region in the country. Public interest in astronomy is increasing fast ever since.

The popular and educational activities, mainly of the Ege University and Ankara University observatories, partly supported by the “TUBITAK’s Science and Society Project” during 2006-2008, offered the following.

- a) Public Nights: A one day/night activity each month, mainly from March to October.
- b) Special Events: A one day/night activity on the occasion of an astronomical event (eclipses, comets, meteor showers etc.).
- c) School visits: An educational support activity to science classes of primary and mid-schools (organized on a demand/appointment scheme).
- d) Astronomy camps.
- e) Radio and TV programs.

The activities of the Ege University Observatory (EUO) is noteworthy: a popular night-time public program includes a presentation, observing through a 30 cm telescope with assistance from a telescope operator. Visitors can get fine views of the Moon, the planets and some of the best-loved features of the night-time sky.

EUO also operates a one-week national public outreach program. Educational programs are designed to inspire and motivate students and are suitable for ages 8–18, vacation care, tertiary, and adult education students. Programs are also available for groups who have special needs and access requirements. All educational programs are conducted by highly trained astronomy educators. Students are encouraged to ask questions throughout the courses. The courses include exploring the heavens, astronomical concepts, stargazing skills (choosing and using a small telescope), the Sun, variable stars, stellar evolution, Universe, cosmology, and life in the Universe. Up to now about 800 participants completed these courses.

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## **UKRAINE**

### ***Overview***

In the past astronomical education in the Ukraine was very well organized and developed. Unfortunately, after the collapse of the Soviet Union this field of activity suffered from the absence of the deserved financing and trained personnel. Nevertheless, despite these troubled times astronomical education survived, although in a limited volume. It is now supported by some university astronomical departments,

observatories (belonging to Ministry of Education and Sciences and Academy of Sciences of Ukraine), and astronomical societies (professional and amateurs).

### ***Primary school***

Some basic knowledge is given to children in the primary school within the program of the disciplines of the natural sciences. Astronomy is a part of these regular disciplines. Unfortunately, the teachers of the elementary school have no special astronomical education, and thus they cannot provide the necessary firm astronomical ground. Nevertheless, many teachers are interested in astronomy, and they try to find any possibility to acquaint children with astronomical news. More easily this can be done in big Ukrainian cities where planetariums or university departments of astronomy can afford such a possibility. For instance, in Odessa, the University planetarium accepts a few thousand pupils during the year, and provides professional lectures on astronomy. Unfortunately, for the majority of Ukrainian schools in the countryside this is not possible.

### ***Secondary schools***

Astronomy, as an independent subject, is being delivered in Ukrainian secondary schools in the 11<sup>th</sup> grade. The total number of lessons per month is four. The main problem for the great majority of the schools is an absent of the qualified teachers of astronomy. In the best cases astronomy lessons are delivered by teachers of physics, but only a small proportion of those teachers had attended, during their University years, some astronomical courses. (Normally, at present time in the national universities such a course on astronomy/astrophysics is delivered to the students of the third year in the physics department, but only during one semester). In many cases astronomy in the school is delivered by teachers of chemistry, mathematics, or is not delivered at all. Now, the Ministry of Education and Sciences of Ukraine is preparing reform of astronomical education. According to this reform astronomy will also be delivered in the 12<sup>th</sup> grade of the specialized physical-mathematics schools.

At present there are two new textbooks on astronomy for the secondary school that were issued during the last few years.

### ***Universities***

Astronomy as an independent subject exists in the following Universities: Kiev National University (KNU), Odessa National University (ONU), Kharkov National University (KhNU), Lviv National University (LNU), Tavrian National University, Prikarpatian National University, Nikolaev State University, Kherson State University, Tcherkassy State University. But only in KNU, ONU, KhNU and LNU astronomy is a separate specialty among others and these Universities have astronomy departments. In these universities professional astronomers are prepared starting from the first university year and lasting for 5 years in total (starting from the third year in LNU, and thus for 2 years).

In other universities any student of the physical (or physical-maths) faculty can select astronomical disciplines and can prepare qualification work, but in the diploma there will not be written “astronomer”.

### ***Education conferences and astronomy events in the Ukraine***

There is an annual conference, Modern Astronomy for Teachers of Physics and Astronomy, at the Department of Astronomy of Odessa National University, Regional Council of Odessa, Odessa.

Table 1 lists annual events for school pupils only.

Table 2 lists the annual events for students, school pupils, and young amateurs of astronomy.

In both tables only the latest events are indicated.

