

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

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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 2011, though many reports (including my own for the UK!) were prepared several months into 2012, so might contain information straying into 2012. 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. A few reports were received in plain text in emails, so modifiers of the basic Roman alphabet characters (e.g. \dot{a} , c) 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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MEXICO

Overview. Mexico is a country where only 52% of the youngsters between 15-19 years old are enrolled in secondary education. It has 110 million inhabitants and there are about 200 professional astronomers.

Elementary (primary) education. Throughout the country, astronomy education at elementary 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 has meant a further reduction of science courses and consequently a reduction of the importance of astronomy 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 basic astronomy concepts.

College level. This level in Mexico is already highly specialized, there are about 50 institutions that offer physics programs, in some of them astronomy can be learned as part of the optional courses.

Graduate programs in astronomy. There are 3 fully established graduate programs in astrophysics with a total enrollment of 120 students. In addition some physics and engineering programs occasionally prepare students in astronomy.

Astronomy lectures for general public. This activity is well established and in some of the large cities there are regularly scheduled conference programs.

Observatories and planetaria. There are 2 large optical observatories, 3 small optical observatories; the Large Millimeter Telescope is now in operation. There are 38 planetaria in Mexico, distributed over the whole country. In these planetaria there are also additional public lectures and astronomical activities.

Related activities. There is an Astronomical Olympiad that is in its eighth edition. It has attracted the attention of young people and it has been growing in interest.

Star parties. There have been several nationwide star parties (April 2010, February 2011, and the one scheduled for November 2012). On December 2011 a simultaneous observation of the moon attracted

observers to gather more than 2000 telescopes in more than 40 sites to set a new Guinness Record, that superseded one set in 2009.

The Venus transit of June 2012 was very widely publicized in the media. It caught the interest in some sections of the population. It attracted the general public, as well as students either to observe it (directions to protect their eyes were very well advertised in advance), or by following the web sites of professional observatories.

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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, together with the Netherlands Astronomical Society (NAC) are actively engaged in promoting astronomy in primary as well as secondary education. NOVA is also responsible for the national outreach, operating the national Dutch astronomy outreach center NIC (NOVA Information Center), which employs both an education officer and a general outreach/press officer.

The NOVA Outreach website (<u>www.astronomie.nl</u>) has an ever increasing popularity. Target groups are primary and secondary schools, the press, and the general public. Lots of educational materials such as the ESA/ESO practical exercises (<u>www.astroex.org</u>) are available through this website; there's also an image bank, a semi-popular encyclopedia, a prize-winning interactive Black-Hole website, and information about the university astronomy education. Teachers can subscribe to the NOVA electronic Newsletter.

Social media are gradually becoming more important. All NIC activities are overseen by the Minnaert Committee, consisting of several knowledgeable representatives of the Dutch astronomy departments. Excellent contacts exist with the Outreach and Education officers at the Netherlands Institute for Radio Astronomy, ASTRON, in Dwingeloo, the Netherlands Institute for Space Research, SRON, in Utrecht, the national Dutch ESA/ESERO education at the NEMO Science Center in Amsterdam, and the Dutch UNAWE (Universe Awareness) effort in Leiden. Also, amateur groups and observatories are in the loop.

Each year the national Dutch Astronomy Olympiad for high school students is organized, by one of the astronomy departments. The winner usually gets a free trip to the La Palma observatory, to carry out an observing project.

Astronomers in Groningen won a national science communication and education contest. Their project "Discover the invisible universe", focusing on infrared radiation and infrared astronomy, was carried out during 2009. An infrared photography contest for high school students, meet-and-greet performances of the reborn William Herschel, and hands-on infrared experiments were part of the project. The Discovery truck, which took those experiments to dozens of schools and city squares throughout the country, was also present at the kick-off of the IYA2009, at UNESCO in Paris.

Both the Groningen Kapteyn Institute and the NOVA NIC operate a (traveling) mobile planetarium, for school visits, science weekends, etc. These planetaria are a major success. The Blaauw observatory, operated by Kapteyn Institute astronomers since 2010, offers monthly public viewing nights and edutainment lectures for the general public in the northern Netherlands. Nijmegen also offers public viewing; Leiden and Amsterdam will shortly follow.

The project "Keys to the Stars", where a performance by the professional Grieg piano duo is being accompanied by an astronomical video (and a short lecture) has been a success, since its inception in 2009. A dozen performances in concert halls throughout the country have been given; these will be continued, hopefully also abroad.

A committee involved in a major revision of the high school physics curriculum finished its work; astrophysics and geophysics are new topics which will be taught as of 2014. The Groningen Kapteyn Institute offers an interactive astronomy webclass, which can be taken by interested high school students, two times one month every year.

The Dutch government and the Royal Netherlands Academy of Sciences continuously invests into the quality and quantity of science education at all levels, from preschool to university. Teacher CPD and Inquiry Based Learning are important elements in these efforts, including general science for elementary education as well as astrophysics for maths and physics in secondary education. All major universities offer science hubs supporting elementary education since 2010. Several Dutch staff astronomers are actively engaged in these efforts.

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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 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 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's 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 chemical 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 audiovisual means for astronomical education. Teachers are keeping interest for postgraduate education in Astronomy.

University

As said in the previous report, all the BSc and MSc degree courses in Portuguese universities are now following the rules of the Bologna agreement: 1st cycle (3 years), for BSc. degrees; 2nd cycle (2 years), for MSc degrees; 3rd cycle (3 to 4 years), for PhD degrees.

Some of the Portuguese Universities offer specific MSc degrees and have special programmes for PhD degrees in Astronomy. There are a good number of students registered for such degrees. Some proceed in international centres, through organizations of which Portugal is a member, to get specialization. Other universities teach astronomical subjects within the curricula of their degree courses and have been active in

their promotion. There are, also, some specific courses carried out on the basis of international networks. Astronomy continues to be taught in military schools.

To be mentioned also, is the active participation of university centres in the most important international organizations, and advanced projects and missions for astronomical research, including the development of astronomical instrumentation.

Education conferences

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 along 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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ROMANIA

In Romania astronomy belongs not long to the curriculum, neither in undergraduate education, nor colleges. However, due to the interest that many teachers and astronomy attraction that one finds in young students, we recorded unexpected success on different levels, especially during the international Olympiads. Not to mention this extraordinary work performed during IYA 2009, schools together with mass media, but few specific actions that have had great audience: national and international Olympiads, "Cassini scientist for a day" contest or "Hands on Universe".

Olympiads

As it is shown in the list below, Romanian students returned from each Olympiad as winners. 2009:

- International Astronomy Olympiad (China): 2nd in Europe, 5th in the world: 2 silver medals, 3 bronze medals
- International Astronomy and Astrophysics Olympiad (Tehran, Iran): 1st in Europe, 3rd in the world: 1 gold medal, 2 silver medals, 1 honorable mention

2010:

- International Astronomy Olympiad (Crimea): 2nd in Europe, 4th in the world: 2 silver medals, 3 bronze medals
- International Astronomy and Astrophysics Olympiad (Beijing, China): 1st in Europe, 2nd in the world: 2 gold medals, 2 silver medals, 1 bronze medal

2011:

- International Astronomy Olympiad (Kazakhstan): 2nd in Europe, 3rd in the world; 1 gold medal, 3 silver medals, 1 bronze medal
- International Astronomy and Astrophysics Olympiad (Poland): Romania won the gold medal for the best team in competition, 2 bronze medals, 2 honorable mentions.

For the next year, the Minister of Education, Research, Youth and Sport (MECTS) proposed to organize in September 2012 the quadrilateral contest in Astronomy – Romania, Bulgaria, Serbia and Hungary. The international board of the international organization on Astronomy and Astrophysics competitions (IOAA) approved Romania as organizer of the 8th edition of the International Organization on Astronomy and Astrophysics Competitions (IOAA) in 2014. An official letter of invitation was received by MECTS.

Cassini Scientist for a Day

This was an essay contest designed to give students a taste of life as a scientist. Students compare and research three possible targets that the Cassini spacecraft can image during a given time set aside for education. The contest was really a success.

For the 2009 essay 112 teachers contributed for the success of the contest: 47 schools, 132 essays, 283 students, finally directed by 25 teachers. In 2010, the essay attracted 151 students from 45 schools abd were directed by 57 teachers: we had 125 students for the degrees 5-6, 118 for the degrees 7-9 and 15a for the degrees 9-12. For the 2011 essay contest were involved 280 Romanian students, with 7 participating schools for the degrees 5-6, 10 schools for the degrees 7-8 and 21 for the degrees 9-12.

Hands on Universe

The following activities were directed by the University of Craiova in the frame of the EU Program "Hands on Universe"

- 20 - 21 March 2009: "Celebration of Cosmos and Life" - scientific session

- 10 - 11 April 2009: "**The Cosmos between Spirit and Matter**" - conference dedicated to the International Year of Astronomy

- 30 May 2009: "Watching on the Universe – A day of Astronomy" - theoretical training session and sitepractice session for the local community. Slogan: "Test your eyes! Watch high in the sky!"

- 22 September 2009: "**Cosmos, Culture, Education**" - cycle of activities involving high school and university students, including the concert "**Music of the spheres**" performed by the "Oltenia" Philharmonic Orchestra from Craiova

- 5-8 November 2009: "**Science and Society**" - bilateral meeting Romania–Serbia, including a student contest with the participation of students from Craiova (Romania) and Nis (Serbia).

- 10-11 April 2010: "**Universe of Knowledge, Universe of Education**" - meeting for promoting sciences 3-25 April 2010: "**Classic and modern in teaching Astronomy**" - training session and symposium in Astronomy. Guest: Roger Ferlet (UPMC Paris, France)

- 9-10 June 2010: Meeting (round table) with the teachers participating in the training course of the team of Romania participating in the International Olympiad of astronomy

- 15-17 April 2011: The third meeting "*Science and Society*", with the participation of teachers and students from: Craiova and Drobeta Turnu Severin (Romania), Nis and Kladovo (Serbia).

