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

Newsletter Supplement
National Liaison Triennial Reports 2003-2005
(countries N-Z)

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

Contributions to the newsletter are gratefully received at any time.

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TRIENNIAL REPORTS FROM NATIONAL LIAISONS

The triennial reports from National Liaisons for countries N-Z have been collected into this supplement, and cover the three years up to the end of 2005. Reports for countries A-M are in a separate document. This completes the reports received. Regretfully, many have not been received.

Each report has required more or less editing, at the very least to attain a modest uniformity of style. Several reports were received in plain text email, so (unless instructions were included) modifiers of the basic Roman alphabet characters will have been absent – I doubt if 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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NETHERLANDS

The Netherlands Research School for Astronomy (NOVA) together with the Netherlands Astronomical Society (NAC) are actively engaged in promoting astronomy in primary as well as secondary education. The latter is currently ••••••• going through major revision: the relevant steering committees wish to offer challenging astronomy within secondary (physics) education.

The ESA/ESO practical exercises (www.astroex.org) have been translated into Dutch; all schools received a complete set as well as the CD-ROM. The NOVA Outreach website is currently being updated, and will also contain interactive astro-exercises. All (secondary education) schools furthermore received a copy of the Hubble Space Telescope 15th Anniversary DVD. A successful national Teachers' day on the topic of Solar System astrophysics was held in 2002. The Netherlands hosted the 2004 Teachers' Summer School organised by the EAAE, the European Association for Astronomy Education. A 2005 observing contest for high school students was very successful: the four winners travelled to La Palma and carried out their own projects using the 2.5 metre Isaac Newton Telescope. Several schools have been equipped with cosmic ray detection systems as part of a national/European astrophysics education effort.

The Washington Charter as conceived by an IAU Division XII Working Group was endorsed by the Dutch professional and funding organizations – see www.communicatingastronomy.org

Major outreach and education events were organised connected to the 2004 Venus transit.

Concerning primary education, a working group is currently designing practical exercises and materials dealing with basic nature education: astronomy, biology, geography, and meteorology. An interactive website will be part of this initiative, which finds it origin in growing concerns within the professional organizations. The project aims to reach (eventually) all primary schools in the country. Efforts are also ongoing to produce a national interactive astronomy game Kids-in-Space. A national contest for elementary school children was organised related to the launch of the Venus Express Mission.

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NORWAY

Overview

Norway has a population of 4.6 million people, including 600 000 students in primary schools, 200 000 in high schools and 200 000 in colleges and universities. School starts at age 6. The official languages are Norwegian and Sami.

Elementary (primary) school

The curriculum for primary schools was changed in 1997, and has some astronomy for grades 4, 8 and 10. The curriculum will change again in 2006 and will still contain some astronomy.

Secondary school

The curriculum for high schools was changed in 1994, and it contains some astrophysics, for example information from light. At the highest level in physics, stars, galaxies and cosmology are included. A new curriculum will be introduced in 2007 or 2008.

College and university

Norway has five universities. A full education in astronomy and astrophysics at all levels exists only at the University of Oslo, where a new bachelor and mastera program was introduced in 2003. 15 students are enrolled in the masters program and 11 study for a PhD.

Observatories and planetaria

The country has five permanent planetaria. Four of these are of school class size, and located at science centers, and are open to the public. The largest one, Nordlysplanetariet i Tromsø, with 90 seats, belongs to the Science Center of Northern Norway and is used only for schools. In addition there are nine mobile planetaria, mostly owned by the science centers.

Other public education

Public interest in astronomy is high and increasing. The Norwegian Astronomical Society, which is an organization for amateurs and other interested people, has grown from 1900 to more than 3000 members during the triennium, and is the largest astronomy amateur organization in Scandinavia. It has 8 observational groups country wide, and is an umbrella organization for 28 local astronomy clubs with additional members. The clubs have 15 observatories for public use. The Norwegian Astronomical Society issues a bimonthly magazine Astronomi. An annual Astro-Festival in Oslo attracts 10 000-20 000 people. The Society has an information service for its members and the general public. Astronomical topics were presented in radio and television several times every week in the triennium.

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NEW ZEALAND

Introduction

Astronomy education is on the three levels, University, Secondary and Primary school.

Four universities have undergraduate courses – the Universities of Canterbury, Auckland, Otago, and Victoria University in Wellington. However, Canterbury is the main university for astronomical studies and is the only one with courses in each year.

At all secondary and primary school levels there is a component of astronomy in the curriculum strand Planet Earth and Beyond. This is augmented by astronomy based Learning Experience Outside the Classroom (LEOTC) programmes run by Stardome in Auckland, Carter Observatory in Wellington, Science Alive! in Christchurch and Otago Museum in Dunedin. In addition there are several mobile planetaria that tour parts of New Zealand.

For a fuller view of astronomy education go to Section 3 of An Overview of Astronomy in NZ at http://carterobservatory.org/overview/

Astronomical education activities at the University of Canterbury

Over the last 3 years the non-science major course (The Cosmos: Birth and Evolution) has had a consistent enrolment of more than 150 students and continues to be a popular course for those who want an introduction into astronomical topics of current interest. There have also been a number of students who have subsequently taken the more science-orientated first year astrophysics course, which regularly has about 40-50 enrolments. And the University of Canterbury offers the only BSc, BSc (Honours), MSc and PhD programme in astronomy in New Zealand.

An anonymous donor has generously provided funding for us to develop two astronomical initiatives. They are the Aurora School and the Aurora Scholarship. The Aurora School is a week-long residential astronomy course for about 20 senior high school students who are given talks by the academic staff, undertake laboratory astronomical exercises, and make a two night visit to Mt John Observatory for photometric and spectroscopic observations. The travel and local expenses of the students and tutors for this course are covered by the very generous donor. The Aurora Scholarship is awarded each year to an excellent young high school student who wishes to undertake their studies in a space science area. Their university fees are paid for their first year of university study (~$NZ4000) and there is also a travel award of up to $NZ6000 for the scholar to travel within New Zealand and overseas to visit astronomical facilities. The University of Canterbury gratefully acknowledges the very generous contribution from this donor.

There continues to be a strong graduate programme in astronomical topics at the University of Canterbury. There are currently 12 graduate students enrolled in MSc and PhD programmes in astrophysical topics. Some of these make use of facilities at the University's observatory at Mt John while others use observational data from other facilities (including HST, the AAT and various neutrino experiments in the Antarctic) or are involved in cosmological topics. A new 1.8 metre telescope for microlensing observations (a joint New Zealand-Japan initiative) began operation at Mt John during 2005. In addition, the University of Canterbury is a shareholder in the Southern African Large Telescope (SALT), that also began routine observations towards the end of 2005.

A number of our graduate students are involved in science outreach activities within the College of Science at the University of Canterbury. They visit regional high schools and give a range of talks on astronomy. The Department of Physics and Astronomy also supports a weekly session (weather permitting) at the Townsend Observatory (a 0.15 metre Cooke refractor). In addition, physics and astronomy graduate students from the Department gave public talks as part of the International Year of Physics.

Over the last year a private company, Earth and Sky Ltd, has begun guided tours through the facilities at Mt John Observatory. These tours will soon include night-time observing through small telescopes. Two students, who took astronomy courses at Canterbury, have been employed by Earth and Sky to prepare and present material for these tours.

Online Astronomy Courses in New Zealand

Carter Observatory, the National Observatory of New Zealand, started running online astronomy courses for senior school students in 2003. These courses earned credits for the students' National Certificate of Education Achievement (NCEA). The courses are for students in their 11th year of schooling (age ~15/16) although the courses are open to advanced younger students and adults of all ages.

For more information about NCEA go to
http://www.minedu.govt.nz/index.cfm?layout=index&indexid=1004&indexparentid=1072
All that is required of the student is Internet access either at home or at school. Each course is designed to take the student ~40 hours (but this varies greatly from student to student). There is a (nominal) time limit of a calendar year to complete the course.

The three NCEA courses are:-

- Our Solar System
- The Milky Way and Other Galaxies
- Space Exploration

Each stage of the courses is assessed, with questions (some written, some single answers, and some multiple choice) as the student progresses. Carter Observatory specialist educators monitor the student's progress. Marking is done online by the teacher at Carter Observatory or automatically by the computer.

In 2005 Carter Observatory introduced an online course for primary school children entitled Astronomy for Little Stars. This is a basic astronomy course for the middle primary school. It introduces fundamental concepts in an interesting way.

