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A to L

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. Several reports were received in plain text in emails, so modifiers of the basic Roman alphabet characters (e.g. á, ç) will have been absent – I hope that I've put all of these back. If there are any mistakes or obscurities please let me know as soon as possible and I will make amends.

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

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Argentina

In the last three years, Astronomy Education in Argentina has evolved in different ways depending of the education level considered (i.e. university, secondary school or first level education). With respect to the primary and secondary school, after almost a decade of being almost absent, Astronomy has returned to the official curriculum of natural sciences, which is very good news. We face, however, a very poor formation of the teachers in specific and basic subjects, with very few exceptions. University institutions, like La Plata National University, are implementing different kind of strategies, like strong outreach programs and astronomy courses designed specifically for primary and secondary school teachers, in order to try to overcome this difficulty. Outreach programs, intended to popularize Astronomy are also developed by scientific institutes.

Non-formal education is passing for a very interesting phase. A modern and relatively big planetarium, depending on one of Argentine's Astronomy Faculty, is being build up at La Plata. This new planetarium (one of the four big planetariums in Argentina) will be fully operative during 2012 and it is expecting a huge popular audience, including schools. Other initiatives that are operating from relatively long time ago are the Astronomical Complex "Plaza del Cielo" in Patagonia, and an interactive museum, including a small planetarium, in the city of La Punta, province of San Luis. Also in this same region the local government placed several monumental sculptures related to Astronomy. Amateur astronomical organizations, have also outreach programs designed for young people, like astronomical camping.

Regarding the University level, three institutions are currently offering a degree in astronomy. They are the Facultad de Ciencias Astronomicas y Geofisicas of La Plata National University, the Facultad de Astronomia, Matematica y Fisica of the Cordoba National University, and the Facultad de Ciencias Exactas, Fisicas y Naturales of the San Juan National University. All of them are public universities without annual or registration fees. The degrees are equivalent and their formal duration is 5 years, although the real time to get the degree, especially at La Plata and Cordoba, is substantially longer (about 8 years). The total number of degree students of astronomy in Argentina during 2011 was about 650. 37 students obtained their degree during the last three years, showing that the formation of human resources is growing at a constant, sustained rate during the last few years. All the above-mentioned institutions offer a PhD degree supported through different fellowship programs. 24 PhDs in astronomy were completed in the period 2009-2012. In the last years, a growing number of Latin American students are studying astronomy in Argentina at the different university levels. The number of teachers in the three astronomy high-level institutions is about 200 people.

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Austria

Overview

The three university institutes in Vienna, Graz and Innsbruck, together with various amateur astronomer organizations throughout Austria, and the people's education systems in Vienna and other Austrian cities, do astronomy education in Austria. Almost all of the organizations involved are members of the Austrian Society for Astronomy and Astrophysics (ÖGAA), which among other tasks organizes nationwide events complementing the local activities.

In the period 2009-2011, the most important step for Austrian astronomy was joining the European Southern Observatory as a full member. As a consequence, the presence of ESO and its research results in Austrian media increased significantly.

Elementary and secondary school

A growing number of educational activities for this age group are offered in Austria, especially during the summer months and other school holidays. A well-established event in this context is the Kinderuniversität (children's university) held at various places throughout the country. At the Kinderuniversität, kids both from elementary and secondary school can listen to talks and presentations from university faculty members. Astronomers were highly involved in these activities in the years 2009-2011.

The University of Vienna offered typically 25 guided tours for school classes in each of the years 2009, 2010, and 2011. The students had the occasion to study, see and 'touch' both the historical and modern instruments of the Vienna University Observatory.

Various amateur groups contribute to the astronomy education for this age group, in particular by offering first hands-on experience with stargazing. The Vienna Astronomy Association established a co-operation with a Viennese ocean museum. The Antares group in Lower Austria (Michelbach) started the program ANTARES KIDS using simple experiments to introduce to pupils astrophysical topics from meteorites to the Big Bang. Over the past three years this program reached more than 200 kids.