- 1-3 June 2011: "The scientific and didactical film festival" - presentation of 20 short scientific films produced by students and teachers

- 19-21 August 2011: **"Balkan Summer School 2011" - t**raining seminar for teachers jointly organized with the South Eastern European Network for Mathematical and Theoretical Physics –SEENET MTP". It included a visit at Astronomical Station at Vidojevica (Belgrade Observatory)

- December 2011: Acquisition of a **radio-telescope SRT 10** which will be placed in an European network of 5 instruments

The Romanian Society for Meteors and Astronomy (SARM)

SARM organized a lot of educational activities during the last three years. The most important were organized in Târgovişte, about 80 km North from Bucharest. Activities for students and teachers included presentations in schools and universities, trips to astronomical observatories and planetariums, conferences and photo exhibitions, observing astronomical phenomenon such as solar and lunar eclipses, meteors, public campaigns, activities for people with disabilities, two activities for convicts (in a Maximum Security Penitentiary and a Rehabilitation Center), activities in rural areas for children and students, symphonic cosmic concert with a Symphonic Orchestra. Most activities were organized during the Global Astronomy Month 2010 and 2011 and Astronomy Days 2009-2011. Detals include the following .

- The Astronomical and Science Festival for Youth, editions 2010 and 2011.

- The National Astronomical Camp and Summer School PERSEIDE, every July-August.

- The 7th edition of the National Astrophotographical Contest and International Exhibition ASTROFOTO 2010.

- ASTRONOMIA 2009 and ASTRONOMIA 2010, two summer camps for students in the Bucegi Mountains.

- ASTRO 2009 and ASTRO 2010 – Invest in education!, two editions of the national symposium of education through astronomy.

- Festival of Cosmopoetry, 58 projects in 2009-2011 period on the web portal www.cosmopoetry.ro

- 100 Hours of Astronomy Festival (Highly Commended – Largest single registered 100 Hours of Astronomy event).

- Galilean Night Festival (Winner for Outstanding Galilean Nights Event).

- First Romanian educational expedition to El Gran Telescopio Canarias, La Palma, 2010.

- International Meteor Conference – IMC 2011 (<u>www.imo.net/imc2011</u>), the 30th edition, Sibiu, Romania, where students and teachers had access to the program of the conference and when were organized two public activities: and an astrophotographical exhibition at the public library and observations through telescopes in the main public square.

Others

We could also mention GOLIAT, the first Romanian satellite to make space debut on February 9. GOLIAT mission focuses on educational and experimental research. An important role was played by the Romanian participation to different solar eclipses: China 2009, Pacific 2010, and Finland 2011.

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<u>Serbia</u>

Overview

Astronomy education in Serbia in the past three years was characterized by intense and various activities. Although the re-introduction of astronomy as a compulsory course in secondary school curricula was announced in 2008, astronomy still makes part of the primary and secondary school curricula neither as a separate nor as a compulsory subject. After a system of academic degrees, introduced by the Bologna process, had been implemented at all five state universities in Serbia, in the past three years the study programs were accredited. The interest for astronomy is steadily increasing among the general public. Four new amateur astronomical societies have been founded and only one ceased to exist. Serbian teams continued to successfully participate in the International Astronomy Olympiads.

Elementary (primary) school

In the elementary school curricula astronomy topics are taught as part of the courses of Natural History, Geography and Physics. Within the current reform of primary school education, three astronomy lectures: "Observations of celestial bodies", "Solar and lunar eclipses" and "Eratosthenes' measurement of Earth's circumference" have been introduced as extra topics in the 8th year physics course curriculum.

Secondary school

Astronomy has not been reintroduced in the secondary school curricula as a separate and compulsory course in the 4th year as was announced 3 years ago. It is worth to recall that after 25 years (from 1969 to 1994) being a separate fourth year, one hour per week course, in 1990 astronomy topics became incorporated as part of the fourth year physics courses. Attempts are being made to reintroduce astronomy as a separate and compulsory subject, but hitherto without success.

Petnica Science Center

Petnica Science Center (PSC) is the largest independent and non-profit organization (founded in 1982) for extramural scientific education in the South Eastern Europe. The majority of programs are dedicated to secondary school students, but there are the programs for elementary school pupils, undergraduate students and high school teachers as well.

From October 2008 to October 2011, the Program of Astronomy in PSC realized 21 seminars for secondary school students interested in astronomy, which were attended by 150 participants in total. About 30 researchers from the Universities of Belgrade and Novi Sad, Belgrade Astronomical Observatory and other institutes, and about 20 students of astronomy took part in their realization. During the past three years forty individual research projects were realized by the participants of the seminars that belong to the most advanced group, of which twenty were presented at the Conferences of the PSC participants "A Step into Science" and published in "Petnica Notebooks".

Several participants of seminars and young collaborators of PSC attended the International Meteor Conferences, as well as the Summer schools of astronomy in Croatia, Germany and Israel. The collaboration with the International Meteor Organization (IMO) is very intensive. Each year at least 5 campaigns of observations of meteor showers have been organized by the Petnica meteor group. The PSC was also very active in the preparation of the Serbian team for the International Astronomy Olympiad, particularly in the practical training activities.

The major reconstruction of the PSC, including the building of the new observatory on the hill above the campus, began in July 2011.

International Astronomy Olympiad (IAO)

The participation of Serbia in the International Astronomical Olympiad (IAO) was initiated by Professor J. Milogradov-Turin in 2002. Since 2004 the National Astronomical Olympic Committee has been in charge of training, testing and selection of the national team. In the last three years Serbian teams participated at two IAOs (International Astronomy Olympiads) and the IOAA (International Olympiad on Astronomy and Astrophysics) and won in total two gold, eight silver and eight bronze medals, one special prize and three recognitions.

University

Astronomy courses are taught at five state universities in Serbia (University of Belgrade, University of Novi Sad, University of Niš, University of Kragujevac and University of Priština in Kosovska Mitrovica). In the course of past three years the studies have been accredited. The Universities of Belgrade and Novi Sad offer graduate studies in astronomy.

The University of Belgrade is still the only university in Serbia with the Department of Astronomy (at the Faculty of Mathematics). Students can enroll astronomy from the first study year. Since 2006/2007 academic year study programs of Astronomy and Astrophysics have been adjusted to the new ECTS, and a model 4+1 for the first two degrees (Bachelor and Master) was accepted. In 2009/2010 the studies were accredited at the Faculty of Mathematics and the study program in astronomy was changed. New accredited study program "Astronomy and Astrophysics" consists of 3 programs (Computational Mechanics and Astrodynamics, Astrophysics, Astroinformatics) at undergraduate (4 years) level, 2 study programs (Astronomy, Astrophysics) at Master studies and one study program (Astronomy and Astrophysics) at PhD studies. In the past three years, 21 students graduated in Astrophysics and 4 in Astronomy. In total, 10 master, 3 MSc and 7 PhD theses have been defended.

Since 2011/2012 the Faculty of Mathematics participates in "AstroMundus", a 2-year common master program in astronomy and astrophysics of 5 universities from Innsbruck (coordinator), Rome, Padova, Gottingen and Belgrade.

At the University of Belgrade astronomy courses are also taught: (1) at the Faculty of Mathematics – a compulsory course "Introduction to Astronomy" (3rd study year) for the students of L division (mathematics and informatics teachers), an elective course "Selected Topics in Astronomy" (4th year) for all students of Mathematics and two elective courses "Stellar Astronomy" and "Ephemeris Astronomy" (1st/2nd year) for the students of Informatics; (2) at the Faculty of Physics - a compulsory one-semester course "Fundamentals of Astrophysics" at the 1st year of master studies for physics teachers division, and an elective one-semester course under the same name for the students of the 1st year of theoretical division and for the students of the 2nd or the 3rd year of general division; (3) at the Faculty of Civil Engineering - a compulsory course "Geodetic Astronomy" (4th year), and (4) at the Faculty of Geography, some astronomical topics are taught as part of the first-year course "Mathematical Geography".

The students of the Department of Astronomy have training in observations at the Ondrejov Observatory (Czech Republic) since 2007. In the next future they are going to use also the facilities (Astro Optic 60cm reflector) at the Astronomical Station on the mountain Vidojevica (southern Serbia).

The Department of Astronomy continued to organize regular seminars on different topics in astronomy on every second Tuesday throughout the academic year, so that 44 seminars have been held in the past three years. Eighteen seminars were also held in the same period at the Astronomical Observatory of Belgrade.

The Astronomy Students Workshops have been organized since 2007 by the Department of Astronomy in Belgrade, the Department of Physics in Novi Sad and Astronomical Observatory of Belgrade, aimed at improving contacts between the students of astronomy from Belgrade and Novi Sad.

The Department of Physics of the Faculty of Natural Sciences at the University of Novi Sad has started studies of astronomy in the 2002/2003 academic year, introducing ECTS with the model 3+1+1. Since 2008/2009 new accredited studies are of the model 3+2. Many of the disciplines of astronomy and astrophysics are taught within one-semester elective courses to the students of other study programs at the Department of Physics (e.g. courses "Fundamentals of the Solar System" (1st year) and "Egzobiology" (2nd year) for the students of physics at the undergraduate level, or one-semester courses "History of Astronomy", "Interstellar Medium", Extragalactic Astronomy and Cosmology", "Astrochemistry", "Planetology" etc. at the master studies in physics). In the past three years eleven students got 3-year diplomas and one student received the Master's degree. At the Department of Geography of the FNS in Novi Sad, a course "Mathematical Geography with Fundamentals of Astronomy" is taught in the first study year.

At the Institute of Physics of the Faculty of Natural Sciences of the University of Kragujevac there is onesemester compulsory course, "Astrophysics and Astronomy", for the 5th-year students of physics. The students use a Carl Zeiss Telescope 150 f/15 and a 200 f/5 Newton telescope at the Astronomical Observatory that belongs to the Faculty.

At the Department of Physics at the Faculty of Natural Sciences of the University of Niš, an elective course "Introduction to Cosmology" is taught (3rd year) at undergraduate studies. At Master studies, a compulsory course "Fundamentals of Astrophysics" (2nd year) for the students of General Physics is taught. The same course is elective for the master students (1st year) of Physics - Informatics. At the PhD level, there are two elective courses: "Cosmic Plasma" and "Fundamentals of Cosmology". At the Department of Biology, an optional course "Fundamentals of Astrophysics with Astrobiology" is taught at the first study year of undergraduate studies. At the Department of Geography, an elective course "Astronomy" is offered to the first-year master students. The other courses (Physical and Mathematical Geography) include a number of astronomical topics.