See http://www.carterobservatory.net for more information on all our online courses.

Stardome Observatory (Auckland)

Stardome Observatory and Planetarium is one of several NZ organisations that have a contract with the government's Ministry of Education to provide astronomy education to local schools. It is typical to have three or four large school groups visit the 87-seat planetarium during school hours each day, amounting to roughly 22 500 school students per year.

A small proportion of students (about 600 per year) are visited by a Stardome educator offsite, most commonly in evening sessions at their school camp.

In addition to school students, daytime sessions are booked by groups of senior citizens, language schools, preschool groups and homeschool groups. During school holidays we run a set holiday programme (involving launching rockets) that has been popular.

Groups of pre-service teachers may have sessions free-of-charge by arrangement, which we hope increases their confidence in teaching astronomy as well as introducing them to Stardome as a resource for future use.

When teachers book a session at Stardome they are sent a CD-ROM (free) containing a range of astronomy resources and information. The CD was updated during 2005 and contains material produced by Stardome educators, and collections of resources such as pictures from NASA. It is intended to be freely reproducible for classroom use.

Stardome provided activities, images and written material for a school poster set produced by a New Zealand educational publisher. Each November Stardome Observatory produces the full-colour, 100+ page Astronomical Yearbook, containing simple star charts and astronomy articles, that is marketed to teachers and general public.

Stardome's website (http://www.stardome.org.nz) contains links and programme information, and contact details for people to forward astronomy questions.

Astronomical Education at Carter Observatory

The Carter Observatory offers a unique educational facility students as it is the only fixed planetarium in the lower North Island, the other fixed planetarium in New Zealand is in Auckland. Carter Observatory has been offering curriculum based astronomical experiences for 9 years through a Learning Experiences Outside the Classroom (LEOTC) contract with the Ministry of Education. This programme is targeted at local primary and secondary students, but we also teach students from around the country. This program reached 6700

students during 2005, but many more attended other events at the Observatory. Using the planetarium we show the Southern Stars exploring the myths, legends of Maori, Pacific and European cultures. We also use a number of in house audio-visual planetarium shows that cover the planets of the Solar System, stars and the Milky Way Galaxy and life in the Universe.

As well as the planetarium sessions we have a teaching session during which we explore: day and night, seasons, the year, the phases of the Moon, space exploration, or any topic that may be requested. We also use our 138-year-old 0.25 metre refracting telescope. If the weather permits students observe the Sun using special filters to safely view sunspots and solar prominences.

Schools receive information packs prior to visiting, and feedback prior and post visit is an important part of the teaching experience.

Astronomical Services Ltd

Astronomical Services Ltd runs two Starlab planetaria visiting schools and other centres in the North Island of New Zealand. All school programmes are curriculum based and other non school programmes are suited to the particular needs of the group.

Starlab continues to be in use for the majority of the school year as more and more schools are realising the ease of bringing that part of the school curriculum to their school by using a specialist provider. Since January 2003 Starlab has been visited by approximately 65 758 pupils. This consisted of 47 858 primary and intermediate pupils and 17 900 secondary pupils. Astronomical Services also ran a workshop for teachers at a local school, and two workshops on simple ways of teaching astronomical concepts to trainee teachers. Starlab was involved with helping them to understand some of the concepts they are expected to teach, and ongoing assistance is available by email. A resource book has been written at the request of teachers who need activities to assist in teaching the astronomy module of the school curriculum. It is continually being updated and new activities are added when necessary. It is available to all schools visited by Starlab and helps to reinforce the pupils' visit to Starlab.

Starlab was also involved in many community projects including holiday programmes, charity shows and conferences.

For more information contact: http://www.starlab-astronomy.co.nz/

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PHILIPPINES

Elementary Education

Astronomy has been practiced in the Philippines for more than 100 years now. However, activities in astronomy education and research in the country is limited in scope. In elementary schools, astronomy is taught as a part of the general science subject where it is normally given a three-hour per week period in Grades V and VI classes.

Secondary Education

At high school level, astronomy is only an elective subject. It is taken in one semester (four months) in the first year.

College and University

Before 2002, no university in the country offered an astronomy course. In the school year 2002-2003, the University of the Philippines, through its National Institute of Physics, offered a course entitled Physics and

Astronomy for Pedestrians. The course serves as an introduction to the different aspects of physics and astronomy, from its emergence up to its current developments.

The school year 2005-2006 made a great change in the history of Philippine education in the field of astronomy. For the first time, the Rizal Technological University in Mandaluyong City offered a graduate program leading to a masters degree in Astronomy. The course is designed for students with any BSc degree, who are interested in astronomy. The course subjects include Principles of Basic Sciences, Survey of Principles Concerning Stars, Seminar on Galaxies, Basic Concepts of Cosmology, Basic Principles of the Solar System, Life in the Universe, Laboratory Work on Observational Astronomy, Astronomy Education, and Astronomy and Meteorology.

The course is descriptive in nature. It aspires to make its students become good in all aspects of astronomy, including the more scientific aspects, or just the plain enjoyment of the night sky and everything it has to offer. The students are expected to learn about the constellations, identify the brightest stars and the more famous features of the Moon, and observe sunspots and a few hundred deep-sky objects. As a whole, the course aims to make the students into versatile astronomers who will be able to contribute to the sum total of the knowledge of mankind in their tiny but significant way.

Observatories and Planetaria

During the last three years, the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) Planetarium has had an average of 31 500 visitors, composed of teachers, students and astronomy enthusiasts. In 2005, a project proposal with the objective of upgrading the equipment of the planetarium, was approved and will be funded by the Science and Education Institute (SEI) of the Department of Science and Technology.

On the other hand, the PAGASA Astronomical Observatory, which is located inside the campus of the University of the Philippines, accommodated an average of 2000 visitors during the last three years. The close encounter between Mars and Earth that occurred in August 2003 and October 2005 gained a lot of interest among astronomy enthusiasts. During the Mars opposition in August 2003, more than 1000 guests visited the observatory. Other phenomena observed were the Transit of Mercury in May 2003, the total lunar eclipse and transit of Venus in 2004. For 2005, the Macholz comet was observed as well as the partial lunar eclipse and the Antares occultation.

Mobile planetarium shows, stargazing, and telescope sessions were also provided to various schools in Luzon. In 2005, a total of 20 673 visitors were accommodated, including 35 schools.

Other Public Events

Since 1993, a National Astronomy Week has been an annual celebration. During the past three years, an average of 2500 visitors were accommodated at the PAGASA Planetarium and Astronomical Observatory where free lectures were conducted. In 2004, a Seminar on Basic Astronomy for Science Teachers was conducted in Pangasinan, where the late Dr Maher Melek of Cairo University delivered the lecturers. The activity was made possible through cooperation between PAGASA and the IAU-TAD.

In October 2005, the Philippine Space Week was celebrated in the country. The SEI was the lead agency in its celebration. A total of 3000 students from various schools in Metro Manila attended the opening ceremony that was conducted in cooperation with the PAGASA.

Other Activities

In 2002, with Commission 46 of the International Astronomical Union through its Teaching for Astronomy Development (TAD), a cooperative program was signed between the IAU and PAGASA. The program aims to support the development of astronomy and astrophysics in PAGASA through the establishment of astronomical observation at the PAGASA Astronomical Observatory and the education and training of its astronomy personnel. From 2003 to 2004, five lecturers have visited the country to give lectures on

astronomical observation, stellar physics, cosmology, solar physics, and dynamical and physical concepts of astronomical research.

In 2003 PAGASA organized an astronomical society named Astronomical Organization of the Philippines Inc. The organization aims to promote astronomy as an important science, its value and contribution to mankind and environment. It also aspires to provide information on the advances in astronomical techniques and instrumentation, particularly in the field of space science research and modern discoveries. Likewise, it seeks to conduct lectures, symposiums and conferences to upgrade public awareness about astronomy.

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POLAND

General information

The Polish school system consists of 6 years of elementary school, followed by two secondary schools – 3 years gymnasium and 3 years high school or lyceum. Education can then be continued at universities, usually for 5 years.

Elementary schools

Some astronomical information is presented to pupils 10-12 years old, as part of a subject called The Environment.