The activities are accompanied by teacher training courses offered by various institutions. While astronomy is only marginally present in the curriculum of the elementary schools, we notice a still growing interest in this subject at this school level. The various institutions continued their work in the promotion of astronomy in Austrian secondary schools. There is no separate subject "astronomy" in Austrian secondary schools, but the topic is partly included in physics and geography. The amount of time actually dedicated to astronomy strongly depends on the interests of the teacher. A few schools established an astronomy course as an optional discipline.

Educational material

The Department IT Systems for Educational Purposes of the Austrian Federal Ministry of Education, the Arts and Culture (BM:UKK) together with the Department of Astrophysics, University of Vienna, are collaboratively working within national and international projects to implement more astronomical practices in the classrooms of schools and universities and to train teachers in using pedagogical materials and tools. Therefore, several workshops and teacher trainings were organised to disseminate and present as well as use actively the products, services and results provided by the projects. The aim is also to show teachers how to plan and organise their teaching practice according to the inquiry learning and teaching methodology (IBSE; Inquiry Based Science Education) in order that the students get insights into how the scientific process works and how scientists get their knowledge and make new discoveries.

In the international projects COSMOS (2007-2009), Learning with ATLAS@CERN (2008-2010), and the follow-up project Discover the COSMOS (2011-2013), as well as the project Pathway (2011-2013), portals with educational content and learning activities in several European languages are built up e.g. to give teachers and students free access to robotic telescopes, scientific databases, and archives. The approach outlines instructional models that characterize inquiry based educational practices for assisting teachers and science educators in their teaching practice. All outcomes and products of the national and international

projects are documented on the website of the Virtual School Austria (http://www.virtuelleschule.at).

The main goal of the Austrian project coordinators is to establish a thematic cluster for astronomy and astrophysics, to initiate effective community building between researchers, teachers, and students, and empowering the latter to use, share, and exploit the collective power of unique scientific resources (research facilities, scientific instruments, advanced ICT tools, simulation and visualisation applications, and scientific databases) in meaningful educational activities. Teachers, scientists in research facilities, institutions for informal learning (e.g. Museums and Science Centers), stakeholders, as well as NGOs (Non Governmental Organisations) and NPOs Non Profit Organisations) are connected to organise various activities like online meetings or act as contact points for questions and possible invitations to events organised by schools or universities.

University

Astronomy can be studied as a separate subject at the University of Vienna, and it is further offered as part of physics in Graz and Innsbruck. The number of university professors related to astronomy and astrophysics has increased significantly between 2009 and 2011. Three kinds of academic degrees, namely bachelor, master and doctor, can be obtained. New curricula for the three kinds of studies have been released recently. At the University of Vienna a doctoral school on the cosmic matter cycle was completed successfully in 2010; a new doctoral school on planetology started in the same year.

The number of astronomy beginners stayed roughly constant throughout the observed time span at a level of about 120 students in Vienna. The total number of students in astronomy bachelor courses is about 300 each year, with a proportion of women of about 30%. The master and doctoral studies also kept a rather constant level of number of students with typically 50 master students each year. Here the fraction of women is at the 40% level. The University of Innsbruck, where astrophysics is taught as part of physics studies, reports a total number of 7 master and 7 doctoral degrees awarded between 2009 and 2011, directly related to astrophysical research topics.

Every year the ÖGAA runs a competition for the best diploma thesis on an astronomical subject. Annual meetings of the ÖGAA at alternating places in Austria allow students to become acquainted with their colleagues at the other Austrian universities offering lectures in astronomy and astrophysics.

Observatories and planetaria

Beside the University Observatory, four further institutes are involved in public education activities in Austria's capital Vienna: the Planetarium Vienna, the Kuffner Observatory, the Urania Observatory, and the Vienna Open Air Planetarium. The network of the Vienna people's education system runs the first three. Public talks and workshops on various astronomical topics were offered frequently at all three places. The Planetarium Vienna offers several shows on various astronomical topics, among them in-house developed shows particularly suited for kids between 6 and 10.

In the South of Vienna, the Open Air Planetarium Georgenberg is run by the Österreichischen Astronomischen Verein through the Astronomische Büro. It promotes astronomical observations with the unaided eye. Guided tours for the public are offered on a regular basis. In 2009 a fully automatic fire-ball detection station was opened in Martinsberg in northern Austria. It is operated in close collaboration with the Czech Academy of Science.