*(After the Tables other astronomy events are listed. Editor)*

Table 1 Annual events for school pupils only.

Date	Event	Organizer	Status, region or city	Number of participants
11-13.02.2008	Conference of the section of the Minor Academy of Sciences	Odessa Regional Authority of the Education and Science, Odessa Regional Humanitarian Center of the Non-school Education and Training	Odessa Region Odessa	Up to 30
15-20.04.2008	Conference of the section of the Minor Academy of Sciences	Ministry of the Education and Science	Ukrainian Kiev	Up to 30
26-27.01.2008*	Astronomical tournament	Astronomy Dpt of ONU, Intellectual Forum of Ukraine, Regional Humanitarian Center of the Non-school Education and Training	Odessa Region Odessa	Up to 50
5.02.2008	Regional contest Cosmos	Regional Humanitarian Center of the Non-school Education and Training	Odessa Region Odessa	Up to 30
28-30.10.2008	Ukrainian contest Peaceful Cosmos	Ukrainian Aerospace Association of the Young People Suzirya (Constellation)	Ukrainian Kiev	Up to 100
23-24.03.2008	Ukrainian contest Cosmic Fantasies	Ukrainian Aerospace Association of the Young People Suzirya (Constellation)	Ukrainian, Kiev	Up to 100
12.12.2007**	Tournament of the Correspondence Aerospace School	Ukrainian Aerospace Association of the Young People Suzirya (Constellation)	Ukrainian, Kiev	Up to 50
15-18.03.2008	International Conference Zoryanyj Shlyah (Star Path)	National Center of the Aerospace Education of the Young People of Ukraine, Dnepropetrovsk	International (Ukraine, Russia, Moldova), Dnepropetrovsk	Up to 150
22-28.09.2008	Ukrainian Autumnal Colloquium Cosmos, Lyudyna, Duhovnist (Cosmos, Human Being, Culture)	Ministry of Education and Science, Regional Authority of the Education and Science of the Transcarpatian region, Transcarpatian Regional Center of the Scientific-Technical Creative Work of Young People	Ukrainian, Uzhgorod	Up to 150

\* was organized for the first time

\*\* in 2008 it was not held, postponed to the beginning of 2009.

Table 2 Annual events for the students, school pupils, and young amateurs of astronomy.

Date	Event	Organizer	Status, region or city	Number of participants
14-19.03.2008	XV Young Scientists' Conference on Astronomy and Space Physics	Dpt of Astronomy and Space Physics of Kiev National University	International, Kiev	Up to 100
09-11.04.2008	International Scientific-practical Conference for the Young Scientists Human Being and Cosmos	National Center of the Aerospace Education of the Young People of Ukraine, (Dnepropetrovsk), Dnepropetrovsk National University, Open Joint-stock Company Ukrainian Scientific-research Institute of the Technology of the Mechanical Engineering, Dnepropetrovsk University of Economics and Law	International, Dnepropetrovsk	Up to 1000
14.03.2008	Student Olympiad on Astronomy and Astrophysics, first round	Ministry of Education and Science	Different Regions of Ukraine	Up to 30
24-28.03.2008	Student Olympiad on Astronomy and Astrophysics, second round	Ministry of Education and Science, Dpt of Astronomy and Space Physics of Kiev National University	Ukrainian, Kiev	Up to 30
08.2007***	Astrofest	Ukrainian Association of the Astronomy Amateurs	Different Regions of Ukraine	Up to 100
10-12.03.2008	Ukrainian AstroForum	Fund UkrAstro, Kharkov Astronomical Club Asterion	International, Kharkov	Up to 100
18-23.08.2008	Gamow's Summer Astronomical Schools-Conference: Astronomy on the Border of Sciences – Astrophysics, Cosmology, Radioastronomy, Astrobiology	Odessa National University (Astronomy Dpt and Astronomical Observatory), Odessa Astronomical Society, Euro-Asian Astronomical Society	International, Odessa	Up to 100

\*\*\* in 2008 it was not held due to unfavorable circumstances

#### *Other events*

2006 The School for Young Astronomers (Ukraine, Kiev)

2007 The School for Young Astronomers (Ukraine, Bila Tserkva)

2007 Astronomical School for the Young Scientists (organizer: Kiev National Aircraft University, Kiev)

12.01.2007 Scientific-practical Conference devoted to 100<sup>th</sup> anniversary of Acad S P Korolyov (organizers: Astronomy Dpt of Odessa National University – ONU, The Southern Scientific Center of the National Academy of Sciences of Ukraine, and Odessa Regional Council). Affiliated event – the contest of school pupils, devoted to the life and activities of the Acad S P Korolyov (organizers: Regional Humanitarian Center of the Non-school Education and Training, and Odessa Regional Council)

26-28.09.2007 The School The Young Observer (organizer: Main Astronomical Observatory of the National Academy of Sciences, Kiev)

29.09.-07.10.2007 The team of Ukraine took part in the International Astronomical Olympiad (Ukraine, Crimea, Simeiz). This Olympiad was organized by the International Euro-Asia Astronomical Society.