Secondary school (gymnasium & lyceum)

The astronomical topics are part of two subjects: Physics and Astronomy, and Geography. The first includes such astrophysical information as: the physical properties of the Solar System, the stars, the principles of cosmology, etc.; the second is mainly information about the celestial sphere, the coordinates of celestial bodies, time, the problem of determination of latitude and longitude, etc. The teachers are graduates of physics (or geography, as appropriate), and usually they are not specialists in astronomy.

The Almukantarat society, made up of university students and recent graduates, exists to promote and support astronomy among high-school students. It has held annual week long star parties at a dark-sky site in the countryside for a number of years, which include lectures and observing sessions, as well as other events. High-school students who participated in society events have often gone on to study astronomy at university and, in many cases, entered postgraduate courses and research careers in astronomy.

College and University

Unlike other countries, some Polish universities (Krakow, Poznan, Torun, Warszawa, Wroclaw, and Zielona Gora) have dedicated 5 year masters degree studies in astronomy. These are very similar to those for physics, with the differences appearing in 4th and 5th year courses. Graduates who wish to stay in the field can find jobs at astronomical observatories or secondary schools, or move on to PhD level courses.

Education and conferences, public events

Some astronomical institutes (e.g. the Astronomical Center of the Polish Academy of Sciences) annually organize special 2-3 day seminars for teachers. In 2005 attendance was approximately 100 teachers from across the country. The seminars are an opportunity to catch up on the latest developments in astronomy through lectures by institute staff and to share teaching ideas and experiences. Mt Suhora Observatory, as part of the Cracow Pedagogical University, is involved in training teachers in astronomy, and also works with schools in developing teaching aids and methods for the classroom. Students and recent graduates of the Cracow Pedagogical University Astronomy Department organized a successful 3-day conference on astronomy for teachers in October 2005. Finally, the European Hands-on Universe project and the

Telescopes in Education project are both active in Poland, with the former having recently received a grant to provide a webcam-based observing system designed by the Center for Theoretical Physics of the Polish Academy of Sciences to schools across the country.

For the general public, the Astronomical Center of the Polish Academy of Sciences in Warsaw has weekly public lectures through the year, given by members of staff, with the schedule published well in advance. These are usually very popular. There are also annual science festivals in a number of cities organized by some of the universities and institutes (Warsaw, Cracow and others). During these festivals, public lectures, seminars, observations, and experiments are presented, again with the schedules published in advance in the press.

In addition, public events are often organized for occasional spectacular astronomical events. For example, special public observations were performed in institutes across the country during the last transit of Venus in front of the solar disc.

Observatories and planetaria

Almost all Polish astronomical observatories are open to the general public once a week or once a month. During these open days astronomical observations are performed and short lectures are given. In addition, some observatories (for example, Mt Suhora and Cracow) will take organized groups by appointment, usually of schoolchildren, and provide them with a guided tour and a question-and-answer session with the staff. There are also about 10 planetaria in Poland. Among them the biggest are in Chorzow, 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.

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PORTUGAL

Overview

In the period covered by the present Report, the activities in astronomy continue to increase in all areas: school education at different levels, promotion of astronomy through different strategies, and research activities. 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 events. 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 that are very active in 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.

Secondary school

At the secondary school level, astronomy is included in the programs 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 centers, mainly within the framework of the Programa Ciência Viva, a program already included in the previous report. As a result, the interest of school teachers in astronomy continues to increase, with resulting visits to astronomical centers, invited lectures, demonstrations, and night sky observations. Also, more and more schools are getting their own telescopes, and more teachers are looking for postgraduate education in astronomy.

Universities

There are two universities offering, for some years now, BSc and masters degree courses in astronomy. Therefore, the number of students with a diploma in astronomy has increased greatly in recent years. Many of them proceed to higher education, masters and PhDs, in universities in the country or abroad. Several go to international centers, through organizations of which Portugal is a member, to get specialization. As a consequence, the number of PhDs in astronomy has also increased greatly in recent years. Some other universities have started to introduce astronomical subjects in the curricula, and to promote different kinds of astronomical activities. 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 several other degree courses, in science, engineering, and in military schools.

Observatories and planetaria

Astronomical observatories, research centers 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. Some services are now being provided through the Internet, including services on-line. Regarding astronomical observations, it must be noticed the activities organized in connection to phenomena like solar eclipses and the transit of Venus.

Education conferences

During the period covered by the present report, conferences were organized on a regular basis, by some of the universities, observatories, research centers and planetaria. 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.

Other public events and activities

Another point to be stressed in this report is the large dissemination of amateur astronomical associations all over the country. Some have their own means of making observational, sometimes through building small observatories, and all are very active in organizing special events for the promotion of astronomy. They also cooperate with schools and professional astronomical centers.

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ROMANIA

During the last General Assembly, the IAU approved the special Resolution on the Value of Astronomy Education. It was the result of the effort of many astronomers in the world, the Romanian ones included. In spite of these efforts, astronomy is not yet taught in the Romanian schools. Paradoxically, the pupils take part in the international olympiads of astronomy with very good results (see the IXth and Xth International Astronomy Olympiads, October 2004, Simeiz Ukraine, and October-November 2005, Beijing China). It is the merit of the teachers who are training them in these programs.

The yearly Open Day of the Astronomical Institute, and the Venus campaign in 2004 and 2005, constituted good opportunities to attract a large public to a better knowledge of the Universe.

At the same time we continue to try to convince our authorities that the building constructed specially for a planetarium in the Capital has to be endowed with the projector.

In the context of our efforts to improve astronomy education, we mention the first three parallel sessions organized during JENAM:
– JENAM 2003, Budapest, 25-30 August 2003, Astronomy Education in Europe, convenor Magda Stavinschi
– JENAM 2004, Granada, 13-17 September 2004, Teaching and Communicating Astronomy, convenors G Bernabeu, M Stavinschi, V Martinez
– JENAM 2005, Liege, 4-7 July 2005, Astrophysics, and How to Attract Young People into Physics, convenors Naze Yael, Magda Stavinschi. Martine Vanherck.

Other educational meetings co-organized by us:
– an astronomy summer school, South Eastern Europe Youth at the Telescope, 4-11 July 2003, Belogradchik (Bulgaria)
– Yale Summer Workshop on Basic Astrometric Methods, 18-22 July 2005, Yale University, New Haven, USA, SOC W F van Altena, M Stavinschi, E P Horch
– Scientific Programs and Astronomy Education in SEE and Ukraine, 16-18 September 2005, Bucharest, Romania, organized under the aegis of the Astronomical Institute of the Romanian Academy and UNESCO-ROSTE.

Main publications:
– Lecons d'Astronomie, eds. S Collin, M Stavinschi, Ars Docendi, Bucharest, 2003
– The Special Issue on Astronomy Education in Europe, the European Astronomical Society, Teaching of Astronomy in Asian-Pacific Region, Bulletin19, Mitaka Tokyo, Japan, 2003.

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SERBIA AND MONTENEGRO

Overview

In Serbia and Montenegro, a new curriculum in astronomy is being prepared for all educational levels. There is an increased interest in astronomy among the general public. Five amateur astronomical societies have been founded in the last three years.

Elementary (primary) school

Astronomy topics are taught within natural history, geography and physics.

Secondary school

Astronomy topics are incorporated in physics and partly in geography. The current textbook in astronomy had its sixth edition in 2005. Astronomy is taught as a separate course, with one class hour per week, only in the fourth year of the Mathematical High School in Belgrade and in the equivalent grades attached to secondary schools in seven Serbian towns. There are no astronomy courses (in such grades) in Montenegro. Within the reform of education, in the last three years several attempts have been made to reintroduce astronomy as a separate and compulsory course in the last year of secondary school (as it was the case from 1969 to 1990), however without success for the time being.

College and University

There is a total of 13 universities in Serbia and Montenegro, out of which six are private. Natural sciences are studied at six state universities. Astronomy topics are taught at all six of them.

The University of Belgrade is the only one with a department of astronomy (in the Faculty of Mathematics). Students can enroll in astronomy or astrophysics. Within the last three years, 25 students graduated in astrophysics and 3 in astronomy. Eleven postgraduate students acquired the masters degree and two students PhD degree. There is a compulsory one-semester course Fundamentals of Astrophysics for the 3rd year students of the Faculty of Physics (physics teachers division). A compulsory course Geodetic astronomy (4th year) is taught at the Faculty of Civil Engineering. Since October 2003 a one-semester optional course, Fundamentals of Astronomy, has been introduced for the 4th year students of mathematics.