Outside Vienna three further planetaria in Klagenfurt, Schwaz and Königsleiten are offering shows and information programs on a regular basis. In Linz, the capital of Upper Austria, several public talks were performed in the Wissensturm, an institution run by the local people's education system. Astronomy shows at the Ars Electronica Center (AEC) in Linz were offered a few times a year and attracted several hundred visitors. A special attraction at this site is a 3-D animation of a flight through the Universe.

In September 2011 astronomy and cosmology played a major role in the six-day science, art and technology festival (Origin) at the AEC with 1200 visitors in total.

Amateur astronomy

There is a vivid scene of amateur astronomy clubs in Austria; most of them are also actively involved in

public outreach. The Vienna Astronomy Association offered seminars and courses on various astronomical topics for the interested public. Outside the major cities amateur astronomy clubs play a major role in communicating astronomy to local school classes. Furthermore, as several of them are located in touristic areas, they also attract a number of tourists each year.

Other public outreach activities

An astronomy day is organized once a year to present the Austrian research and amateur institutions to the public. Typically 20 to 30 events throughout Austria attract several thousand visitors each year. This event was also a focus point of public outreach and educational activities in IYA09 when it was extended to "100 hours of astronomy" in collaboration with institutions worldwide. This activity attracted a large number of people

Online media play an increasing role in science communication today. In Austria, several internet pages informing both about new science results and local events for the public are online, like an information page run by he Vienna Astronomy Association, or another one installed in the course of the IYA09 events. There is an ESO Austria page operated within the ESO Science Oureach Network providing press releases of ESO translated into German, and other information. A long tradition has the online forum AstroAustria. But also the classically printed newsletter Der Sternenbote is still quite popular.

Within the programme University Meets Public, astronomers from the universities at various institutes gave several talks on astronomical topics for people's education. Finally, local contributions like public talks, radio stories, and school activities from individual professional and amateur astronomers, complete the effort to popularize astronomical research and its results among the general public and, in particular, young people in Austria.

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BRAZIL

Overview

The International Year of Astronomy (IYA2009) is the richest year of events to report here, since the Brazilian participation was enormous, providing the commitment of several National Nodes to continue their educational projects beyond the IYA2009. Among the 228 active National Nodes, 201 reported their activities informing that in total occurred 16 369 public events with the participation of 2 292 675 people. The Brazilian Olympics of Astronomy and Astronautics (OBA – *Olimpíada Brasileira de Astronomia*) was attended by a total of 858 157 students, involving 74 555 teachers. The organizing comittee of IYA2009 in Brazil (PI Dr A Damineli) prepared 250 kits of the exposition "*Paisagens Cósmicas*" that were exibited in 725 different places and visited by 641 067 people from the entire country.

In Brazil, all the goals of IAY2009 were exceeded, excepting the "number of people who could observe the stars using a telescope", which was disappointing due to the bad weather - the year 2009 was especially wet, and only reached reached 311 752 people in 2666 events, 31,17% of the expected public.

One of the more important results of IAY2009 was the creation of the "*Rede Brasileira de Astronomia* (RBA)", a network designed to continue the acctivities of astronomy outreach in Brazil. The federal agencies like *Ministério de Ciência e Tecnologia*, *Ministério de Educacão e Cultura* and CNPq (*Conselho Nacional de Desenvolvimento Científico e Tecnológico*) were sponsors of this huge event organized in Brazil. Details on the IAY2009 Brazilian participations can be seen at http://www.astronomia2009.org.br.

As Rio de Janeiro hosted the IAU XXVII General Assembly in 2009, several of our educational projects were presented in the IAU Special Session 4 "Astronomy Education between Past and Future", organized by de Greve, Kochhar and Guinan. Owing to the IAU 2009 meeting, several public events took place in the city of Rio de Janeiro, all were intended for the general public and were associated with the XXVII IAU General Assembly. A list of some of the eveniis is presented at http://www.astronomy2009.com.br/assocevts.html.