4-5.10.2007 Scientific-educational Conference for Young People 50 Years of the Cosmic Era (Ukraine, Chernigov)

30.11-9.12.2007 A team of Ukrainian students took part in the 1<sup>st</sup> International Olympiad on Astronomy and Astrophysics, Chiang Mai, Thailand

2008 Astronomical School for the Young Scientists (organizer: Chernigov State Pedagogical University, Chernigov).

17.05.2008 A contest of the school pupils, devoted to the life and activities of the Acad V P Glushko (organizers: Regional Humanitarian Center of the Non-school Education and Training, and Odessa Regional Council)

17.08-22.08.2008 A team of Ukrainian students took part in the 2<sup>nd</sup> International Olympiad on Astronomy and Astrophysics, Bandung, Indonesia

1-7.09.2008 International Conference Acad V P Glushko and Odessa (organizer: Odessa National University, Astronomy Dpt. of ONU)

09.2008. The School The Young Observer (organizer: Main Astronomical Observatory of the National Academy of Sciences, Kiev)

### ***Correspondence schools***

1. The School in Odessa National University (Odessa): astronomy, physics, mathematics
2. The Aerospace School in the Ukrainian Aerospace Association of the Young People (Kiev): Suzirya (Constellation), astronomy
3. The School in the National Center of the Aerospace Education of the Young People of Ukraine (Dnepropetrovsk): astronomy, physics, mathematics, computer science etc.

A large amount of work with school pupils is also done by the Crimean section of the Minor Academy of Sciences. This section is named Searcher, and is located in the Crimea (Simferopol).

### ***Observatories and Planetariums.***

The number of observatories in Ukraine is rather large (some of them belong to the National Academy of Sciences, some of them belong to the Ministry of Education and Science. There are also some private observatories). All observatories have public outreach programs.

In Ukraine there remain only 8 planetariums in operation (in the following cities: Kiev, Dnepropetrovsk, Kharkov, Vinnitsa, Lviv, Kherson, Donetsk, Zaporozhie). The 9<sup>th</sup> planetarium is the University planetarium of Odessa national University, which has only equipment for lectures on astronomy demonstrations (this planetarium belongs to the Astronomy Department of ONU).

Nowadays the life of some Ukrainian planetariums is severe, since they have to fight with municipal authorities for their territories and buildings. For instance, a big city planetarium of Odessa was closed in 1993. Planetarium buildings were expropriated. All equipment of that planetarium was completely plundered in that troubled time.

### ***Additional information***

Each year we publish Odessa Astronomical Calendar (a book format paperback of about 250 pages) that consists of useful information about all astronomical events for the current year (tables, figures etc), all the necessary data about Sun, Moon, Planets, Comets, Asteroids, Meteor showers etc. There are also many interesting articles written by professional astronomers about stars, galaxies, the Universe. The Calendar is

very popular among professional astronomers and amateurs. It is published by the Astronomical Observatory of Odessa National University (Odessa).

In 2007 the first University textbook "General Course of Astronomy" (authors: Prof S M Andrievsky and Prof I A Klimishin) was issued in the Ukrainian language. This textbook was recommended by the Ministry of Education and Sciences for use in Universities.

In Ukraine there are several astronomical societies. Among them there are the Ukrainian Astronomical Association, Odessa Astronomical Society, a branch of Euro-Asian Astronomical Society, and several amateur astronomical societies. All of them carry out lots of educational work among wide sections of the Ukrainian population.

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## UNITED KINGDOM

### *Overview*

This report has been assembled largely from information provided by Charles Barclay, Julian King, John Mason, Ian Morison, Ian Robson, Robin Scagell, and the UK Royal Astronomical Society, to all of whom I am grateful.

### *Secondary schools*

It has been realised for some time that astronomy has an important role to play in encouraging students to choose scientific, technological, engineering and mathematical subjects both during and beyond the years of compulsory schooling (which in the UK, normally ends at 18 years of age).