At the University of Priština in Kosovska Mitrovica a one-semester course "Fundamentals of Astronomy and Astrophysics" is taught to the second year students of physics. At the Department of Geography a course "Mathematical Geography", which includes some astronomical topics, is taught in the first study year.

In 2010, a university textbook "Introduction to Spectroscopy for Astronomers" was published (Prodanović 2010) as well as the second edition of the university textbook "General Astrophysics" (Vukićević-Karabin and Atanacković 2010).

Education conferences

The Society of Physicists of Serbia organized annual meetings of physics and astronomy teachers where teachers can learn about advances in astronomy. A regular section dedicated to astronomy education is included in the National Conferences of Astronomers (NCAS) jointly organized by the Belgrade Astronomical Observatory and the Department of Astronomy at the University of Belgrade. In August 2011, the Department of Physics at the Faculty of Natural Sciences of the University of Niš organized a seminar of the SEENET-MTP network for teachers from the Balkans "Trends in Modern Physics". Due attention should be paid to numerous popular lectures that are often given at "Kolarac" Foundation in Belgrade on the latest news in astronomy.

Observatories and Planetariums

In 2012 the Astronomical Observatory in Belgrade, one of the oldest scientific institutions in Serbia, celebrates its 125th anniversary. The first phase of building of a new astronomical station of the Belgrade Astronomical Observatory on the mountain Vidojevica near Prokuplje at an altitude of 1155 m is completed, including the installation of 60cm Astro Optik telescope which is fully operational and started with regular observing programs.

There are also several small public observatories that belong to amateur astronomical societies in Belgrade, Novi Sad and Kragujevac. The planetariums in Belgrade (since 1970) and Novi Sad (since 2001) are used for lectures to secondary school students and the general public.

Public outreach and amateur astronomy

Public astronomy education in Serbia was realized mainly through a number of various activities (public observations of astronomical events, lectures, courses, conferences, schools and camps) of 20 amateur astronomical societies (two in Belgrade, two in Novi Sad, Valjevo, Niš, Zrenjanin, Vršac, two in Bor, Prokuplje, Knjaževac, Novi Pazar, Bačka Palanka, Ivanjica, Pančevo, Kragujevac, Kruševac, Leskovac, Vlasotinci). In the past three years, four amateur societies were founded, and one ceased to exist. All the societies offer educational programmes for the general public, ranging from star parties to public lectures. They also took part in the popularization of astronomy through local TV or radio programs, newspapers and web portals.

The Association of Astronomical Societies and Astronomical Sections of Vojvodina was founded in January 2010, whereas the Amateur Astronomers Association of Serbia was founded in February 2010. There is an intensive collaboration among the astronomical societies in Serbia. A nice example was a common project of 13 astronomical societies under the title "Serbia Takes Photos of the Moon", realized from 6 to 15 October 2011.

The astronomical society (AS) "Rudjer Bošković" of Belgrade, the largest and the oldest (1934) society of amateur astronomers in Serbia, continued its numerous activities: (1) publishing of the non-profit astronomical journal "Vasiona" ("The Universe"); (2) organization of "Astronomy Courses for Beginners" each autumn and spring, the Belgrade Astronomical Weekend (BAW) every June, a special topics meeting titled "Summer Astronomical Meetings" and Summer Schools of Astronomy, lasting 7 to 8 days. The Society had an important role in several global projects related to the IYA2009. Within the global project "100 hours of astronomy" several lectures and telescope observations were organized in April 2009, with over 200 people that took part in the activities. In September 2009, the Society took part in the organization of the exhibition on the Serbian-French cooperation in astronomy together with the Department of Astronomy and French Cultural Center in Belgrade. Since 2009 the Society has organized Galileo Teacher Training Program, one of the global IAU projects. About 430 people completed the course. In the past 3 years about 120000 people interested in astronomy participated in various activities of the AS "Rudjer Bošković".

The Astronomical Group of the Organization of Young Researchers "Vladimir Mandić-Manda" from Valjevo organizes the Winter School of Astronomy, running from January to April every year, where new members gain necessary knowledge in astronomy. The members of the Group organize 5-8 day visual observations of meteor showers and send the results to the International Meteor Organization.

The AS "Novi Sad" (ADNOS) organizes Thursday evenings School of Astronomy (including lectures, projections and observations). In the past three years about 180 groups from primary and secondary schools and about 12000 people visited the Planetarium, situated within the Petrovaradin fortress. During IYA2009, special attention was paid to the International Astronomical Camp "Letenka". The members of ADNOS participated regularly in the Astronomical Camp in Vršac, in the Messier marathon and Letenka Summer Camp, Festival of Science, Night of Museums and Night of Researchers.

The members of the AS "Alfa" in Niš are mainly high-school and university students. The Society has a permanent collaboration with the Faculty of Natural Sciences. Public observations of various astronomical events were performed by means of refractor Vixen, provided as the donation by the city of Niš in 2001, the telescope Meade LX200 and several other telescopes, the property of the Society members. Since June 2010, Niš astronomical meetings have been organized and observations performed at the site Ploče, under Suva planina mountain. Members of the Society took part in the activities concerning the bolid recorded by the all-sky camera from the Astronomical Station at Vidojevica mountain in November 2010.

The AS "Milutin Milanković" in Zrenjanin contributed a lot to public astronomy education during the IYA2009 with over 50 articles and participation in numerous radio and TV shows. Its members regularly take part in the organization of the international astronomical camp Letenka on Fruška Gora mountain, and with an ever increasing number of participants in the Messier marathon as well. The Society has a fruitful collaboration with the schools and other institutions in the city and many contacts with other astronomical societies in Serbia and in neighboring countries.

The AS "Lira" in Novi Sad has continued its regular activities: (1) release of the Internet magazine "Astronomical Magazine" (www.astronomija.co.rs), the largest astronomical web site in the country, and possibly in the Balkans as well. Published since 1998, with the contributions by many associates from Serbia and other countries (Croatia, Macedonia, Slovenia, USA, Australia, Italy, Poland etc.), the AM represents an extensive astronomy database; (2) organization of the observation competition in the Messier marathon every year (early in spring) at Letenka. In 2011 it had an international character (teams were from Slovakia, Hungary and former Yugoslav countries); (3) organization of the international astronomical camps "Letenka" (since 2001), lasting four days in July. About 200 people (mostly secondary school and university students) take part in the camps. The AS "Lira" has an active role in publishing of the printed magazine for popularization of astronomy "Astronomski magazin" (publisher: AS "Univerzum"). Despite rather affirmative official reports, the IYA2009 did not meet the expectations of the amateur astronomical community as one of the best magazines for popularizing the science in Serbia, "Astronomija", published since 2003 by the AS "Lira", ceased to exist in that very year because of the lack of financial support.

The Astronomical Group within the Natural History Society "Gea", Vršac, made regular observations by means of a CELESTRON 8 telescope, organized traditional Astronomical Meetings of Vršac at the end of every year, participated at various meetings organized by other astronomical societies, published annual bulletins "Gea" with many contributions dedicated to astronomy, followed all important astronomical events and was present in media and in schools. The Group participated in the IYA 2009 by publishing the leaflet "My Look into Universe" and made a film with the same title. In 2011 they published the leaflet "Discover Your View of the Universe".

The activities of the AS "Magellanic Cloud" in Prokuplje are closely connected to the activities at new Astronomical Station on Vidojevica. The Society gathers and educates amateur astronomers of the Toplica district.

The AS "Andromeda" in Knjaževac is presently the only astronomical society in eastern Serbia with about 350 registered members. The Society organizes Autumn and Spring Schools of Astronomy on regular basis.

The AS "Univerzum" in Bačka Palanka has significantly increased the membership since its foundation in 2006. They initiated establishing of astronomy clubs in many local schools, and financially supported participation of a group of secondary school students at Letenka camp. They organized the exhibition of astrophotographs, first only of the Society members, and later of all astrophotographers in Serbia. It was shown in several towns of Serbia, and several thousand people visited it. The members of the Society participated in all amateur astronomical meetings in Serbia and had an intensive cooperation with astronomers from former Yugoslav countries, Hungary and Slovakia. In collaboration with other astronomical societies they are founders of a new magazine "Astronomski magazin". They purchased some new equipment for the robotized astronomical observatory they succeeded to build during the past three years. During the IYA2009, the president of the Society was the national coordinator of the global project "100 hours of astronomy", which had a great success in Bačka Palanka; several thousand people observed through the telescopes in three days.

The AS "Orion" in Ivanjica organized astronomical camps in the second half of August at a site near Ivanjica between the Javor and Mučanj mountains. During the last three camps the lectures were given on: astrophotography (2009), the Solar system (2010) and telescopes (2011). The AS "Orion" organized the public observations of all major astronomical events in the center of Ivanjica. They possess two 10-inch Dobsonian telescopes, and since this year a home-made 160 mm Newton reflector.

Since its foundation in 2007, the AS "Milutin Milanković" in Pančevo has increased its membership (to 37). The members regularly participate in Letenka camps, Messier marathons and Summer schools. Since 2010 they have organized astronomical camps in Deliblatska peščara. They made observations with a Dobsonian reflector Sky Watcher (D=305mm, F=1500mm).

The AS "Aristarh" from Kragujevac, founded in 2007, possesses a Newtonian reflector with a Dobson mount (250mm, f/5), a Philips ToU Pro II web camera, a 80mm triplet APO refractor, a Losmandy GM8 mount and an Orion (UK) photo-Newton 150/600mm F4 with a coma corrector. Their usual observational site is 55km from the city of Kragujevac on the slopes of Gledičke planine (850m of altitude).

The AS "Eureka", founded in 2010 in Kruševac is very active in promoting astronomy. They have a regularly updated web site and blog "Eureka Corner". They participated in the Festival of science "Days of Eureka" organized in Kruševac, and took an active part in the amateur astronomy section during the XVI NCAS.

The AS "Bor" was founded in April 2011 after many years of astronomical activities of its founders. At the moment the Society has 11 members. They already organized many lectures and the observations by means of three telescopes and two binoculars in the vicinity of Bor.

Another two astronomical societies were founded in 2011 - AS "Kasiopeja" in Leskovac and AS "Vlasina" in Vlasotinci.