The Department of Physics at the Faculty of Natural Sciences of the University of Novi Sad has introduced the study of astronomy since October 2002. Here the European Credit Transfer System (ECTS) was introduced for the first time in Serbia and Montenegro. Optional courses in astronomy and astrophysics are offered from the first study year. A student can graduate after three years as a teacher of physics and astronomy, or as a physicist or astronomer after four years of study. At the University of Kragujevac there is an obligatory one-semester course, Astrophysics and Astronomy, in the third year of physics studies. There is a one-semester course, Fundamentals of Astrophysics, in the third year of physics studies at the University of Niš. At the University of Priština (since the academic year 2002-2003 in Kosovska Mitrovica) a one-semester course, Fundamentals of Astronomy, is taught in the second year of physics studies.

Two astronomy courses are taught at the University of Montenegro. A two-semester course Astronomical navigation (2nd year) was taught at the Faculty of Maritime Studies of Kotor. Since October 2004 a one-semester course Geodetic astronomy (3rd year) has been taught at the Department of Geodesy, Faculty of Civil Engineering in Podgorica.

According to the act passed in September 2005 the ECTS is to be introduced at all universities in Serbia and Montenegro.

A university textbook Opšta Astrofizika (General Astrophysics) by Mirjana Vukićević-Karabin and Olga Atanacković-Vukmanović, was published in 2004. Also, an auxiliary university textbook Fizika Sunca (Physics of the Sun) by Dragan Gajić was published in 2005.

Education conferences

School teachers could learn about advances in astronomy and new way of teaching astronomy in several 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 within the National Conferences of Astronomers organized by the Belgrade Astronomical Observatory and the Department of Astronomy at the University of Belgrade. The staff of the astronomical society (AS) Rudjer Bošković took part in the Festival of Adult Education with several lectures held in the planetarium. Many education conferences were organized by amateur astronomical societies.

Observatories and Planetaria

There is one professional astronomical observatory in Belgrade, founded in 1887. The building of a new astronomical observatory on mountain Vidojevica near Prokuplje started in 2005. There are also several small public observatories that belong to amateur astronomical societies in Belgrade, Novi Sad and Kragujevac.

There are two planetaria in Serbia and Montenegro: 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). Planetaria are mainly visited by the students of elementary and secondary schools.

Other public events and activities (public education)

Public astronomy education in Serbia and Montenegro was realized by lectures at universities, on radio and TV programmes, in popular journals and books, in the two planetaria, in public observatories, and numerous amateur astronomical societies. Fifteen amateur astronomical societies (14 in Serbia and one in Montenegro)

supported education on the broad front. The activities offered by amateur societies were numerous, ranging from public observations of all major events (transits of Venus and Mercury, the great opposition of Mars etc.), lectures, courses, conferences, schools, and camps.

The AS Rudjer Bošković in Belgrade has continued with its regular activities: publication of the popular astronomical journal Vasiona (Universe), for fifty three years now; courses each autumn and spring; lectures to secondary school pupils in the planetarium; demonstration of sky and telescope to the general public at its public observatory and in the planetarium, both within the fortress of Kalemegdan. The Society kept organizing the annual Belgrade Astronomical Weekends with lectures on various astronomical topics. The Society went on organizing also the Summer Astronomical Meetings, each year dedicated to a different topic. In the last 3-years the Society organized three Summer Schools of Astronomy. All the activities have been run by the staff of the public observatory and planetarium, by astronomers from the astronomical observatory and the University of Belgrade, by students of astronomy, and by amateur astronomers. On the occasion of the 70th anniversary of the Society two conferences were held in 2004, organized together with the Belgrade Astronomical Observatory.

The astronomical group of the organization of young researchers in Valjevo, Vladimir Mandić-Manda, organized regular courses, two educational camps per year lasting several days, the Valjevo Astronomical Meetings and numerous observational camps, each lasting 3-5 days. The results of the activities are published annually in the Proceedings of the Society of Young Researchers.

The AS Novi Sad (ADNOS) organized projections in the planetarium for elementary and secondary school pupils and other visitors. Regular projections on Saturdays are followed by some selected popular lectures in astronomy. The visitors can use telescopes of the ADNOS Observatory. The equipment of the Society is used for the training of students of astronomy and astrophysics. Activities have been run by the members of the ADNOS, mainly physicists from the University of Novi Sad, students and amateur astronomers.

The AS Belerofont (Bellerophon) in Kragujevac mainly used the telescope and premises of the Faculty of Sciences of Kragujevac. The members of the Belerofont Observatory were very active, especially in 2004, when a new telescope and the web camera were bought. Educational and observational activities of the AS Alpha in Niš contributed to an increased interest in astronomy in the south of Serbia. Alpha organized numerous lectures, public observations of all major events, 3-day seminars A Little Night Astronomy in 2003, and Spring Astronomical Workshop in 2004. The AS Milutin Milanković in Zrenjanin was active mainly in public astronomical education. A series of lectures was organized during 2004 and 2005.

The AS Lira (Lyra) in Novi Sad edits the Internet magazine Astronomical Magazine (http://www.astronomija.co.yu) since 1998, the largest astronomical web site in the country. Since 2003 the Lyra has published the magazine (hard copy) Astronomija. Every year the Lyra organizes observation competitions in the Messier marathon and astronomical camps on Fruška Gora mountain, lasting 3 days (with 50 to 100 participants from Serbia, Macedonia, Bosnia and Herzegovina and Croatia). Five to ten lectures were given during each camp and an observation competition and exhibition of telescopes were organized.

The astronomical group within the Natural History Society, Gea, in Vršac kept organizing the Astronomical Meetings of Vršac every year. Astronomical observations have been performed by means of a Celestron 8 telescope, bought in 2003. Many contributions in annual bulletins published by the Gea were dedicated to astronomy. The Society for Radio Astronomy Research, Aurora, in Bor observed radio reflections from meteor showers. The main activities of the AS Magelanov Oblak (Magellanic Cloud) in Prokuplje in this 3-years period were connected with the building of a new astronomical observatory on Vidojevica mountain near Prokuplje.

Five new amateur astronomical societies have been founded. The AS Loznica was founded in 2002 in Loznica. The main activity is public education through a local radio programme Astronomical Magazine lasting one hour per week, plus lectures in the secondary schools, a web presentation that is regularly updated, etc. The AS Andromeda in Knjaževac was founded in December 2003. Together with the gymnasium Hristo Botev in Belogradčik (Bulgaria) they organized an International Camp on Old Mountain in Serbia in June 2004. Together with the AS Rudjer Bošković the Society organized the Summer school of

astronomy on Old Mountain in August 2004. The Autumn School of Astronomy was held in 2004 (a CD with edited lectures was produced) and in 2005 (dedicated to the Year of Physics), the Spring School of Astronomy was dedicated to the Solar System. The AS Novi Pazar was founded in April 2004 in Novi Pazar. They have a TAL 200K telesope, a Meade refractor ETX 60, and a 0. 15 metre Newtonian reflector. The Montenegro Astronomical Society was founded in April 2004 in Podgorica. The main aim is popularization and public education in astronomy. They have a 0.28 metre Celestron telescope and two small telescopes. Each Saturday the members participate in a one-hour local radio-programme on astronomy. The Center for Radio Astronomy, Tesla, was founded in November 2004 in Belgrade. Members are mainly students of astronomy and astrophysics. They have three receivers (at 406.7 MHz, 1420 MHz and 40kHz) and measure the variability of the solar radio flux.

Despite high enthusiasm and activity of their members and great interest among the general public, the common problem of all of the amateur societies is a lack of adequate space, equipment and financial support. Very often they survive thanks only to enormous enthusiasm and the hard work of a few people. So, due to a lack of 'critical mass', two astronomical societies: the AS Kraljevo, founded in June 2001 and the AS Vlašići (Pleiades) in Leskovac, ceased to exist during the last three years.

The Petnica Science Center (PSC), for pupils interested in science, organized seven seminars on astronomy per year, lasting 7-8 days on average, with about 20 participants. Starting from 2003, the participants of the seminars belonging to the oldest group did independent research projects. The best work was presented at the conferences of research projects of the PSC participants (organized since 2002). Twelve astronomy papers appeared in the last three issues of Petničke Sveske (Petnica Notebooks). Petnica meteor group organized about 20 camps and various observational activities. The exercises within the courses Practical Astronomy and Practical Astrophysics for the 3rd year students of astronomy and astrophysics were organized during one week in May 2004 in the PSC.