Recent revisions to the Key Stage 3 National Curriculum for Science, which students study up to about the age of 14, have increased the focus on the effects which human activity can have on our planet, whilst retaining the strong astronomical theme centred around discovering the Earth's place in the Universe.

Two fundamental astrophysical topics continue to be included in all of the UK examination boards' GCSE Science syllabi (most students take GCSE exams at about the age of 16).

- First is the evolution of stars, where students study how clouds of hydrogen gradually form into stars (including the Sun). Also included are the final stages of a star's life, such as supernovae, neutron stars or black holes, which push modern physics to its very limits.
- Second is an introduction to Cosmology, starting with Edwin Hubble's perplexing discovery that the light from distant galaxies is red-shifted, and going on to show students why we believe that we live in an expanding universe which began 13.5 billion years ago in the Big Bang.

Although attracting a much smaller cohort of entries each year than the GCSE Science syllabi, GCSE Astronomy continues to grow in popularity, with over 2000 entries in 2009. This course aims to give students a good general grounding in most areas of astronomy, ranging from the Earth-Moon-Sun system, through exploration of the Solar System to the working of the stars and galaxies, culminating in the discovery of our expanding Universe. There is now significant input from both professional astronomers and teachers to bring the content up to date, for example with the inclusion of dark energy and dark matter, exoplanet discoveries, exobiology, and Near Earth Objects. The course has maintained its observational emphasis with 25% coursework that now demands greater planning and analysis along the lines of a professional observing time proposal and implementation. Current observing centres are seeing increased numbers but the biggest increase has been in brand new centres.

As reported at JENAM in Vienna in September 2008, there also now exists for the first time a vehicle for studying astronomy within the syllabi in the sixth form (typical ages 17 and 18). As might be expected, a more mathematical approach is taken, giving students the basic grounding should they wish to pursue their study of astrophysics into higher education. The Extended Project Qualification was launched nationally in September 2008 after a pilot year. It is 100% coursework and a student has free choice of topic. The product can be in the form of a dissertation, numerical investigation, or a designed artefact, and so is ideally suited for in-depth astronomical study. The pilot year already resulted in projects on Solar Weather Near Solar Minimum, the Chances of Finding Life Elsewhere in the Solar System, and whether Close Binary Systems as Progenitors of Type 1a Supernovae.

The exposure to astronomy through the International Year of Astronomy 2009 is encouraging schools and colleges to widen their horizons, and embrace the enthusiasm of younger pupils by choosing to offer astronomy within the curriculum.

### ***College and University***

The UK's Royal Astronomical Society conducted a survey in September 2008 of all 76 institutions in the UK, mainly universities, that offer degree level courses in astronomy and/or geophysics. The aim was to quantify the popularity of astronomy courses and to establish a benchmark for future years, against evidence that undergraduate courses containing astronomy are *declining* in popularity. The response rate was disappointing, with just 18 institutions responding fully or partially. Among the rest (the majority) there were three institutions with purportedly large undergraduate numbers. One of these declined on the basis of confidentiality, and the other two gave no response.

The main results from a possibly unrepresentative sample of institutions are as follows. For the 604 students on astronomy degree pathways

- 71% were male, 29% female (for physics degrees around 20% are female)
- 22 undergraduates transferred into astronomy, but 33 transferred out, about 5% of the cohort
- a mere 12 students were enrolled on full-time or part-time taught MSc courses, possibly because of the difficulty in getting student grants below PhD level (at which level there are many hundreds of students in the UK).

Of the 1328 students taking astronomy courses as a minor part of their degree, 519 were enrolled on what the RAS termed "informal courses", such as distance learning or extra mural courses "that would not normally lead to an undergraduate degree". As I'm recently retired from the Open University, which is dedicated to distance education, I'm not sure whether my ex-institution responded, but it is *certainly* the case that the great majority of OU students who include astronomy in their undergraduate courses, *do* obtain BScs!

Other results include

- 93.5% of the undergraduates originated in the UK
- 4.5% came from other EU countries
- only 0.3% came from countries beyond the EU
- 10 of the 18 responding institutions cited evidence that students on physics/physics-related courses elect to take astronomy courses
- the majority of institutions do not provide careers information for astronomy graduates
- there is evidence that a higher proportion of astronomy graduates go on to further study than is the case for physics-only graduates, though the career destinations are similar.

This is not a particularly encouraging outcome, but not a disastrous one either. It is important to remember that the results are based on a survey that elicited a poor response, with some of the main players among the non-respondents. Clearly, another survey is needed, designed and promoted to obtain a much higher response.