Aiming to describe the educational activities developed during the period concerning this triennial report, I summarize here the abstracts of talks and poster contributions presented during the meetings of the Brazilian Astronomical Society (*Sociedade Astronômica Brasileira*, SAB) published in bulletins related to the XXXVth (2010) and XXXVIth (2011) annual meetings. it is interesting to note the amazing rise in the number of educational projects presented in the SAB annual meetings. In my last report it was on average 23, which increased to 49 in 2010 and 34 in 2011. Even considering that 2010 was exceptional, since most of the presentations were related to the IAY2009, we can estimate that educational projects in Brazil have increased almost 50% since 2008. In the following sections I give details of some of these works. The references to the abstracts are given as a function of the year of the SAB's meeting and the page number in the respective Bulletin (e.g. 2010 v. 29, 2011 v. 30).

College and University

The project PIBID/Capes (*Programa Institucional de Iniciação à Docência*), specially designed for undergraduate teachers, has been largely applied by several universities aiming to improve the education of physics based on astronomy and astrophysics, for instance described by Machado (2011 p62), Fernandes et al. (2011 p63) , Marranghello, Ferrari & Pavani (2011 p67).

Saraiva (2010, p57) reports the Brazilian participation in GTTP (Galileu Teacher Training Program), which started at *Universidade Federal do Rio Grande do Sul* (UFRGS) during the IAY2009 and now has the Universidade Federal de São Carlos (UFSCar) as Brazilian representative in this international program. UFSCar has also enjoyed another large scale collaboration to discover and to survey asteroids such as NEOs (Near Earth Objects): the International Astronomical Search Collaboration (IASC) as reported by Prando & Rojas (2011 p68). Another interesting international collaboration involving Brazil-Uruguay-Argentina, organized by UFRGS (Saraiva et al. 2010 p72) used measurements made during the equinox of 2009 and 2010 aiming to improve the teaching of the Earth movements, as well as to reinforce the collaboration of Latin-American researchers and teachers.

Portugal has also been an important partner in collaborative educational programs. Universities of Porto and Lisboa (PT) and Pernambuco (BR) are joining efforts to design a multi-wavelength solar observatory attending both scientific and educational purposes (Bezerra et al. 2011 p59).

Master degree projects proposing non-conventional scholastic material for astronomy teaching have been developed in *Universidade Cruzeiro do Sul* (UNICSUL) in São Paulo. Oliveira & Lanfranchi (2010 p63) interviewed directors of Planetaria from different regions to verify the impact of dome sessions in the scholar curriculum. Albrecht & Voelzke (2010 p58) study the use of comics in classroom activities of secondary schools.

The use of comics for astronomy teaching in college has also been adopted by Langhi & Martins (2011 p66) from *Universidade Federal do Mato Grosso do Sul* (UFMS) . The comic books "*Ombros de Gigante: a história da astronomia em quadrinhos*" aiming to tell about the life and the work of Kepler, Galileo and Newton was published by Hetem, Gregorio-Hetem & Tenorio (2009), and was freely distributed among the schools and teachers that attended the OBA during the IYA2009.

Langhi & Almeida (2011 p72) describe the hole of the project "*Erastótenes no Brasil*" in teachers training programs (http://sites.google.com/site/projetoerato/).

Secondary and Elementary schools

Bretones (2010 p11) from UFSCar (São Carlos, SP) discussed the educational activities focused on teachers and students of Municipal elementary schools. Klafke & Corte (2011 p65) present the project ORBITER, a flight simulator designed to make the teaching of orbital dynamics and celestial mechanics attractive for students from both elementary (final levels) and secondary schools.

The schools of Itajubá (MG) and nearby cities collaborate with two main institutions leading astronomy education: LNA (*Laboratório Nacional de Astrofísica*), has very interesting outreach projects, like "*Observatório no Telhado*" (Oliveira-Abans et al. 2010, p63), as well as the local university UNIFEI (*Universidade Federal de Itajubá*), with teaching programs described by Ribeiro et al. (2010, p58). Carvalho et al. (2011 p62), Gonçalves et al. (2011 p64), among others.

The same occurs at São José dos Campos (SP), where two centers of research on astronomy are also devoted to educational programs. INPE (*Instituto Nacional de Pesquisas Espaciais*) has a partnership with the *Secretaria Municipal de Educação* to develop classroom activities and to offer teachers training courses (Bernui et al. 2010 p60). The local university UNIVAP (*Universidade do Vale do Paraíba*) organized several IYA2009 public events that were attended by more than 12 000 people of the Vale do Paraíba (SP) region, as well as from Rio de Janeiro and Minas Gerais (Barbosa et al. 2010 p60).