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

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SOUTH AFRICA

Report on education and outreach activities in astronomy 2010 - 2012

School-based activities

Astronomy featured at the annual National Science Festival (SciFest Africa) in Grahamstown, in the Eastern Cape Province. The event attracts more than 70 000 learners and members of the public from all the provinces and some of the neighbouring countries. The astronomy activities at SciFest include lectures, demonstrations, star parties, workshops and exhibitions. A number of South African astronomical organisations and astronomy societies join together to present these activities.

The national AstroQuiz is growing in popularity, with 65 000 learners participating nationally each year. This quiz is open to primary school learners up to Grade 7 (12 years old). Four learners from each school participate in the quiz, which tests basic astronomical knowledge with a series of multiple-choice questions. The first round is a provincial round. The winners of the provincial round participate in a national final round.

Older learners in Grades 10 - 12 participate in the AstroEssay competition, which is run along similar lines as the AstroQuiz, except that the learners have to write an essay on a topic selected from a list of prescribed topics. About 2 000 learners participate in this competition each year.

In 2011 South Africa joined the Universal Awareness (UNAWE) programme of the IAU. These activities are being driven by the South African Astronomical Observatory, in collaboration, with financial support from the European Union. The UNAWE programme focuses on young children in the school environment to stimulate interest in science and to raise awareness about astronomy and global citizenship issues.

The national Department of Science and Technology has a programme to sponsor certain schools with a reputation for excellence in science and mathematics to start astronomy clubs. The Department donates small telescopes and books for this purpose.

Several universities offer continuing professional development programmes for school-teachers focusing on astronomy.

The Royal Society of South Africa runs an annual essay competition, that regularly contains astronomical topics and has about 1 000 entries. For example, this year the winning essay was on the Square Kilometer Array (SKA), a radio telescope.

Public awareness and outreach

The national science centres also conduct astronomy programmes during focus periods such as Astronomy Month and World Space Week (October 4-10, annually). These activities bring together a large number of stakeholders in the astronomy community to combine all their outreach offerings into a series of high-impact events aimed at the public.

Each year, the Department of Science and Technology funds and coordinates the National Science Week. The theme for 2010 was on the societal impact of astronomy and the theme for 2011 and 2012 was on the SKA. The reach of these activities is not certain, but it is estimated to be in the hundreds of thousands of learners.

The planetaria in Cape Town and Johannesburg continued to operate during the period under review. Both facilities have ageing projectors and are seeking funding for newer equipment. A number of inflatable planetaria have entered use in several provinces. These planetaria are operated by science centres and education-based organisations, as well as the provincial education departments.

The national observatories (SAAO, HartRAO and Boyden Observatory) conduct visitor programmes on a regular basis. These programmes include tours, night viewing, and public lectures. Thousands of visitors participate in these programmes annually. In addition, with South Africa (SA) bidding for the SKA, the SA SKA community has been very active in promoting astronomy, and produced posters, pamphlets and assorted materials for schools and the public.

The Astronomical Society of Southern Africa, ASSA, continues to be active in most provinces of the country and frequently assists the National Facilities (such as the planetaria) with Open Nights. The Association has both professional and amateur members and participates in a number of the outreach events as described above. In addition it publishes and an annual sky guide (Sky Guide Africa South) that is sold in many bookshops around the country. The ASSA also publish its monthly notes (MNASSA) and this is now available for free on the internet. There is also a biennial Symposium, usually well attended by ASSA members and the public.

SCOPE-X is an annual Astronomy Exhibition run by the Johannesburg Centre of the ASSA and has over the years become a major feature of the astronomical calendar, attracting over 3 000 learners and members of the public on the day. As an innovation, this year there were lectures presented live from overseas via the Internet (WebEx) – most successful.

With the now successful bid for 80% of the SKA and the location of the IAU Global Office for Astronomy Development at the SAAO in Cape Town, we can look forward to maintaining, and increasing, an active astronomy outreach programme in SA.

At a tertiary level many SA universities run some form of astronomy programme.

At a post-graduate level the National Astronomy and Space Sciences Programme, NASSP, is running successfully.

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SPAIN

General Information

The national report of Astronomy in Spain from 2009 – 2011 must include a special mention of IYA2009. Although this project was more focused in outreach, the implication for education is evident and we will include a special mention at the end of this description, but we can conclude that the result of IYA2009 has been to generate more than 3100 activities, driven at least 1600 different entities working with the aim to invite people of all ages, origins and beliefs, to travel the cosmos in an unforgettable adventure.

School Education

In Spain there were interesting and educational reform movements in the 1980s. In this situation emerged numerous activities (non-regulated, not included in the curriculum) related to Astronomy (astronomy club, astronomy workshop) voluntary for students and teachers. Given the extent of the movement the central and regional governments accepted the subject of Astronomy (among others) as one possible elective subject in secondary schools. The optional workshop of Astronomy was successful and was taught in many schools. Various regions began to withdraw gradually from the programs after 2000. At present a few schools teach a workshop on astronomy. Practically, it disappeared from the 17 different regions in Spain. No doubt there are economic reasons behind this retreat: a wide range of electives involve groups with few students, and some teachers may need more. In this situation the Association for Astronomy Education, APEA, is collecting signatures of institutions and individuals to help maintain this optional workshop of astronomy.

University and professional astronomers

For the last eight years, Astronomy in Spain was not bad, and over 500 professional astrophysicists that are part of the SEA (Sociedad Española de Astronomía) are a good example of this: they studied, investigated and published. The current situation is not so good. In the last two years the financial found had been reduced and this introduce problems in infrastructures and personal, specially. The situation is very difficult for young researchers.

The situation in universities is difficult too by reason of the crisis in which the country is involved. The reduction of funds arrived at the universities that have to reduce the number of groups of students by increasing the numbers of students in each group. After the Bologna process the percentage of astronomy in the sciences degrees did not increase. Maybe in some particular department the number of subjects and students who learn astronomy has increased, for instance in the faculty of physics in Barcelona University, but in general in the country the numbers of students has decreased.

In the years previous to the crisis, the Spanish astronomical community has progressed from a minute presence in Spanish science to producing about seven percent of the total number of papers on astronomy published in the entire world. This has been achieved in a remarkably short period of 30 years.

In the International Year of Astronomy 2009, SEA intended to bring the work done by Spanish professional astronomers to society. The project materialized in 2009 with the editing of a book entitled *Astronomía made in Spain*, where we collected the answers to six questions sent to all the Spanish astronomers who had published a paper in the preceding 30 years. Each author describes in his or her contribution the context in which the research was carried out, what was new with respect to the knowledge in that field at that moment, some personal views on the subsequent trajectory of the researcher, and even some anecdotes about the paper's elaboration. The contributions are presented in chronological order according to the publication date of the papers, thereby giving a historical perspective of the way in which the different branches of each scientific article have evolved.

The first Spanish edition was corrected in the second, 2010 edition, published in electronic format, which expands on the first edition with contributions from authors who published papers in 2009.

Outreach and education for the General Public: IYA2009 and its consequences

The National Commission for Astronomy (CAN) formed a coordination committee with representation from the CNA, the Ministry of Science and Innovation MICINN, the National Research Council CSIC, the Spanish Society of Astronomy SEA, and the Spanish Foundation for Science and Technology FECyT. They formed a team composed of people from museums, planetariums, research centers, schools, universities and amateur groups in Spain responsible for coordinating with the backing of the activities promoted by different actors (research centers, amateur groups, etc.) and most of the major projects of national or international level in which our country has participated. It was also an honorary committee chaired by SAR Prince Felipe de Borbon. It also created the Spanish Network for IYA2009 in which 141 institutions are represented and which also has the support of 48 partner groups.

On December 16 2008, all political groups represented in the House of Representatives unanimously adopted a non-legislative proposal on the International Year of Astronomy 2009 in Spain which encouraged

scientific organizations, schools and media to celebrate this anniversary. Furthermore, it urged the government to support organizations involved in the IYA2009, and to strengthen support for the development of astronomy in our country (research, technological development, dissemination, education).

In addition to hundreds of initiatives at local, regional and autonomous, Spain was involved in 22 major projects of national or international level. Here we describe briefly some of them.



The president of the CAN and president of the CSIC D Rafael Rodrigo, shows to Spain's Prince Philip and to Mrs Catherines Cesarsky, then president of the IAU, the exhibition "The Universe, Yours to Discover".

"100 Hours of Astronomy". Over 300 activities 2-5 April. In the webcast "Around the World in 80 Telescopes" (made fin Spain), 11 of about 80 links are to the observatories of the Roque de los Muchachos, Calar Alto and Sierra Nevada among others.

"Discover the Dark Sky." Project highlighted the IACO (Action Initiative against Light Pollution) and a Course Applied Photometry Light Pollution Measurement, which was held from 16 to 18 October at the Calar Alto observatory and with the participation of amateur astronomers in Spain.

"She is an astronomer." This is the first sociological study on the situation of women in Spanish astronomy. There was a series of 8 TV programs entitled "Women in the Stars" dedicated to women's contribution to the development of astronomy in Spain, and the exhibition "With A astronomers" which toured the country from 2009 to 2011.

"The Universe, Yours to Discover". It showed that exposure at more than 100 locations attrected visitors estimated at several million.

"Measuring the Radius of Earth." On March 26, 2009, teachers and students in more than 600 schools all over the country had the experience of Eratosthenes and obtained a result with only a 5% error.

"Star for All". The emergence of Astronomy in everyday life through beautiful astronomical images presented in sweepstake lottery tickets, travel tickets, stamps, backgrounds for mobiles, screensavers, etc.

"Evolution" and "Jors, Jars, Jurs and Galigalitos' are iwo large planetarium productions driven by major science museums and planetariums in Spain. "Evolution" is the first program to be displayed simultaneously in all Spanish planetary fuldome projection system. It is estimated that at least half a million people have been able to enjoy it. Both programs continued in theaters in 2010 and 2011.

"Astronomical activities aimed at disabled people". The edition of a book in braille teaching astronomy and the creation of "Astroadapt", a free software for popular astronomy aimed at people with physical disabilities and production of the planetarium program "Heaven in Your Hands" for people with visual disabilities Hemisfèric in the City of Arts and Sciences in Valencia.