### ***Education conferences***

No conferences devoted to astronomy education were held in the UK in 2006-2008, though astronomy education featured within broader conferences.

### ***Observatories***

An exciting development in the UK in recent years has been the rapid growth of research-based science education, in which teachers and students have free access to robotic telescopes such as those operated by the Faulkes Telescope Project, the National Schools' Observatory and the Bradford Robotic Telescope. The Faulkes Telescope Project is the education arm of Las Cumbres Observatory Global Telescope Network (LCOGTN), which currently operates two research class 2-metre robotic telescopes, one in Hawaii and the other in Australia. These telescopes are available to teachers and students for them to use as part of their curricular or extra-curricular activities and are fully supported by a range of educational materials and a team of educators and professional astronomers. For further information see <http://www.faulkes-telescope.com/>

The National Schools' Observatory (NSO) utilises the 2-metre Liverpool Telescope, a robotically controlled telescope for astronomical research and education, which is sited on La Palma in the Canary Islands. Schools registering with NSO gain access to the Liverpool Telescope, NSO software (including site licence) and the Liverpool Telescope Image Archive. Individual school registrations are currently supported by Liverpool John Moores University, which means that schools in the UK and Ireland can join and re-register each year at no cost to themselves. After joining NSO, teachers and students are able to request images from the Liverpool Telescope and download the software needed to analyse the pictures they get back. For further information see <http://www.schoolsobservatory.org.uk/>

Another robotic telescope in use in the UK is the Bradford Robotic Telescope (BRT), consisting of a collection of telescopes and other instruments situated at the Observatorio del Teide site of the Instituto De Astrofísica De Canarias, in Tenerife, Canary Islands. It is also free to use for all, via the website. For further information see <http://www.telescope.org/>

Operation of the Faulkes Telescopes is different to that of the other instruments in the sense that the user requests and is allocated observing time, then controls the telescope in real-time during the booking to make observations of objects as they wish. The robotic telescopes of NSO and BRT work by receiving requests from users for observations of particular objects, which are then carried out as time and observing conditions permit, with the requested observations being delivered to the user for analysis at a later date.

Several major UK observatories offer access to the public and encourage visits by school and college students. The Jodrell Bank Radio Observatory, Institute of Astronomy at Cambridge, Armagh Observatory, University of London Observatory, and the Royal Observatory Edinburgh are some examples. The 2007-2008 construction activity to refurbish and maintain the University of London Observatory buildings has now finished and it has been back in full operation since April 2008. At the Observatory Science Centre near Herstmonceux, telescopes are used by the public on open evenings and special evening events, and, during twilight, visits by schools and Scouting and Guiding groups. There are also smaller-scale initiatives, where observatories are opened for the benefit of school students and the general public by universities, colleges and amateur astronomical societies all over the UK.

At university level the Open University has installed a remote observatory on Majorca, based on a Celestron 14 inch (356 mm) Schmidt-Cassegrain telescope on a German equatorial mount. It has excellent remote control software. Though it is presently restricted to students of Open University astronomy courses, there are plans to make it more widely available in the near future.

### ***Planetaria, and science centres***

There are around 20 planetaria and/or science centres in the UK, some located at observatories. The British Association of Planetaria is very active in astronomy education, and portable planetaria are available all over the UK for school visits in addition to the fixed dome installations. The Royal Observatory Greenwich, whose new state of the art Peter Harrison Planetarium opened in May 2007, is particularly active, promoting the public understanding of astronomy via servicing the media, holding summer schools, running outreach

programmes to local schools, and world wide video conferencing connecting astronomy tutors to school students. Another new planetarium, with a giant 15-metre diameter dome, has opened at the Intech Science Centre near Winchester. In addition to putting on general shows for school groups and the general public, some planetaria are broadening their output. For example, working with local universities, the South Downs Planetarium and Science Centre near Chichester has developed programmes for trainee teachers, and runs continuous professional development courses for teachers in conjunction with Science Learning Centre South East. There are also specialist weekend courses for able, gifted and talented pupils, and for adult groups such as the University of the Third Age.