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

Since 2001-2002 there has been no competition Nauku Mladima in astronomy, and those with work in astronomy have been directed to the competition in physics.

International Astronomy Olympiad (IAO)

In 2002 Prof J Milogradov-Turin, then the president of the Society of Astronomers of Serbia (SAS), initiated the participation of Serbia and Montenegro in the International Astronomical Olympiad. A total of one silver and five bronze medals were won in the last 3 years.

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SOUTH AFRICA

Overview

The highlight was undoubtedly the opening of the Southern African Large telescope, SALT, on November 10, 2005. The South African (SA) president, Thabo Mbeki, addressed over 1 000 invited guests at the opening at the observatory near Sutherland in the Karoo. The opening marks the beginning of a whole new era of astronomy in this part of the world, and accompanying this will also be a whole new effort in education and public communication. Tourism to the village of Sutherland has increased many fold over the last few years and it is hoped that eventually the people in the village will benefit from this increase.

Already there are plans to change the focus of the various outreach programmes of the astronomical community, and to raise the awareness for the need to develop resources for schools and teachers, since SALT does now form a part of the new curriculum.

Primary Schools

New textbooks have been written for the General Education and Training band, Grades 1-9, and all those covering natural science now also include some aspects of astronomy, mainly of course a trip through the Solar System, and some details of planets and moons. There is one very active group, the Primary Science Programme, PSP, that spends a substantial amount of time developing, in conjunction with the SA Astronomical Observatory, resources for primary schools. These are trialled and then made available for all primary schools that want to use them. It is hoped that ultimately they will become available nationally.

Secondary schools.

New material is being developed for the implementation of the Further Education and Training band, Grades 10-12, and it contains a substantial amount of astronomy and astronomy-related material. This presents the astronomical community with an ideal opportunity to contribute accurate and usable material to various writers, resource and curriculum developers.

Tertiary Education

The National Astrophysics and Space Sciences, NASSP.
This programme started some years ago and is progressing well with over 25 students doing honours and masters in addition to three PhD students. This programme is hosted by the University of Cape Town, but is supported by all universities in SA that have astronomy departments.

Universities
Many universities in SA, have astronomy departments with emphasis on differing aspects of astronomy. The largest department is at the University of Cape Town, where Prof Renee Kraan Koorteweg is the new head of department. It has a good first year intake, some of which carries on into the second year. The third year course will be re-introduced this year. UNISA, a distant learning institution, has a small but consistent group of quality students who often go on to do postgraduate work through the NASSP, although some stay on to do masters degrees in radio astronomy. Over the last few years there has been an amalgamation of universities and within these new structures different specialities continue: Potchefstroom does high energy astronomy using the HESS array in Namibia, Pietrmaritzburg does computational astrophysics, Durban does space weather and related topics, Free State, with the re-furbished Boyden telescope, is part of the PLANET group, Witwatersrand does galactic dust clouds, and Rhodes does radio astronomy training. All these universities have students at all levels.

National facilities

There are two national astronomical facilities: the South African Astronomical Observatory, SAAO; and the Hartebeesthoek Radio Astronomy Observatory, HartRAO.

SAAO has concluded an MOU with the Centre for Basic Space Science in Nsukka, Nigeria, to allow Nigerian astronomers to access the SA portion of SALT time. We expect the first two Nigerians to visit SAAO in early 2006, where they will begin by observing on the smaller telescopes to get some practical observing and research experience.

The observatory runs a summer school to recruit NASSP students, and as part of the SALT collateral benefits have set up teachers exchanges with Wisconsin-Madison in the US. There are also the SALT Stobie scholarships which are taken up at Dartmouth College and Rutgers University in the US and Southampton in the UK. The observatory also runs an active outreach programme interacting with schools, teachers and the public, and is active in developing resources. To help with this, an international collaboration between all the major observatories around the world, called STARTEC (State of the Art Telescope Educational Collaboration) was set up in 2001, has been established, and it is anticipated that this collaboration will contribute significantly to resource and teacher development.

At the Cape Town facility there are regular open nights to accommodate an ever increasing demand. In Sutherland there is now a Visitors Centre and there are regular tours to SALT and the smaller telescopes, with numbers reaching 1 000 per month.

HartRAO, like the SAAO, has a very active teachers and schools outreach programme reaching over 10 000 schoolchildren per year. There are also many teachers workshops to help them with the new curriculum. The observatory also has a Visitor Centre on site that houses 50 interactive exhibits and is well attended by both school groups and families.

SA is bidding for the Square Kilometre Array, and this is helping to raise the awareness of Radio Astronomy around the country which in turn is bringing more people to both of the astronomical facilities. In addition, staff from SAAO and HartRAO are often asked to deliver talks at assorted topics.

Planetaria

There are two planetaria in SA, one at the Iziko Museum in Cape Town, and one at Witwatersrand University, Johannesburg.

The Cape Town planetarium hosts over 75 000 people per year consisting of the general public and school groups. These presentations are delivered in three languages, English, Afrikaans and Xhosa. In addition an introductory course on astronomy, the Starfinder Course, is offered twice a year. The director is also a sought speaker and author of popular books on astronomy.

The planetarium in Johannesburg had over 85 000 visitors of which about 80% were in school groups. They made a special event of the Mars opposition in 2003 and the Transit of Venus in 2004.

General

The SA government has set aside time to highlight astronomy throughout the country, and each year October has been declared an Astronomy Month. This allows many other groups not normally involved in astronomy to get state funding to host astronomical activities. The SA science centres in particularly become very involved and then have funding to bring in expertise from the wide range of universities, planetaria and observatories to these centres around the country. In addition there is World Space Week that hosts a School Rocket Challenge.

In addition, there are regular dedicated radio slots on a number of radio stations as well as regular newspaper columns in daily and weekly newspapers.

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SPAIN

General information

The Astronomy content has decreased in Spanish secondary schools. The Spanish curricula have fewer hours for science subjects than some years ago. This situation is worse for the astronomy content because this was included in other courses. If the teachers do not have enough time to finish their syllabus, normally the teachers do not introduce astronomy.

School education

In secondary school the astronomical content is decreasing. In the past it was possible to teach two hours per week in an astronomy workshop. Currently, astronomy is only a part in the physics curricula and teachers, who taught astronomy some years ago, are not able to teach it now. The number of hours to teach physics has been reduced and the teachers have reduced the astronomy topics in particular.

However, the interest in astronomy is still present in teenagers, especially in the Spanish contests Adopta una Estrella and Pilla el Tránsito, organised by Real Sociedad Española de Física RSEF, Real Sociedad Matemáticas Española RSME, and Instituto Astrofísico de Canarias (IAC). These were a tremendous success in terms of participants, and the quality of the reports has been excellent in general. The European program Catch a Star and Venus Transit 2004 achieved an important outcome for pupils.

Since 2005 the contests will be sponsored by Consejo Superior de Investigaciones Científicas (CSIC), and the IAC will promote a new competition on Light Pollution and Sustainability in order to introduce this topic in the schools. It is important to mention that Adopta una Estrella will be open to pupils (primary and secondary) from Spanish and Portuguese speakers' countries. The first prize is a trip to one of the astronomical centres of CSIC in Spain for all the members of the winning team.

The situation in primary schools did not change in relation to the previous report. Astronomy appears briefly and distributed throughout several subjects. Sometimes teachers go to the 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.

The Spanish Association for Teaching Astronomy (Asociación para la Enseñanza de la Astronomía, ApEA) continues its activities organising a national conference every two years. Since the last report, ApEA has organised the 5th and 6th conferences in Zaragoza and in the Science Museum of San Sebastian respectively. The number of teachers participating was about one hundred. Currently, they are preparing the meeting for 2007 in Tenerife (Canaries Island).

University education

The Spanish university students can study astronomy during their courses in physics, mathematics and in some cases in engineering, especially in the final years of the degree courses. The astronomy subjects are not compulsory. Relatively, the interest in science degrees is decreasing, because young people are now more inclined to study humanities, social sciences, law, economics, management, or health professions.