Blind and partially blind with his hands he could touch the stars.

"Festival of Stars." Five parties were held in total, three national and two international, boosted by about 80 astronomical groups in Spain. Some 50,000 people looked through a telescope.

"One University, One Universe." They formed a great team of over 170 speakers from all over Spain who gave lectures to about 240 to about 15 000 people.

"Music and Astronomy." Between February 2009 and June 2010 were held 40 concerts in different Spanish cities for more than 30000 people. Moreover, Mozart's Little Night became an audiovisual of great beauty in which Sancho and Don Quixote roamed beautiful images of the universe.

In short, the success achieved by the IYA2009 could not have been possible without the involvement of institutions and the participation of thousands of people who have worked in most cases selflessly. The National Commission for Astronomy (CAN) decided at its meeting of 3 February 2010 to create the Spanish Network for Disclosure of Astronomy, which keeps the spirit and the main objectives of the International Year of Astronomy.

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Turkey

Overview

Four universities in Turkey provide undergraduate and graduate courses in astronomy and eight more universities offer graduate studies in astronomy and astrophysics within physics departments. The activities of IYA2009 in Turkey have played an important part in public interest and amateur activities in astronomy, as well as teaching in schools.

Turkish Astronomical Society

The Turkish Astronomical Society (TAD), which has over 100 members, has collaborated with universities in the promotion of astronomy and public outreach, in training school teachers at national and local levels, as well as holding the professional bi-annual astronomy meetings, with separate sessions for amateur astronomy. TAD issues a free e-bulletin for popular astronomy, which started in IYA 2009.

IYA 2009 and the aftermath

TAD organized the activities of the 2009 International Year of Astronomy in Turkey, helped by the universities across the country. Participation in the IYA 2009 Cornerstone Projects was excellent, especially in the projects: 100 hours of astronomy, Dark Skies Awareness, and From Earth to the Universe. Since 2009 the exhibition From Earth to the Universe has been realized at many venues, ranging from museums and universities to primary schools in villages, and the demand still continues to be met now in 2012. The Galileo Teacher Training program was organized by TAD, with contributions from Sabanci University, and workshops organized at Ege, Çanakkale Onsekiz Mart, and Sabanci Universities every year since 2008 and continuing in 2012.

Amateur telescope making flourished in 2009 IYA: 100 telescopes of 20 cm size, including the mounts, were made during a seven day workshop (4-9 July 2009) at Istanbul Kültür University followed by an Amateur Astronomy Symposium on 10 July. The majority of the participants were school teachers, who took the new telescopes to their schools for use in their activities. An amateur group in Süleyman Demirel University made 10 telescopes in August, 2009.

TAD organized sponsored contests for amateur astronomy photography in 2010, and telescope making in 2011 and 2012.

Primary and Secondary Schools

Basic astronomy topics previously taught in primary education as parts of other subjects are collected under *The Earth and the Universe*. There is no compulsory astronomy course in secondary schools; astronomy topics are taught in the physics course. Starting in 2010, however, we have also an elective (optional) astronomy course, called "Science and Technology Course", 17 lecture hours at 11th grade (age 17), dealing with stars, galaxies and the universe at elementary levels.

At the beginning of 2009, seven schools had their own observatories or telescopes, used for teaching astronomy to their pupils. The number is increasing, promoted by our activities during and after the IYA 2009!

Special programs for school teachers

The teacher training programs of several universities, including Ege University (Izmir), Sabanci University (Istanbul), Istanbul Kültür University, Çanakkale Onsekiz Mart University, and Ankara University, in some cases partly supported by the "Science and Society Project" of TUBITAK (Scientific and Technological Research Council of Turkey), continued during the period of this report.

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. Akdeniz University has recently opened a Space Sciences and Technologies Department. Eight other universities offer fundamental astronomy courses at 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 Çanakkale universities have access to telescopes and observing facilities at their university observatories. The graduate students have access also to the advanced facilities of TUBITAK National Observatory (TUG).

Teaching of radio astronomy in Turkey is new, started by Erciyes University (Kayseri) in 2006. Establishment of a small radio astronomy observatory in the university campus is continuing. Site selection work for a national radio astronomy observatory is being completed by Erciyes University. A single-dish parabolic radio antenna of 30–40 m will be installed near the city of Karaman. Selecting the future site for a large Turkish radio telescope is a key issue. A 4m IR telescope project for Erzurum has received initial approval.

TAD started a program of one week summer schools for astronomy undergraduates in 2011. These will continue as Hakki Ogelman Summer Schools from the Summer of 2012.

Observatories and planetaria

There are 11 small size planetaria in Turkey, including two universities and two schools. More planetaria are being planned by several universities and municipalities. It is noteworthy that the major cost of the Amasya Planetarium with a capacity of 40 people plus a 20 cm Meade telescope, which became operational in November 2010, was met by money collected by 65 000 pre-school, primary, and secondary school pupils from selling postcards and books and from other activities. This is probably the first in the world.

In Turkey, there are several university observatories which offer access to public visits and to school students. The observatories of the Ege University, Ankara University, Çanakkale University, TUG, and Istanbul University perform intensive educational programs both for the schools and the public (see the section "Public education and outreach" below). Hundreds of schools, with tens of thousands of pupils, visit these observatories and planetaria each year.

An educational support activity to science classes of primary and mid-schools is organized on demand in an appointment scheme by several universities, which also produce special programs for hundreds of elementary and secondary school teachers and students and for the public. There are also similar activities open to the public, but on a smaller scale, by a few schools with an observatory.

Amateur Astronomy

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. Several groups of amateur astronomers have developed experience for scientific outreach using web sites.

Public Education and Outreach

The "National Night Sky Festivity" organized by TUG is held every summer in a pre-selected region in the country for participants of all ages. The popular and educational activities, mainly by the Ege, Ankara, and Çanakkale University observatories, TUG, Istanbul University, Sabanci University, and Istanbul Kültür University, partly supported by the "TUBITAK's Science and Society Project" during 2009-2011, were performed in different ways such as public nights, special events (eclipses, meteor showers, etc), school visits, astronomy camps, radio and TV programs.

The well known activity of the Ege University Observatory (EUO) continued during 2009-2011. A popular nighttime public program includes a presentation, observing through 30-40 cm telescopes 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 nighttime sky. EUO also operates a series of one-week national public outreach programs. Educational programs are designed to inspire and motivate students and are suitable for ages 8–18, vacation care, tertiary, and adult education students. All educational programs are conducted by highly trained astronomy educators. The courses include exploring the heavens, astronomical concepts, stargazing skills using a small telescope, the Sun, variable stars, stellar evolution, the Universe, cosmology, and life in the Universe. Similar programs are carried out by the Çanakkale University Observatory.

Sabanci University and Istanbul Kültür University conducted teacher-training programs, the latter also conducted several star parties across the country with their portable telescope.

The astronomers with a team of 40 persons from Ankara, Ege, Erciyes, and Istanbul Universities made an 11-day tour of 9 provinces of south eastern Turkey (11-21 October 2010) with the title "*Astronomical voyage from the depth of space to the past history*" as part of the "*World Space Week*". They carried a portable planetarium and portable telescopes to show the beauty of the night sky to school children, teachers, and the local people. Approximately 10 000 persons attended the activities, including conferences, talks, and an exhibition of 75 photographs of celestial objects.

In 2009, Istanbul University opened a centre under the name of "Children's University". Three-week "astronomy and space summer schools" have been held since 28 June 2010.

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Ukraine

Overview.

During last three years no significant changes happened with Ukrainian astronomical education. Astronomy is now being delivered in the schools and in some universities. Several important events dedicated to astronomical education were organized during this period in different cities of Ukraine. They were attended by school pupils, university students, astronomy amateurs, and teachers. More detailed description is given below.

Primary School

Some elements of a basic astronomical knowledge are given in Higher Primary School in 5th Class. This is achieved within the course of the knowledge about Nature.

Secondary School.

Astronomy is a separate subject, and it is delivered in 11th Class. The total amount of hours allocated for astronomy lectures is small (either one academic hour per week during half a year or 0.5 of academic hour per week during a year). Two textbooks on astronomy by Ukrainian authors are available now, but very often teachers of astronomy use instead of available textbooks the subjectively selected information from the Internet. There are two main problems of astronomical education in the Secondary School. First, the lack of the necessary number of teachers who can professionally deliver astronomy lectures. As a consequence of this, in some schools astronomy is delivered by teachers of geography, chemistry or mathematics, while in some schools it is not delivered at all. Generally, the problem of the availability of qualified teachers is more severe in the countryside. In the best cases astronomy lectures are given by the teachers of physics, who got the astronomical knowledge in universities. Second, the problem of a great majority of the schools.

Universities

Astronomy departments exist in several Ukrainian National Universities (Kiev, Odessa, Lviv, Kharkiv). These Universities train professional astronomers. Before this year they graduated only masters of astronomy. From this year they will graduate also bachelors of astronomy. Perhaps, this circumstance can help to improve school astronomical education. It should be noted that in the above mentioned universities astronomy is also delivered for students of some others specialties (but in significantly reduced numbers). Astronomy is also delivered in some other universities that do not possess pure astronomy departments (e.g. Nikolaev, Kherson, Dnepropetrovsk and some others). PhD astronomy programs exist in Kiev, Odessa, Lviv, and Kharkov National Universities.

Amateur Astronomy

There are several amateur astronomy societies and groups (as well as many unorganized amateurs) in Ukraine. Societies and groups have different numbers of members, but all of them do very important work distributing astronomical knowledge among the Ukrainian population.

Planetariums

The same work is done by Ukrainian planetariums. At present there are eight working planetariums in Ukraine.