### ***Amateur astronomy***

There are approaching 200 local amateur astronomical societies across the UK, with active memberships ranging from a few tens to nearly 200. Some operate observatories which are open to school groups and the general public. Many are equipped with computer-controlled telescopes of 0.4-metre aperture and above, fitted with CCDs and other sophisticated equipment. High quality digital imaging is popular, and some of the observations made with these instruments are of research quality, for example on variable stars, asteroids and comets. For further information see <http://www.fedastro.org.uk/cgi-bin/observatories.php> Most societies have a programme of invited speakers. Many are engaged in outreach, and are planning a considerable increase in such activities during International Year of Astronomy in 2009 (IYA2009), celebrating 400 years since Galileo first used a telescope to look at the Moon, and 40 years since the first Moon landing. Many local astronomical societies are affiliated to the Federation of Astronomical Societies, a national coordinating body that has a speakers list and holds an annual conference.

The British Astronomical Association (BAA), founded in 1890, has about 3000 members, mainly experienced amateur astronomers, and it has an international reputation for the quality of its observational work. It coordinates research by amateurs via many Observing Sections, such as Sun, Mars, Deep Sky, Variable Star, etc., each coordinated by an experienced Director, many of whom cooperate with professional astronomers. The Journal of the BAA, containing the results of observing programmes, is published six times a year. The BAA also holds meetings for its members, including Back to Basics Workshops aimed at beginning observers. See <http://britastro.org/baa/> for further details.

The Society for Popular Astronomy (SPA), was founded in 1952 as the Junior Astronomical Society, and is aimed more towards the beginner than is the BAA, though it includes many experienced observers as well. The SPA has a similar number of members to the BAA. It has quarterly meetings, a quarterly magazine called *Popular Astronomy*, and an occasional news bulletin. It has several observing sections. Thanks to funding from the Science and Technology Facilities Council (STFC), the SPA has obtained 1000 telescopes to award to secondary schools, for use by pupils aged between 11 and 14. The free telescope is a high quality 70mm refractor, and comes with a DVD (funded by the Royal Astronomical Society) showing how to use the telescope, what to look at, and much more. This project is part of a special initiative to coincide with IYA2009.

Many societies bemoan the lack of young people among their members or attending public talks. As a result, in 1997 the SPA decided to create a Young Stargazers' group, giving membership of the SPA at a subsidised rate and extra benefits. This has tripled the SPA's membership under 16, but still has a long way to go to rival other youth groups such as young ornithologists or archaeologists, which remain as role models in enthusing youngsters.

See <http://www.popastro.com/> for further details of the SPA.

### ***The International Year of Astronomy***

The UK IYA2009 activities in the area of C46 are the following: Schoolscope; UNawe (Universe Awareness); Galileo Teaching Ambassadors. These are all effectively IYA2009 Cornerstone Projects, the Schoolsopes being the UK version of the Galileoscope. The Schoolscope project, as noted above, is led by the Society for Popular Astronomy and will provide good quality telescopes (70mm refractors with various eyepieces, tripod and finder) into 1000 secondary schools in the UK. It is funded by the Science and

Technology facilities Council. An educational DVD will also be provided, aimed at the 11-14 age group, and this is funded by the Royal Astronomical Society.

UNAWE is for the Primary (Elementary) Schools sector and is a part of the global UNAWE initiative, which aims to broaden the minds of young people through hands-on/minds-on activities. The Royal Astronomical Society has funded the provision of Earthballs as part of this programme. The Galileo Teaching Ambassadors (a programme to “teach the teachers” about how to deliver the astronomy curriculum) will commence in late 2009.

### ***Public education and outreach***

There is nothing to report that has not been mentioned above.

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## **UNITED STATES OF AMERICA**

Astronomy education in the US remains very decentralized. Some astronomy units are contained in elementary-school education. The grades 7-9 education largely remains biological science, Earth science, and then physical science, with astronomy units in the latter two. Unfortunately, there are few astronomy units for high schools, grades 10-12 (normally ages 16-18); enrolments decline by factors of two from 10<sup>th</sup> grade biology to 11<sup>th</sup> grade chemistry to 12<sup>th</sup> grade physics, the normal path; a "physics first" campaign is having some success, on the grounds that physics is more basic than biology or chemistry, though it is still in the minority.

Many activities are planned for the International Year of Astronomy. See <http://astronomy2009.us> for the American node. Among many activities, one particularly interesting one is the Galileoscope, an inexpensive, molded plastic model of Galileo's original telescope, available for distribution for only \$15 each (and cheaper in quantities over 100), plus shipping. See more details at <http://www.astronomy2009.us/Content/Documents/GalileoscopeProgramSummary.pdf> and order at <https://www.galileoscope.org>.

The Planetary Society (<http://www.planetary.org>) has, among its many projects, a daily podcast: <http://www.planetary.org/programs/projects/iya/365days.html> and directly to <http://365daysofastronomy.org>, available free at their website or through iTunes.