Public education

Public education in astronomy is carried out by planetaria, science museums and the media. In particular, in 2004 activities related to the transit of Venus involved a lot of people. There were planetaria and science centres which prepared special programs for this day, involving observations, lectures, films and several kinds of contests. The majority of universities also developed several programs for 8 June 2004 related to the transit. Often, astronomy is presented alongside other topics such as history and arts, in order to make it more approachable for a general audience.

The Planetarium of Pamplona was the national node in the Transit Venus 2004 programme. This institution promoted different initiatives and collected information about many activities carried out in all the country. It has a website (http://www.venus04.org) with links to other ones – the Science Museum, planetaria, and science centres in Spain (roughly 30 institutions decided to participate actively). More than 100 groups of amateur associations were also involved. Specialized magazines included information and promoted activities. Newspapers, radio and TV also gave information. The news radio station Radio 5 Todo Noticias (of the public national radio and television network) included a daily commentary on the Venus transit from a month before. A brochure was edited (26 000 copies) and distributed by science centres, universities and amateur associations. The contest Catch the Transit was organised by the Real Sociedad Española de Física and the Real Sociedad Española de Matemáticas, and distributed 40 000 brochures to a lot of schools and universities.

The estimate is of more than 100 public activities, with around 50.000 people attending them. The Internet audience was a factor 20 to 30 times greater.

Participants in the final event of "Catch the Transit" in Granada

The winners of Catch the Transit with Richard West in Granada

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TANZANIA

During the past three years, we were able to continue with regular and continuous monthly publication of articles on astronomy, highlighting interesting events that were to take place during the following month, as well as writing about recent news and developments in the world of astronomy. The Internet, especially the Universe Today website http://www.universetoday.com proved to be a very useful source of the most recent news stories because astronomy books and journals are still very rare in Tanzania due to their high costs and low priority in funding.

Various stories were elaborated in simple language so as to make astronomy and science more appealing. Some of these news stories such as asteroid impact predictions and the search for extraterrestrial life have raised a lot of interest in Tanzania. Timings and positions were calculated or converted so that they are useful for local viewing positions in Tanzania. This information is crucial because it would otherwise not be relevant to viewers in Tanzania.

Events that were handled included individual sky events (such as solar and lunar eclipses, the transit of Venus, comets, tracking of the International Space Station, etc.), as well as regular but changing events (such as the planets, phases of the Moon, brightness of Algol etc.), and also regular occurrences (such as positions and timings of stars and constellations, the Milky Way etc.). Monthly sky maps that could be used for our locations in Tanzania were created using the Expert Astronomer software and drawn using Corel Draw software.

This information is made available in print, the Internet, and radio. Two print publications, a long established national daily newspaper, The Daily News, and a popular monthly tourist magazine, What ís Happening in Darí, have published my monthly articles for many years, while on the Internet, an educational website http://www.tanedu.org publish on their website my astronomy content monthly. Popular astronomy events were also covered as news stories in many local media. We also received television coverage with an interview on the national television station TVT.

Astronomy news also received international coverage for Swahili speaking people from radio interviews by the Swahili services of the BBC and Voice of Germany. These stations are heard all over the eastern part of Africa in more than eight countries including Tanzania, which is the home of the Swahili language. Swahili has become a lingua franca of Africa and is a recognized world language. Interviews for the BBC were conducted in their studios in Dar es Salaam, while the Voice of Germany interviews were conducted over the telephone from Bonn.

The annular solar eclipse of 3 October was.seen all over Tanzania as a partial solar eclipse. Observing sessions were conducted at the Open University of Tanzania, at which the Vice Chancellor, Prof Tolly Mbwette took an interest and watched the eclipse through a darkened filter and by projection through a pinhole. The eclipse prompted a wide coverage in the news, with reports both before and after the event. Due to absolutely clear skies and an 80% obscuration, the dip in solar insolation was apparent to observers even without any observing equipment. Eclipse and star observing events were also held at the International School of Tanganyika. Astronomy nights were also held at the Shaaban Robert Secondary School.

A practical/laboratory compendium for an option course at the University of Dar es Salaam is being prepared. I also participated in the international baccalaureate teaching of the practicals for astrophysics, which has become a very popular option in physics.

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UNITED KINGDOM

Overview

The UK is very active in all areas of astronomy education. In several of the following sections, illustrative examples are given with no attempt at being comprehensive.

Primary and secondary schools

The UK has a national curriculum to specify what *must* be taught in state schools up to the General Certificate in School Education (GCSE) examinations, normally taken at the age of 16. Nearly all of the teaching time in the schools is devoted to teaching the National Curriculum. This is specified in four Key Stages. Stage 1 has no specification for astronomy, but the three later stages do, currently as follows.

Stage 2 is normally completed at age 11 at the end of primary school. This requires students be taught

- that there is a force called gravity that pulls them downwards towards the Earth
- that the Sun, Moon, and Earth are roughly spherical
- how the Sun's position in the sky changes during the day and how this affects shadow length
- how day and night are related to the Earth's spin
- that the Earth orbits the Sun once a year, and the Moon orbits the Earth to give intervals between full Moons of about 29 days.

Key Stage 3 is completed in secondary school, normally at the age of 13. This requires students be taught

- how the movement of the Earth causes the apparent daily and annual motion of the Sun and stars
- the relative positions of the Earth, Moon, and planets
- the movements of the planets around the Sun, and how this is related to gravity
- that the Sun and stars are sources of light, whereas planets reflect light
- about the use of satellites and spacecraft to observe the Earth and the other planets.

Key Stage 4 is also completed in secondary school, normally at the age of 16, when the GCSE examinations in science are taken. This Stage requires students be taught

- the relative positions and sizes of planets, stars, and other bodies, such as meteors, comets, black holes, galaxies, etc.
- that gravity acts throughout the Universe
- the basics of stellar evolution
- about the origin and evolution of the Universe
- about the Search for Extraterrestrial Intelligence.

A review of the astronomy content of the science GCSEs has recently been completed, with the result that most schools will be teaching a revised curriculum from September 2006 – see the next triennial report!

Most students take about 10 GCSEs, covering a wide variety of subjects. There is also an optional GCSE in astronomy, which naturally contains far more astronomy than the science GCSEs. Its popularity is increasing, and in 2005 nearly 1000 students sat the examination.

After GCSE, most students go on to Advanced-level (A-level). Typically three of these two-year courses are taken, though in the first year five or so are often taken, leading to AS level examinations before the number is reduced. There is no A/AS-level in astronomy. Instead, there are astrophysics options, delving deeper into stellar evolution, the basics of astronomical observation and measurement, and so on.

School students also have many further opportunities for astronomy education, through visits to schools by astronomers and astronomy educators, through public outreach by various institutions, through planetaria, via telescope time, and through the activities of amateur astronomy societies.

The UK Association of Astronomy Education is active in providing support for teachers and students. Its activities include providing a list of speakers who visit schools (now taken over by the Education Committee of the Royal Astronomical Society (RAS)), publishing its journal Gnomon, has a website (http://www.aae.org.ac), and acts as a repository of information and umbrella for astronomy education, mainly in schools.

Universities

Nearly all astronomy departments in UK universities have been absorbed by physics departments, and many physics departments have added astronomy courses, in part to attract students into physical science degree programmes. Consequently, most erstwhile physics departments are now physics and astronomy departments. There is not a lot of teaching to non-science undergraduates. One notable exception is in distance education. The Open University teaches undergraduates only at a distance, and has a few short astronomy courses at first-year level, presented four times a year, that are aimed at all students. The most basic of these, Introducing Astronomy, has an annual enrolment of about 1500. The North-East Consortium of Universities also offers distance education in astronomy. The OU is currently developing astronomy courses for the Internet, that can be taken for credit from anywhere in the world.

Education conferences

The UK Association for Science Education (ASE) has an annual meeting in January extending over several days, that attracts several thousand school teachers. There are always astronomy events and exhibits. The UK Particle Physics & Astronomy Research Council (PPARC) sponsored a day of astronomy talks at the 2006 meeting.

The RAS promotes an annual National Astronomy Meeting, around Easter, which usually has a 1.5-2 hour session on education, sometimes more.