Some events

Below is the list of some astronomical events that were organized in Ukraine in the period 2009-2011. To this list one should also add numerous lectures, the night sky shows, and consultations within the public outreach programs that are carried out by each Ukrainian observatory for all people interested in astronomy, as well

as numerous TV, radio and newspaper interviews on astronomy related topics, granted to Ukrainian astronomers for mass media.

| 2009 | |
|---------------------|--|
| 3 -10.01.2009 | Astronomical School of the Small (Junior) Academy of Sciences "Iskatel" (for pupils of the 5- 11 Classes), Crimean Astrophysical Observatory |
| 2-5.01.09 | Amateur Conference "Christmas Nights", Crimean Astrophysical Observatory |
| 21.01.09 | Competition of Small Academy of Sciences on astronomy and physics, Uzhgorod |
| 27.01.2009 | Conference of Kherson section of the Small Academy of Sciences, Kherson |
| 29.01.09 | Small Academy of Sciences regional Competition on astronomy, Uzhgorod |
| January 2009 | Conference "Creative works of the astronomical sessions of the Small Academy of Sciences of Crimea", Simferopol |
| 13-14.02.2009 | Conference of Odessa section of the Small Academy of Sciences, Odessa |
| 19.02.2009 | Nikolaev School competition of the creative projects on astronomy, Nikolaev |
| February-March 2009 | Conference "Creative works of the Astronomical sessions the Small Academy of Sciences of Crimea", Sevastopol |
| 4.03.2009 | Regional Round of the 3rd Ukrainian Olympiad on astronomy and astrophysics, Kyiv |
| 16-20.03.2009 | Final Round of the 3rd Ukrainian Olympiad on astronomy and astrophysics, Kyiv |
| 26-27.03.09 | Regional Competition "Space Fantasies", the Small Academy of Sciences, Uzhgorod |
| 26-27.03.09 | Competition of the Small Academy of Sciences on astronomy and physics, Nikolaev |
| 15.04.2009 | Regional Forum of the junior amateurs of physics and astronomy, Nikolaev |
| April | "Boulevard Astronomy", Odessa club of amateur astronomers "AstrOdes" |
| All year | Support of the WEB pages and blogs of the Ukrainian Association of Variable Stars Observers and Ukrainian Association of Amateur Astronomers |
| 27.04 02.05.2009 | 16th Open young scientists Conference on astronomy and space physics, Kyiv |
| 26-29.05.2009 | International Conference "Astronomical School of the Young Scientists", Kherson |
| 3 - 17.06.2009 | Astronomical School of the Small Academy of Sciences "Iskatel" (for pupils of the 5-11 Classes), Crimean Astrophysical Observatory |
| 17-23.08.2009 | 9th Gamow International Summer School of young astronomers "Astronomy and beyond: astrophysics, cosmology, radioastronomy, high energy physics and astrobiology", Odessa |
| 24-30.08.2009 | Conference of amateurs of astronomy "Astrofest-UA-2009", Odessa |
| 25-27.09.09 | National Colloquium "The Universe, Humanity, Spirituality", Uzhgorod |
| 22.10.2009 | 6th regional Conference of astronomy teachers "The modern astronomy and cosmonautics in the school education", Odessa |
| 10-11.12.09 | Competition-selection for the award of Ukrainian Astronomical Association for amateur astronomy of Transcarpathian region, Uzhgorod |
| February | Regional Conference of the society "Cosmos", Odessa |
| February | Regional Conference on "Cosmic Art", Odessa |
| April | All-Ukrainian Conference of the Small Academy of Sciences, Kiev |
| April | All-Ukrainian Conference of the society "Cosmos", Uzhgorod |
| April | All-Ukrainian Conference of the society "Cosmos", Dnepropetrovsk |
| May | "Astronomical School for young scientists", Kiev National Aviation University |
| November-December | Working group "Odessa National Maritime University" for observations at the robotic telescope of the Tzec Maun Foundation. |
| 10 months per year | Astronomy amateurs Club "Far and Near Universe" at the astronomical observatory of Kyiv Taras Shevchenko National University, Kyiv |
| 10 months per year | Astronomy amateurs Club "AstrOdes" at the astronomical observatory of the Odessa National University, Odessa |
| 10 months per year | Public Performances at the "Odessa house of scientists" organized by the Odessa astronomical society |
| November | Publication of the "Odessa Astronomical Calendar -2010" |

| 2010 | |
|---------------------|--|
| 21.01.2010 | Conference of Kherson section of the Small Academy of Sciences, Kherson |
| 2-6.01.10 | Amateur Conference "Christmas Nights", Crimean Astrophysical Observatory |
| 24.01.10 | Competition of the Small Academy of Sciences on astronomy and physics, Uzhgorod |
| January 2010 | Conference "Creative works of the Astronomical sessions of the Small Academy of Sciences of Crimea", Simferopol |
| 03.02.10 | Small Academy of Sciences regional Competition on astronomy, Uzhgorod |
| 5-6.02.2010 | Conference of Odessa section of the Small Academy of Sciences, Odessa |
| February-March 2010 | Conference "Creative works of the Astronomical sessions SAS of Crimea", Sevastopol |
| 4.03.2010 | Regional Round of the Ukrainian Olympiad on astronomy and astrophysics, Odessa |
| 10.03.2010 | Regional Round of the Ukrainian Olympiad on astronomy and astrophysics, Odessa |
| 10.03.2010 | Regional Round of the 4th Ukrainian Olympiad on astronomy and astrophysics, Kyiv |
| 23 -30.03. 2010 | Astronomical School of the Small Academy of Sciences "Iskatel" (5-11 Classes), Crimean Astrophysical Observatory |
| All year | Support of the WEB pages and blogs of the Ukrainian Association of Variable Stars Observers and Ukrainian Association of Amateur Astronomers |
| 27-28.03.10 | Regional Competition "Space Fantasies", the Small Academy of Sciences, Uzhgorod |
| 27-28.03.2010 | Competition of the Small Academy of Sciences on astronomy and physics, Nikolaev |
| 29.03 02.04.2010 | Final Round of the 4th Ukrainian Olympiad on astronomy and astrophysics, Kyiv |
| 29.05-14.06 .2010 | Astronomical School of the Small Academy of Sciences "Iskatel" (5-11 Classes), Crimean Astrophysical Observatory |
| 26.04 01.05.2010 | 17th open young scientists' Conference on astronomy and space physics, Kyiv |
| 17 -27.07.2010 | 1st Ukrainian astronomical School of the Small Academy of Sciences, Crimean Astrophysical Observatory |
| 23-28.08.2010 | 10th Gamow International Summer School of young astronomers "Astronomy and beyond: astrophysics, cosmology and gravitation, cosmomicrophysics, radio-astronomy and astrobiology" |
| 23-25.09.10 | National Colloquium "The Universe, Humanity, Spirituality", Uzhgorod |
| September 2010 | Astronomical study Group from Zaporozhye city |
| 16-24.10.2010 | XV International Olympiad on astronomy, Sudak, Crimea |
| 16.11.2010 | Conference on astronomy and physics School teachers of Odessa region, Odessa |
| January-May | Working group "Odessa National Maritime University" for observations at the robotic telescope of the Tzec Maun Foundation. |
| February | Regional Conference of the society "Cosmos", Odessa |
| February | Regional Conference on "Cosmic Art", Odessa |
| May | Astronomical School for young scientists", Kiev National Aviation University |
| April | All-Ukrainian Conference of the Small Academy of Sciences, Kiev |
| April | All-Ukrainian Conference of the society "Cosmos", Uzhgorod |
| April | All-Ukrainian Conference of the society "Cosmos", Dnepropetrovsk |
| 10 months per year | Public Performances at the "Odessa house of scientists" organized by the Odessa Astronomical Society |
| 10 months per year | Astronomy amateurs Club "Far and Near Universe" at the astronomical observatory of Kyiv |
| 10 months per year | I dias Sheveneliku National Uliveisity, Kyiv |
| ro monuis per year | University |
| November | Publication of the "Odessa Astronomical Calendar -2011" |

| 3 -10.01.2011 | Astronomical School of the Small Academy of Sciences "Iskatel" |
|---------------|---|
| | (5-11 Classes), Crimean Astrophysical Observatory |
| 26.01.11 | Competition of the Small Academy of Sciences on astronomy and physics, Uzhgorod |
| | |
| 26.01.2011 | Conference of Kherson section of the Small Academy of Sciences, Kherson |
| January 2011 | Conference "Creative works of the Astronomical sessions of the Small Academy of Sciences of |
| | Crimea", Simferopol |

| 03.02.11 | Small Academy of Sciences regional Competition on astronomy, Uzhgorod |
|---------------------|---|
| 4-5.02.2011 | Conference of Odessa section of the Small Academy of Sciences, Odessa |
| 04 02 2011 | Kviv Round of the Ukrainian Olympiad on astronomy for School pupils Kviv |
| 12.02.11 | Regional Olympiad on Astronomy, Uzhgorod |
| 12.02.11 | Regional Olympiad on Astronomy, Nikolaev |
| 13.02.2011 | School Olympiad on astronomy of Odessa region, Odessa |
| 26.02.2011 | School Olympiad on astronomy of Kherson region, Kherson |
| February-March 2011 | Conference "Creative works of the astronomical sessions of the Small Academy of Sciences of Crimea", Sevastopol |
| 14-18.03.11 | Transcarpathian region team preparation for the Republic Olympiad on astronomy |
| 16.03.2011 | Regional Round of the Ukrainian Olympiad on astronomy and astrophysics, Kyiv |
| 16.03.2011 | Regional Round of the Ukrainian Olympiad on astronomy and astrophysics, Odessa |
| 24.03.2011 | Conference of the School pupils of Odessa region dedicated to 140th anniversary of astronomical observatory of Odessa National University, Odessa |
| All year | Support of the WEB pages and blogs of the Ukrainian Association of Variable Stars Observers and Ukrainian Association of Amateur Astronomers |
| 25-26.03.11 | Regional Competition "Space Fantasies", the Small Academy of Sciences, Uzhgorod |
| 25-26.03.11 | Competition of the Small Academy of Sciences on astronomy and physics, Nikolaev |
| 03-07.04.2011 | Final Round of the 5th Ukrainian Olympiad on astronomy and astrophysics, Kyiv |
| 09.04 10.04.2011 | Ukrainian Small Academy of Sciences: final Competition on astronomy and space science for the School pupils Kviv |
| 02 05 - 07 05 2011 | 18th open young scientists` Conference on astronomy and space physics. Kviv |
| 24-27.05.2011 | Astronomy and space physics in Taras Shevchenko National University of Kviv |
| May 2011 | Astronomical Scool for young scientists. Kiev National Aviation University |
| 28.05 - 12.06.2011 | Astronomical School of the Small Academy of Sciences "Iskatel" |
| | (5-11 Classes), Crimean Astrophysical Observatory |
| 22.07 - 1.08.2011 | 2nd Ukrainian astronomical School of the Small Academy of Sciences, Crimean Astrophysical Observatory |
| 22-28.08.2011 | 11th Gamow International Summer School of young astronomers "Astronomy and beyond: |
| | astrophysics, cosmology and gravitation, cosmonicrophysics, radioastronomy and astrobiology" |
| February | Regional Conference of the society "Cosmos", Odessa |
| February | Regional Conference on "Cosmic Art", Odessa |
| April | All-Ukrainian Conference of Young Academy of Sciences, Kiev |
| April | All-Ukrainian Conference of the society "Cosmos", Uzhgorod |
| April | All-Ukrainian Conference of the society "Cosmos", Dnepropetrovsk |
| 21-23.09.2011 | Astronomical study Group of Zaporozhye city |
| 21-23.09.11 | National Colloquium "The Universe, Humanity, Spirituality", Uzhgorod |
| 03.10.11 | "Problems of the astronomical education in Ukraine" - Section at the sixth International Scientific Conference in Honor of Bohdan Babiy "Selected Issues of Astronomy and Astrophysics", Lviv National University, Lviv |
| 13.10.11 | Regional educational Seminar on the teaching of physics and astronomy in the School, Uzhgorod |
| 27.10.2011 | Conference of astronomy and physics school teachers of Odessa region, Odessa |
| November 2011 | Conference "The 50th anniversary of Simferopol Junior astronomical observatory", Crimean |
| | Astrophysical Observatory |
| 10 months per year | Public Performances at the "Odessa house of scientists" organized by the Odessa Astronomical Society |
| 10 months per year | Astronomy amateurs Club "Far and Near Universe" at the astronomical observatory of Kyiv Taras Shevchenko National University Kyiv |
| 10 months per year | Astronomy amateurs Club "AstrOdes" at the astronomical observatory of Odessa National |
| montais por jour | University |
| November | Publication of the "Odessa Astronomical Calendar -2012" |