Much of the astronomy education in the US is coordinated by the Astronomical Society of the Pacific, which provided the following summary: “The Astronomical Society of the Pacific’s (ASP) mission-based astronomy and space science education and public outreach activities work to promote science literacy through the enjoyment of astronomy”. Since 1993, the ASP has been building a network of 15 sites across the country that recruit volunteer astronomers to work with a classroom teacher throughout the year facilitating hands on activities. The Project ASTRO™ National Network serves 15-20000 students annually. Central to the training of the partners are the astronomy education volumes: Universe at Your Fingertips and More Universe at Your Fingertips, over 1000 pages of hands-on, minds-on activities for the astronomy classroom. Complimentary to that program, is the Family ASTRO set of materials that bring astronomy fun to family science nights. They are especially designed for small group work, so are also easily adaptable to classroom settings. The enthusiasm of amateur astronomers as volunteers in Project ASTRO inspired another program just for them. The Night Sky Network is a coalition of over 200 clubs across the country that share their telescopes and expertise in a variety of public settings bringing the excitement of NASA science and discovery to the public. Through the ASP this NASA funded program develops and distributes outreach toolkits to the clubs to enhance their outreach efforts. The third major audience that the ASP serves is educators from small nature and science centers. Astronomy from the Ground Up provides professional development workshops both online and at a variety of sites for educators who would like to bring

astronomy programming to their audiences. The workshop provides in-depth training so that new educators not only have resources, but the confidence to introduce astronomy programs at their facilities. This program continues to expand through NASA funding that will allow for the expansion of the network to include state and national park rangers and interpreters. For an overview of these and additional resources, the ASP website is worth browsing: <http://www.astro society.org/education.html>.

The American Astronomical Society is the organization of professional astronomers. Its education programs are summarized and linked at <http://www.aas.org/education>. Its mission statement is “The education mission of the American Astronomical Society is to optimize the contributions of both the AAS and its members to enhanced science literacy for all, provide encouragement and to broaden educational opportunities for all, with particular attention to groups under-served in the physical sciences, and ensure that undergraduate and graduate programs in astronomy prepare not only the next generation of professional astronomers but also broadly trained individuals with strong technical and scientific backgrounds.” Among its activities are workshops on education at the semi-annual meetings of the American Astronomical Society as well as posters and oral presentations on education at the meetings, outside the quota of one research talk per presenter.

The Astronomy Education Review, begun by Andrew Fraknoi and Sidney Wolff with support from the National Optical Astronomy Observatories, has transitioned to support from the American Astronomical Society with a new website at the American Institute of Physics. It is an online journal, available free at <http://aer.aip.org>.

A general statement, known as a Charter, for astronomy education research was discussed at a Tufts University meeting, called for the purpose in 2007 and cosponsored by Tufts's Wright Center for Science Education and by the American Association of Variable Star Observers. See Aaron Price et al. 2008, *Astronomy Education Review*, 6, 130. The Charter is available at <http://www.aavso.org/astroedcharter>.

The American Association of Variable Star Observers (<http://www.aavso.org>) has many public-information web pages. Also, their Hands-On Astrophysics curriculum is now available in electronic form <http://www.aavso.org/education/vsa/>, downloadable as PDFs. The AAVSO also provides written material for astronomy clubs, speakers, PowerPoint presentations on variable stars and other astronomical topics, and other activities. See <http://www.aavso.org/education/>.

Many university-level textbooks in astronomy, often non-technical for the American-style non-astronomy-major courses, continue to be published. David Bruning surveyed 23 of them in the *Astronomy Education Review*, most recently at volume 5, issue 2, 182-216 (2007), <http://aer.noao.edu/cgi-bin/article.pl?id=21>. He also surveys the astrophysics (as opposed to mere astronomy) and provides statistics in the *Astronomy Education Review*, volume 6, issue 1, 80 (2007), for 21 of them. It is downloadable from <http://dx.doi.org/10.3847/AER2007009>.

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## VATICAN

### *Summer Schools*

For a month in the summer of 2007, the Eleventh Vatican Observatory Summer School (VOSS) in Astrophysics was held at Castel Gandolfo and probed the topic Extrasolar Planets and Brown Dwarfs. The 26 early-graduate level students came from 22 countries, and as previously they were selected without reference to race, religion, national origin, gender or physical handicap, while giving special emphasis to those from non-industrialized nations. The Observatory has found that this, combined with an excellent and generous faculty, fosters a worldwide community of young scholars in astronomy and astrophysics that will stand them in good stead during their later research careers. An indication of the policy's success is that two

of the VOSS faculty were alumni of earlier schools. Another healthy indication is the competition among proposers of excellent topics for this and other VOSSs.