Observatories, planetaria, science centres

One of the most exciting developments in the UK in the last few years has been the emergence of robotic telescopes. A few years ago Dill Faulkes donated a sum of money to construct two 2-metre robotic telescopes, mainly for remote use by UK school students, for whom usage is free of charge. One telescope is located in Hawaii, the other in Australia.. In November 2005 the Faulkes Telescope Project (FTP) merged with Las Cumbres Observatory (LCO), based in Santa Barbara, California. FTP will now form the educational arm of the LCO Global Network, which plans to add several new 2.5-metre telescopes to the existing Faulkes Telescopes, and also build a dedicated education system consisting of around 20 small (0.4-0.6 metre) telescopes and 8-10 intermediate sized instruments (0.8-1.0 metre). FTP access is currently free to UK schools, with the eventual plan that the LCO network will be free to any school, anywhere in the world. It is hoped that this will be possible by 2008/09.

FTP currently has over 400 registered users in the UK, with another ~50 overseas. The project has pilot education programmes running with the British Council in Poland, and has recently started working with the British Council in Israel and Russia, as well as the European and Global Hands on Universe projects.

For further information see http://www.faulkes-telescope.com/

Among the other robotic telescopes that have emerged from the UK is the Bradford Robotic Telescope, consisting of two cameras and a 0.35 metre telescopes on Tenerife. There is no charge for usage. For further information see http://www.telescope.org/

Several UK observatories offer access to the public and encourage visits by school students. The Jodrell Bank radio observatory, the Armagh Observatory, the University College London Observatory, and the Royal Observatory Edinburgh are prominent examples. There are also smaller-scale initiatives, such as the outreach programme of the Marlborough College Blackett Observatory in Wiltshire. Among the amateur astronomical societies, Sheffield's is planning a substantial observatory and education building for school students and the general public.

There are at least 16 planetaria and/or science centres in the UK, some at observatories. The British Association of Planetaria is very active in astronomy education, and several portable planetaria are available. The Royal Observatory Greenwich, 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. It is currently undergoing a huge refurbishment and expansion. As one further example, the Lawrence House Astronomy Centre, in Lancashire, which includes a planetarium and an observatory, offers astronomy education to all ages and levels.

Amateur astronomers

There are well over 100 amateur astronomy societies in the UK, with active membership ranging from a few tens to over 100. Some are well endowed with telescopes from 0.3 metre aperture upwards, plus CCDs and other sophisticated equipment. Some of the observations are of research quality, for example on variable stars and comets. Most societies have a programme of invited speakers. Many are engaged in outreach, and there was extensive coverage of the transits of Mercury and Venus, and other astronomical events.

The majority of 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. It coordinates research by amateurs via many groups, Mars, Deep Sky, etc., and publishes its Journal of the BAA six times as year. It also holds meetings for its members. See http://britastro.org/baa/ for details.

The Society for Popular Astronomy (SPA), 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 somewhat more members than the BAA. It has quarterly meetings, a quarterly magazine called Popular Astronomy, and an occasional news bulletin. It has several observing sections. See http://www.popastro.com/ for details.

Radio and television

The BBC and commercial stations, TV and radio, carry much science, including astronomy. This is not only as news items, but as a variety of dedicated programmes. The Sky at Night has made monthly appearances on BBC television since the autumn of 1957, when Sputnik 1 was launched. Throughout its long history it has been presented by Patrick Moore, with guests consisting of amateur and professional astronomers. The UK Open University makes a valuable contribution to the content and production of radio and TV programmes on astronomy.

Other initiatives

Every few years there is a UK-wide initiative, National Astronomy Week, that encourages and coordinates a wide range of events, mainly for public understanding, and centred on some astronomical event. The most recent one was in 2003, with Mars as its focus – in August 2003 Mars was in a very close opposition.

PPARC, though a research council, has an obligation to the public understanding of science and to supporting school education, in astronomy (and particle physics). One recent initiative was a PPARC-sponsored visit by about a dozen UK A-level school students to 8 schools in South Africa, and a research visit to the Southern African Large Telescope.

The UK Atomic Education Authority is developing a project aimed to show the public and school students how fusion works in the Sun. It is planned to launch it at the Edinburgh International Festival in 2007.

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UNITED STATES OF AMERICA

Astronomy education in the United States continues across a broad range.

Meetings of the American Astronomical Society regularly boast of sessions devoted to Education and Public Outreach (E/PO). Each NASA mission has a component devoted to E/PO, and the Hubble Space Telescope (http://www.stsci.edu/outreach; see also http://hubblesite.org/newscenter/), the Chandra X-ray Observatory (http://chandra.harvard.edu), and the Spitzer Space Telescope (http://spitzer.caltech.edu) represent the flagship missions. Many activities are available online at http://amazing-space.stsci.edu/. Other missions also have Websites with educational functions, including the Transition Region and Coronal Explorer (http://trace.lmsal.com, specifically http://trace.lmsal.com/Public/eduprodu.htm) and the GLAST and Swift gamma-ray missions (http://glast.sonoma.edu/ and http://swift.sonoma.edu; see goals at http://glast.gsfc.nasa.gov/science/swg/sept00/LCominsky.pdf). See also the Stanford Solar Center (http://solar-center.stanford.edu/). NASA E/PO grants subsidize teacher workshops, such as the one held at Williams College 13-14 February for two dozen schoolteachers, and other public-school and community outreach.

The American Astronomical Society has an Education Officer, George Nelson, and a Director of Educational Activities, Susanna Deustua. Their education website provides a variety of links (http://www.aas.org/education). The site lists workshops and other programs for instructors of introductory university courses in astronomy. The United States, uniquely, has many survey courses as part of the general, liberal-arts education of most university students, so students of all majors – perhaps 250,000 per year – benefit from taking astronomy courses, mostly non-mathematical.

The American Astronomical Society's education 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.

"Its goals are to improve undergraduate and graduate education in astronomy and promote science literacy for all. The Society, and more widely the astronomical community, advocates greater attention to, encouragement of, and rewards for both excellence in astronomy education and research on teaching and learning in astronomy. It advocates astronomy and astronomy education in national and state education forums, to funding agencies, and to the scientific and education communities."

The Education Prize of the American Astronomical Society went to Jay Pasachoff in 2003, to Owen Gingerich in 2004, and to Larry Marschall in 2005, with the 2006 prize scheduled to be awarded to Sidney Wolff. The prizes are awarded at the January meetings of the Society.

Among other American Astronomical Society activities is the Harlow Shapley Lectureships, in which members travel to lecture at universities and other institutions in which astronomy is poorly represented. They provide a link to ComPADRE (Communities for Physics and Astronomy Digital Resources in Education), which provides many digital materials that are available free online. ComPADRE is a joint effort of several national societies; their website is unfortunately jargon-laden, though they do try to and intend to distribute materials for teacher use.

Approximately every two years, the American Astronomical Society arranges a full-day meeting of Chairs of astronomy departments, with about two dozen attending at a hotel at the O'Hare Airport, to make in-out connections easy.

Astronomy Education Research (AER) is a spin-off of Physics Education Research, a set of researchers studying educational processes. The Astronomy Education Research group at the University of Arizona, headed by Timothy Slater and Edward Prather, is a leader in carrying out academic research on how students learn astronomy. Sidney Wolff of the National Optical Astronomy Observatory and Andrew Fraknoi of Foothill College (and former Executive Director of the Astronomical Society of the Pacific) have recruited a board of advisors and started a very successful online journal, Astronomy Education Research, available with free registration at http://aer.noao.edu. It is published with the facilities of the National Optical Astronomy Observatories (hence the .noao website URL). As of this writing, they are on their fourth volume, with two issues comprising each volume. The journal is supported by the National Optical Astronomy Observatories and endorsed by the American Astronomical Society and the Astronomical Society of the Pacific.

The Astronomical Society of the Pacific (http://www.astrosociety.org), in spite of 'Pacific' in its name, is a national organization. They are devoted to astronomy education. The following paragraphs about them were contributed by Michael Bennett, their Executive Director.

"In 2004 the ASP announced that they were 'sharpening their focus' to concentrate more on education, especially on training, supporting, and motivating science educators of all descriptions, including K-12 classroom teachers, informal educators, instructors of introductory astronomy for non-science majors, and 'citizen science educators', particularly amateur astronomers who actively participate in public outreach. (At the same time, however, the ASP's services for the academic community, Publications of the ASP and ASP Conference Series, will continue unaltered.)

"The ASP continues to lead the 12-year-old Project ASTRO program, currently operating in 13 locations around the USA. In 2005 these sites trained a total of some 250 astronomer/teacher partnerships, reaching over 25 000 students. Many ASTRO sites continue to also conduct family outreach events using the astronomy kits and games developed under the Family ASTRO program, which concluded in 2005.