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UNITED KINGDOM

Overview

From 2009 to 2012 the growth in schools astronomy was matched by a decline in the amount of money available for pursuing astronomical research at universities. Amateur astronomy held its own. There is a National Curriculum for primary schools and another for secondary schools. These are being improved but I refer to the curricula in place 2009 to 2012.

Primary schools

In the National Curriculum for primary schools the only astronomy is the approximately spherical shape of the Sun, Earth, and Moon, their orbits, and the rotation of the Earth.

Many universities have astronomy outreach to schools, consisting of hands on experiments, demonstrations, planetarium shows, and so on. The universities of Southampton and Sheffield have travelling road shows.

There are workshops for children and talks for parents, on topics such as pacing out the Solar System, Mars Rover simulations, and making pinhole cameras and sundials.

Overall, primary school children have many extracurricular opportunities in astronomy. A new National Curriculum is being launched that will increase the amount of astronomy taught in primary schools.

Secondary schools

In the National Curriculum, the section Energy, Forces, and Space includes

- explain the position of the Sun in the sky as different times of the day
- explain the relative brightness of the stars and planets
- explain gravitational attraction in relation to the movement of bodies in space.

There is a National Schools Observatory <u>http://www.schoolsobservatory.org.uk/</u>. It has a two metre f/10 Ritchey-Chretien robotic reflector (the Liverpool Telescope, <u>http://telescope.livjm.ac.uk/</u>) located at an altitude of a little over 2200 metres on La Palma in the Canary Islands. A lot of time is available to schools. Students submit an observing programme and the images are returned to them.

The Faulkes Telescope Project (<u>http://www.faulkes-telescope.com/</u>) is supported by the Dill Faulkes Educational Trust. It provides access to 1500 hours of observing time on two 2-metre class telescopes located in Hawaii (Faulkes Telescope North) iand Australia (Faulkes Telescope South). The 1500 hours is dedicated to education and public outreach, mainly in the UK, but also for smaller, selected projects in Europe and the USA. (Adapted from *Wikipedia*)

The Faulkes telescopes are clones of the Liverpool Telescope. Faulkes North is located at the Haleakala Observatory in Hawaii, at an altitude of about 10 000 feet, Faulkes South is at Siding Spring, Australia, at an altitude of about 3800 feet.

There are a few, smaller telescopes in the UK that are available to schools. Some schools run astronomy clubs, and to some of their meetings external speakers give talks.

GCSE in astronomy

The GCSE is the examination in a variety of subjects, a selection of which is taken by 16-year-old students at school. There is a GCSE in astronomy but this is rarely taken at school. It's more likely taken by amateur astronomers and by various individuals with a liking of astronomy. Its main components are

- the Earth, Moon, and Sun
- the Solar System
- stellar evolution
- cosmology

• observing techniques, and space exploration.

University

Undergraduates

There are 134 universities in the UK, including some colleges of higher education. The Russell Group (<u>http://www.russellgroup.ac.uk</u>) represents 24 leading UK universities which are committed to maintaining the very best research, an outstanding teaching and learning experience, and unrivalled links with business and the public sector.

To the best of my knowledge, there are now no departments of astronomy at undergraduate level in the UK. However, the great majority of UK universities have departments of physics and astronomy. There are a few departments with different names that teach undergraduate astronomy. Undergraduate teaching of astronomy is performed to a high level in pretty well all universities.

A change that has fallen on undergraduates in recent years is the loss of government grants, replaced by student loans. In England the maximum tuition loan in 2011 to 2012 is up to £3375 per year. The interest rate is low and repayments do not begin until the April after graduation, or leaving the course, and are made only when the graduate is earning sufficient money. Citizens of Wales and Scotland are entitled to "free" tuition within their own countries. As far as I can discern, the situation in Northern Ireland is much the same as in England.

Maintenance awards have also changed. For the 2009/2010 academic year, the maintenance loan was set at £2763 for students living at home; £4998 for students living in London, not at home; and £3564 for students not living at home elsewhere in the UK There is extra for low income households. Again, repayments do not begin until the April after graduation or leaving the course, and are made only when the graduate is earning sufficient money.

That's the broad picture; no need here to go into further details.

Graduates

There are higher degree opportunities at universities, and at other institutions. An upper second class honours degree, or a first class honours degree, and less often an MSc, are required as entry qualifications. Most PhD and MSc students rely on government grants for fees and maintenance, so as the recession bites there are fewer of these. Some higher degree students are supported by industry and commerce. Though there are fewer higher degree theses these are generally of high quality.

Sadly, as is the case for students gaining bachelor degrees, there is no assurance of employment at an appropriate level. Doubtless, as the economy comes out of recession, the job market will improve. Some people with BSc, MSc, or PhD degrees go abroad to seek employment, which is not as secure as they might think.

Professional Astronomy Societies

The Royal Astronomical Society (RAS) (<u>http://www.ras.org.uk</u>) is the premier professional astronomy society in the UK. Membership is by election, to become a Fellow. Impressive amateurs, media people, and others have been elected. It has weekly all-day meetings on Fridays, usually in Burlington House, London. The general public is allowed in at 17:00 for one or two guest lectures.

Education conferences

The RAS has an annual conference covering research in pretty well every aspect of astronomy, including education. It is held around Easter time in a different university each year.

Education conferences on/including astronomy are infrequent. The Association For Science Education (ASE, <u>http://www.ase.org.uk</u>) runs an annual conference for a few days in January, which often includes a session or two on astronomy.

Public observatories and planetaria

Mills Observatory, Dundee, is the only British observatory to have been built with the sole aim of encouraging public understanding of science, and is the UK's only full-time public observatory. It dates from 1935. It has a 10 inch (254 mm) Cooke refractor (1871) and, since 2007 has had a 12 inch (305 mm) Schmidt-Cassegrainian telescope. Other observatories with public access tend to have larger telescopes. These public observatories are inked to universities, municipalities, and otherwise. I counted 14 nationwide, which seems rather low.

I counted about twenty fixed planetaria, spread around the UK, owned by various institutions and open to the public. There are substantially more mobile planetaria. The great majority of UK planetaria have shows that appeal to school students, in several cases linked to the school curricula.

Amateur astronomy including magazines

The UK Federation of Astronomical Societies currently lists 189 amateur astronomy societies/clubs in the UK. There is no requirement to join the FAS, so there must be a substantial number more than 189 (I spotted one absence immediately). The membership of societies/clubs varies from a few tens to a few hundred. Some members are very well equipped for observational astronomy, with telescope apertures ranging upwards from 100 mm. An important development in recent years has been the availability of electronic recording of images. With a tracking telescope multiple images can be taken and the better ones aligned with software such as RegiStax. The outcome is very impressive images with modest telescopes under not very dark skies.

Even though scientific research is not their main goal, many amateur astronomers make a contribution to research by monitoring variable stars, tracking asteroids, and discovering transient objects, such as comets.

All societies/clubs have regular meetings, to some of which external speakers attend, including professional astronomers from universities, government laboratories, and other sources.

There are some outstanding British magazines at the 'popular' level, including Astronomy Now, Sky at Night magazine, Journal of the British Astronomical Association, and Popular Astronomy. The last two are issued to members of the British Astronomical Association (BAA) and the Society for Popular Astronomy (SPA) respectively. Members of the BAA and the SPA are amateur astronomers, the median in terms of level of ability and knowledge is higher in the older society, the BAA.

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UNITED STATES OF AMERICA

A wide variety of educational activities are sponsored in the United States each year, with most activities sponsored by the Astronomical Society of the Pacific (<u>www.astrosociety.org</u>) and the American Astronomical Society (<u>www.aas.org</u>), though the latter deals mostly with professional and professional-outreach activities. At the end, I provide a link to Project CLEA computer-based laboratory exercises in astronomy, which are used around the world.

From the Astronomical Society of the Pacific, Andrew Fraknoi has provided the following information: Since 1889, the Astronomical Society of the Pacific has worked to increase scientific literacy through astronomy. With members in all the states of the USA and over 40 other countries, the ASP is an international organization devoted to astronomy education and outreach.

A. Its educational web site: <u>http://www.astrosociety.org/education.html</u> has a frequently updated series of information articles, resource guides, and program materials for those who communicate astronomy to a variety of audiences (both in the formal classroom and in many informal and media settings).