As follow up to these schools, two international symposia with the participation of alumni and faculty of VOSS were held in 1998 and 2002 and were each called a Super VOSS. The third takes place in the summer of 2009 at Sassone, near Rome, and has the theme Astronomy: A Common Ground for Sharing Humanity's Concerns. Since this symposium occurs during the International Year of Astronomy, it therefore combines presentations of scientific research results and discussions on the public outreach in astronomy. For the first time selected "non-alumni" are invited to participate and present at the Super VOSS.

### ***IYA2009***

The Vatican City State is a firm supporter of the International Year of Astronomy 2009, the worldwide celebration that promotes astronomy and its contribution to society and culture. The support is shown both in homilies and talks by Pope Benedict XVI and through events such as the Super VOSS 2009 (above), an exhibition of historical astronomical instruments at the Vatican Museums, co-sponsored by the Italian Istituto Nazionale di Astrofisica (INAF), and a Study Week on Astrobiology organized at the Pontifical Academy of Sciences. The website for the Vatican national node is at <http://www.astronomy2009.va> and it describes the complete range of sponsored activities.

### ***Other Activities***

In addition, members of the Vatican Observatory staff have taught a general astronomy course at the University of Arizona, and conducted educational and public outreach activities in Argentina, Australia, Bogota, Canada, Chile, Colombia, Italy, Puerto Rico, Spain, the UK, and the USA. More information on such activities, and the web pages of the VOSS and Super VOSS, can be found through the main Observatory website, <http://www.vaticanobservatory.org>

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### **VENEZUALA**

Sometimes the lack of motivation in science starts from the teacher themselves, perhaps due to the fact that he/she cannot find support from the universities or from the educational system. Thereby, in Venezuela, we have been promoting encouragement not only to high and elementary school students, but also to their teachers in order to have a better performance in the process of teaching/learning of science in general.

We have been consolidating successful events focused in high school students (and also in school students). One of which is the well known Encounters with Physics, Chemistry, Mathematics, and Biology, event that includes experiments and workshops in astronomy as well. Indeed, during the years 2006 and 2008, we have been greeting approximately 36000 students and teachers in the VII to IX edition of the event. This number of students attending has been only in the Faculty of Science of the Universidad de Los Andes (ULA), Mérida. As well, our professors and undergraduate students have been traveling around the country, visiting schools and high schools of several states (Apure, Barinas, Falcón, Lara, Monagas, Táchira, Trujillo, Yaracuy, Zulia, and in the whole State of Mérida). The motivation to organize this event goes beyond just having an exposition of experiences. As time goes by, we want to increase the elaboration of specific projects that involve the conclusion of a modern didactic focused in the good learning of important fields of knowledge, such as astronomy. I must point out that all the workshops and events in general have been carried out with some sacrifice because sometimes of lack of funds.

On the other hand, the Centro de Investigaciones en Astronomía (CIDA), also has been welcoming school and high school students in several states (implementing popular talks for the general public as well), with a growing program with the aim to focus attention on this population of students. They have created the

national web to divulge astronomy through the UNawe-CIDA organization. Also, due to the fact that CIDA administrates the Observatorio Nacional de Llano del Hato, it has been a good approach to attract a large number of visitors; as a matter of fact, many talks and displays are given in the Museum of Astronomy located in the Observatory. Also, ULA and CIDA have produced didactic material for children in order to divulge astronomy at this level and beyond, and has promoted information of this science, through TV, newspapers, and periodical reports. The XII Latin-American meeting of the IAU was held in Margarita, and this event was used as a scenario to reach some cities in order to promote astronomy.

It is important also to point out that the Observatorio Cagigal, located in Caracas, has been continuing to give popular and interesting talks with the collaboration of astronomers and fine amateurs. Also, several universities such as Universidad Central de Venezuela (UCV), Universidad de Carabobo (UC), La Universidad del Zulia (LUZ), among others, as well ULA, continues to recruit students that have an interest in astronomy and astrophysics, and to enroll them to pursue their graduate and undergraduate degrees through their programs. Finally, we cannot forget the many amateur societies that are very serious and competent, and continue to help local and overseas astronomers that wish to be able to record specific phenomena, to send notes with popular topics in astronomy, in very understandable language within reach of the general public. These societies are always in touch with Venezuelan and overseas professional astronomers.

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