"Funded by NASA, the ASP's new Night Sky Network has recruited over 200 US amateur astronomy clubs. Member clubs receive (free of charge) one or two Outreach Toolkits per year, containing simple, tested, easy-to-use-activities, demonstrations, and sample presentations on a selected topic, such as how astronomers find extra-solar planets, size and scale of the universe, and telescopes. Some 1000 registered amateurs in these clubs use the materials at their star parties, in class visits, and in many other venues, then log their activities using simple web-based forms. Since its inception in late 2004, Night Sky Network volunteers have logged nearly 3000 events reaching nearly 250 000 people,

"The ASP's newest major program, the NSF-funded Astronomy From the Ground Up, is addressing professional development of informal science educators (ISEs) working in smaller science museums, science centers, and nature centers where there is a high demand for astronomy-related information, and little institutional capacity to provide it. The project is developing both face-to-face and distance learning training for these ISE professionals.

"In 2005 the ASP altered its annual meeting format to provide an annual international conference for astronomy education and public outreach practitioners – roughly defined as those who develop educational materials or programs for other educators to use. Some 400 E/PO professionals attended the ASP's conference in Tucson, Arizona in September. The next ASP conference, aimed at attracting members of the same community, is scheduled for 16-18 September 2006, in Baltimore, Maryland, to be hosted by the Space Telescope Science Institute.

"The ASP's website offers additional free publications and resources for educators interested in beginning, adding to, or improving their astronomy education efforts."

The American Physical Society has a forum on education, whose newsletter is available at http://www.aps.org/units/fed/. Some aspects of their work is relevant to astrophysics.

Astronomy Picture of the Day (http://antwrp.gsfc.nasa.gov/apod/astropix.html, and usually merely http://antwrp.gsfc.nasa.gov) is a popular site worldwide, posting (as its name says) a different astronomical image each day. The images are indexed and come with a paragraph of explanation.

Textbooks continue to be a main source of astronomy education. College/university textbooks are highly illustrated and increasingly come with interactive materials online and on CD-ROMs. An article by David Bruning in the journal AER surveys the current texts. Astronomy appears to some degree in texts for schools, to a lesser extent in elementary schools, as part of Earth science and physical science courses in middle schools and junior-high schools, and only in a minor way in high schools.

Millions of people each year continue to get their astronomy outreach from public planetaria. There are major planetaria in New York (Rose Center for Earth and Space at the American Museum of Natural History), Los Angeles (Griffith Observatory, under major reconstruction and due to reopen in the fall 2006 with its 23.5 metre dome), Chicago (Adler Museum and Planetarium, with major rare-book and historical instrument collections), Philadelphia (Fels Planetarium of the Franklin Institute; their 18 metre dome was replaced in 2002 along with other upgrades), and Pittsburgh (Buhl Planetarium and Institute of Popular Science, still with their Zeiss II under a 20 metre dome). The many smaller planetaria may total more visitors each year. Jordan Marché recently discussed the history of planetariums in Theatres of Time and Space: American planetaria, 1930-1970 (reviewed in AER, 2005). New York and Los Angeles have Zeiss 9 opto-mechanical planeteria; mini-versions from Zeiss, their Skymaster ZKP3/B (the ZKP4 is beginning to be available) have been installed elsewhere, such as Williams College (2005). The price of the Zeiss 9 is in the millions of dollars; the price of the ZKP4 is approximately $400 000. Spitz Space Systems also makes opto-mechanical planetaria, as do Minolta and GOTO. Digital planetarium systems that provide the ability to zoom around the Galaxy or beyond, and show digital video content, are available from companies such as Evans & Sutherland, Sky-Skan, Spitz, and others. A relatively inexpensive digital planetarium, though projecting horizontally into a 1.2 metre hemisphere, is newly available from Ansible Technologies (http://www.ansibletech.com) as their MicroDome for about $30 000. Small digital planetaria are also available from Learning Technologies (their Starlab), Digitalis, and ePlanetarium. Much of the digital content can be shown across a wide variety of platforms, providing the same production quality at different

equipment levels. See a master list of planetarium sites at http://www.lochness.com/links/pltrel.html; Loch Ness Productions (http://www.lochness.com) provides digital planetarium shows, artwork, and music for both 'fulldome' presentations and for slide presentations.

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VATICAN CITY STATE

This summer, the Vatican Observatory invited 27 young scholars from 20 countries to Castel Gandolfo for four weeks of the tenth summer school on Astrobiology: The Search for Our Origins and Life Elsewhere. The Observatory hosts these summer schools to encourage dialogue and foster relationships with young scholars throughout the world. A special emphasis is given to inviting students from non-industrialized countries. The selection is made without reference to race, religion, national origin, gender or physical handicap. Topics that were discussed included the search for life on Mars and Europa, bioethics and planetary protection, biology for astronomers, evolution of life and Earth's climate through time. Each student also was given the opportunity to discuss his/her current research project that they are conducting at their university. The students also participated in a Papal audience and took a tour of the Vatican Gardens and Museums. They visited Florence for a weekend and made a field trip to Gubbin, a site showing the K-T boundary, famous for marking the extinction of dinosaurs.

In addition, members of the Vatican Observatory staff continued to teach a general astronomy course at the University of Arizona, and conducted educational and public outreach activities in Argentina, Canada, Honduras, Italy, Spain, UK, and the USA.

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VENEZUALA

As reported in my previous report, in the School of Science, Universidad de Los Andes (ULA), a very successful event, founded in 2000, focused on high school students (and also other school students), called Encounter with Physics, integrates the three disciplines mathematics, chemistry, and biology. This aim has been achieved, and now the new name is Encounter with Physics, Chemistry, Mathematics, and Biology. This event has grown each year in an exponential way. As a matter of fact, in its sixth year (2005), the number of high school students attending the event, from all over the country, was approximately nine 9000. Among all the experiments that these students could observe and feel, were many involving astronomy. These experiments were prepared by professors, together with graduate and undergraduate students, who are pursuing degrees including astronomy courses and theses involving astronomy.

For the school and high school levels, in the Faculty of Science of ULA, many programs are continuing to grow and to become strong. The ones that are addressed to school and high school teachers have matured, in the sense that now our professors have prepared excellent didactic material that can, together with the hour/class teaching, prepare them for a better understanding of astronomy, providing in this way a better education for their students. As a completion of this work, we have been giving public lectures in the University and at many schools and other universities from all over the country. Perhaps, if we did not have to cope with all other standard duties to be fulfilled in the University, we could do more. But, from a relative point of view, we certainly do more than expected. We have been continuing not only to explain the nature and consequences of solar eclipses, but also to write announcements designed for the public in general, such as for the case of the 8 April 2005 annular-total solar eclipse. We programmed excursions to the sites where the eclipse would occur, with our under- and graduate students, in order for them to have a better understanding of this topic and astronomy in general.

The excitement of the young people is growing; many astronomical events helped to promote this. Certainly, the Mars approach, the annulat-total solar eclipse, among others, induced a large number of visitors to attend the Observatorio Nacional de Llano del Hato, eager to watch the phenomena. The astronomers of the Centro de Investigaciones en Astronomía (CIDA) also prepared talks and had displays in the Museum of Astronomy located in the Observatory. Recently, CIDA has become involved in astronomy at school level, and has implemented popular talks for the general public as well. They also prepared an excursion for the annular-total solar eclipse. The Observatorio Cagigal, located in Caracas, has been continuing to give popular talks with the collaboration of astronomers and fine amateurs. Their activities have not declined and it remains as a nice symbol of Venezuela being included in the group of countries doing astronomy observations and research. In the same way, the Planetarium Humboldt always organizes talks that are suitable for a broad public interested to know more about the sky. Moreover, several universities such as the Universidad Central de Venezuela, Carabobo, and La Universidad del Zulia, among others, have been recruiting students that have an interest in astronomy and astrophysics, and have enrolled them to pursue graduate and undergraduate degrees through their programs and thesis topics for related to these fields. Besides, there are many amateur societies that are very serious and competent in helping local and overseas astronomers who wish to be able to record specific phenomena. These societies also send notes on popular topics in astronomy, in very understandable language suitable for a wide public. They keep always in touch with Venezuelan professional astronomers.


A demonstration of a small telescope


A model of the Sun-Earth-Moon system

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FOR COUNRIES A-M SEE SEPARATE DOCUMENT