Here a few new educational resources from the ASP available to everyone at no charge:

1. Frank Drake Tells How He Came Up with the Drake Equation: <u>http://www.astrosociety.org/drake/</u>

2. A New Classroom Activity: How High Up is space <u>http://www.astrosociety.org/education/activities/I11 How High Space.pdf</u>

3. An Astronomer Looks at Astrology (an information sheet for both students and instructors): <u>http://www.astrosociety.org/astrology.pdf</u>

4. A new issue of "The Universe in the Classroom" with information and activities for the 2012 Transit of Venus: <u>http://www.astrosociety.org/education/publications/tnl/78/78.html</u>

5. Thirty non-technical talks on the latest ideas and discoveries in astronomy are now available as audio and video podcasts free of charge through the web and ITunes. For a complete list and to begin listening, go to: <u>http://www.astrosociety.org/education/podcast/</u>

Speakers include:

- * Frank Drake, on the search for intelligent life among the stars
- * Mike Brown, on "How I Killed Pluto and Why it Had it Coming"
- (Ed. No one person was responsible for Pluto's classification as a dwarf planet.)
- * Natalie Batalha, project scientist on the Kepler Mission
- * Alex Filippenko on finding black holes.

Recent topics added to the offerings include: multiple universes, Saturn's moon Titan (with an atmosphere, rivers, and lakes), our explosive Sun, and whether we should expect doomsday in 2012.

B. For a small charge, the ASP is now making available a DVD-ROM of its many educational activities and resources, as well as images and videos for educators. Called "The Universe at Your Fingertips 2.0," it contains 133 detailed, ready-to-use hands-on classroom activities. For more information and a full table of contents, see: <u>http://www.astrosociety.org/uayf/</u>

C. The Astronomical Society of the Pacific (ASP), in partnership with the American Geophysical Union and the National Optical Astronomy Observatory, held its 124th Annual Meeting and its national conference on "Communicating Science" August 4 - 8, 2012, in Tucson, Arizona. Hundreds of education and outreach professionals, scientists, educators at all levels, authors of print and on-line materials, journalists, public information officers, museum staff, social media managers, and others involved in communicating space and earth science, gathered for panels, workshops, talks, posters, exhibits, and discussions. Similar meetings are held each year, with website as follows updated with the current year: http://www.astrosociety.org/2012meeting.

From the American Astronomical Society, Rick Fienberg (<u>rfienberg@aas.org</u>), Education & Outreach Coordinator, has provided the following information:

Through its education program, the American Astronomical Society nourishes a scientific outlook in society to increase public support for scientific research, improve science education at all levels, attract young people to careers in science and technology, and make evident the connections between science, technology, and prosperity. The highest priorities of the AAS education program are to promote and support training the next generation of astronomers to become successful scientific researchers and educators and to encourage and support high-quality research on the teaching and learning of astronomy.

Except as noted below, AAS education programs are administered by the AAS Executive Office, primarily by Rick Fienberg, Education & Outreach Coordinator (+1 202-328-2010 x116, <u>rick.fienberg@aas.org</u>). General questions should be addressed to <u>education@aas.org</u>. See http://<u>aas.org/education</u> for more information about the items listed below as well as other AAS education programs.

Astronomy Education Board

The Astronomy Education Board is charged with oversight of the education activities of the AAS by providing advice to the Council, the Executive Officer, the Education Officer, and the Education & Outreach Coordinator. The AEB examines the full range of education activities in which the Society and its members are involved, reviews the context in which investments in science education are being made by Federal and State agencies, recommends optimal mechanisms for developing an effective education strategy for the astronomical community, and recommends appropriate roles for the AAS in exercising

leadership in education. Timothy F Slater, Education Officer, Chair (until June 14, 2012) Edward E Prather, Education Officer, Chair (from June 14, 2012) educationofficer@aas.org

Education Sessions at AAS Meetings

Oral and poster sessions on various aspects of astronomy education are regular features of AAS meetings. Special sessions and workshops are often organized by AAS members involved in astronomy-related education research and curriculum development. Workshops usually occur on the weekend before a regular AAS meeting.

Career Brochure

"A New Universe to Discover: A Guide to Careers in Astronomy" provides an overview of the field, describes career options in academia and industry, and lists resources for high school and college students considering a career in astronomy. Printed copies are no longer available, but a PDF is online at <u>http://aas.org/education</u> and may be reproduced and distributed freely.

Harlow Shapley Visiting Lectureship Program

The AAS coordinates a program of two-day visits to colleges and universities by professional astronomers who wish to share the excitement of modern astrophysics with students, faculty, and the public. Participation is open to two-year colleges and four-year undergraduate institutions throughout the United States, Canada, and Mexico, especially ones without their own astronomy programs. Shapley Lecturers contribute to the host institution's academic program and intellectual environment in many ways. They give at least one presentation that's free and open to the public: the Harlow Shapley Lecture. They may also guest teach a class in physics or astronomy; give a research colloquium or seminar presentation; interact with students informally about graduate school and careers; discuss teaching and curriculum with faculty, deans, and administrators; and visit local primary and secondary schools.

Astronomy Center

<u>AstronomyCenter.org</u> is a digital library providing links to a wide range of teaching and learning resources for undergraduate introductory astronomy ("Astronomy 101") courses. All materials are classified by topic and activity type and have descriptions outlining their content. Information about authors, publishers, costs, and copyright is provided. <u>AstronomyCenter.org</u> is a cooperative effort of the AAS, the American Association of Physics Teachers (AAPT), and the ComPADRE Digital Library, a network of free online resource collections supporting faculty, students, and teachers in physics and astronomy education (<u>http://www.compadre.org</u>). It is supported in part by the National Science Foundation (NSF).

Workshop for New Faculty in Physics and Astronomy

The AAPT, in cooperation with the AAS and the American Physical Society (APS) and with support from the NSF, holds an annual workshop for new physics and astronomy faculty members at the American Center for Physics in College Park, Maryland. Now in its second decade, this conference presents a small number of techniques that have proven to be effective in a variety of environments. These tactics can be implemented with minimal time and effort, thus allowing new faculty to devote more of their attention to research and scholarship. See http://www.aapt.org/Conferences/NFW/ for more information.

Astronomy Education Review

The Astronomy Education Review (AER, <u>http://aer.aas.org/</u>) was founded in 2001 by Sidney Wolff and Andy Fraknoi as an online peer-reviewed journal for all who are engaged in astronomy and space science education, in either formal or informal settings. In astronomy education it has traditionally been difficult to find out what other educators have tried; to know what worked and what didn't, and why; and to improve teaching and learning in a systematic way. The AER provides a forum where it's possible to learn from our colleagues and to disseminate new ideas that can be used both in the classroom and beyond. The AAS assumed responsibility for the publication of the AER in 2009 and is assisted by generous support from the Astronomical Society of the Pacific.

Spark

Spark, the AAS education newsletter, is published twice each year, in the spring and fall. It consists primarily of original articles about or related to the education programs and activities of the AAS and its members. Contributions such as editorials, articles, and letters to the editor are welcome from anyone. See http://aas.org/education/spark pubs.php for more information or to download recent issues.

PROJECT CLEA

CLEA , Contemporary Laboratory Experiences in Astronomy, develops laboratory exercises that illustrate modern astronomical techniques using digital data and color images. They are suitable for high- school and college classes at all levels, but come with defaults set for use in introductory astronomy classes for non-science majors. Each CLEA laboratory exercise includes a dedicated computer program, a student manual, and a technical guide for the instructor. PROJECT CLEA is supported by Gettysburg College and the National Science Foundation.

http://www3.gettysburg.edu/~marschal/clea/CLEAhome.html

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VATICAN CITY STATE

Education in astronomy by the Vatican City State is primarily carried out through the Vatican Observatory, whose principal activities in this period were these, some traditional, some inspired by the International Year of Astronomy, and a final one innovative.

Super VOSS '09

The Vatican Observatory Summer Schools (VOSS) started in 1986 and have been held about every two years since. These schools, which are directed to the education at the graduate level of young astronomers especially in developing countries, have helped create a worldwide community of young scholars in Astronomy and Astrophysics. The Super VOSS is an irregularly scheduled reunion of students from all the past VOSS. About 60 attended the one in 2009, which was dedicated to the International Year of Astronomy. Many of the former students are now so well established as professors themselves that this Super VOSS was entirely organized on the academic level by the alumni.

ASTRUM 2009

Also as a celebration for the International Year of Astronomy, an exhibition was organized by the Italian National Institute of Astrophysics (INAF), the Vatican Observatory, and the Vatican Museums. An important selection of the most precious and rarest instruments for astronomical observations was on show for a three month period at the Vatican Museums. Included also among the 130 objects were maps, manuscripts, models of Ptolemaic and Copernican systems, paintings, photographs, codices, and books. While the exhibit was open many visitors admired these objects and learnt about the historical evolution of the tools of the astronomer's trade. This exhibition was only the third of its kind at the Vatican, the others being held in 1929 and 1958.

VOSS in 2010

In June of 2010 the 12th Vatican Observatory Summer School (VOSS) was held on the topic of "*The Chemistry of the Universe*". As previously, 25 students, both men and women from throughout the world, but with an emphasis on developing countries, were invited. The faculty was formed from an all VOSS alumni team, who had proposed the school's topic. For the first time the school was held at the Vatican Observatory's new headquarters at the southern end of the Pontifical Villas at Castel Gandolfo. The renovations to the building, which were made with the schools in mind, did indeed provide a comfortable study environment, and the school once again proved to be a success. The next VOSS on "*The Formation and Evolution of Stellar Clusters*" is scheduled for June 2012.

INCAI

The International Network of Catholic Astronomical Institutions (INCAI) held its first workshop for graduate students, "*Exploring the Nature of the Evolving Universe*", at the Pontifical Catholic University of Rio de Janeiro for a week in August 2011. The Vatican Observatory and the two other INCAI founder members, the Catholic University of America, Washington DC, and the Pontificia Universidad Católica, Santiago, Chile, had signed an agreement in 2008 which expressed their intent to cooperate in promoting education and research opportunities for their faculty, staff, graduates, and students. The success of the first workshop has led to the planning of a second in July 2012 at the Catholic University of America.

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