From the collaboration between LNA and INPE a very interesting Pocket-VO was developed, which is "a simple web-based tool for viewing image and data using the Virtual Observatory (VO) that can be used both in astronomical research and education", as described by Ribeiro Bortoletto et al. (2010 p61).

The web facilities to access information as well as VO data have also been the subject of educational projects developed at *Observatório do Valongo* (Rio de Janeiro), respectively by Rabaça & Lorenz-Martins (2011 p60) and Conde et al. (2011 p61).

Observatories and Planetaria

Fernandes Martins et al. (2011, p11) describe the activities of research, teaching and outreach developed by *Observatório Astronômico Antares* (Feira de Santana, BA), which has been in operation since 40 years ago.

Several of the exhibits of the IYA2009 were related to dome and mobile Planetarium sessions like those promoted by *Observatório do Valongo* at Rio de Janeiro (Cuisinier et al. 2010 p11) and *Planetário de São Paulo* (Calil et al. 2010 p62) and several universities, like UFRGS in Porto Alegre and other locations in Rio Grande do Sul province (Santiago et al. 2010 p12); *Pontifícia Universidade Católica* (PUC) in Belo Horizonte, MG (Leroy 2010 p11); *Universidade Estadual de Londrina*, in the State of Paraná (PR) (Queiroz et al. 2010 p57, Romanzini & Batista 2011 p70); *Universidade Federal de Goias* and *Universidade Estadual de Goias* (Barrio & Martins 2011 p59; Sabota & Sobreira 2011 p70); *Universidade Cruzeiro do Sul* - UNICSUL (Maia Oliveira & Voelke 2011 p68, p71).

Other Public events

A radio show broadcast by UFSCar named PAIDEIA is an exciting and creative form to attract the audience to astronomical news. Rojas et al. (2010 p57) describe their different kinds of radio shows, like "*Uma Música Um Tema*" to discuss the relation of music and astronomy, and "*Um Universo Entre Nós*", a radio-novel based on Galileo's work. The impact of video-casts on the astronomy outreach, like "*O Céu da Semana*" produced by UFSCar's LAbI (*Laboratório Aberto de Interatividade*) was also discussed by Rojas et al. (2011, p. 69) showing the power of communication by using blogs and social networks to teach astronomy for large audiences.

Canalle et al. (2011 p10) report that attendance at OBA (O*limpíada Brasileira de Astronomia e Astronáutica*) has continuously risen. In 2004 the VIIth OBA received about 123 000 students, from 2713 schools, and in 2010, the XIIIth OBA) was attended by 784 390 students from 9 149 schools. With the goal to improve the interaction with students and teachers of other countries, a Latin-American version of OBA, the "*Olimpíada Latino-americana de Astronomia e Astronáutica*" has been realized since 2009.More details can be found at http://www.oba.org.br/

Concerning our efforts at science outreach in the poorest part of our population and/or those with handicaps, several authors have reported their projects, most of them financed by Brazilian agencies. Steffani, Oliveira Saraiva and Zanatta (2011 p11) developed ceramic devices to describe the Moon's appearance and phases and to be used by people who are visually impaired. With the collaboration of APAE (*Associação de Pais e Amigos dos Excepcionais*) of Itajubá (MG), Silva et al. (2011 p61) develop didactic kits to provide the night sky observation in the Braille system. Jafelice (2011 p10, p64) reported results from projects supported by *Ministério de Ciência e Tecnologia*/CNPq designed to discuss astronomical concepts related to cultural and anthropological aspects.

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CARIBBEAN GROUP

Overview

The last triennium report was in 2009, the International Year of Astronomy (IYA), and we had the huge honour of being able to host the International School for Young Astronomers in Trinidad, the first time in the region. There has been consistent, albeit slow development in astronomy in terms of teaching, workshops, research, and public outreach in the Caribbean region. We explore in this report also if the impetus of the IYA 2009 affected our trajectory in astronomy development.

Elementary (primary) school

Astronomy is in the primary school syllabus (children 5-11 years of age). As noted in the previous report, there is no real organized effort to improve the situation here – and this is a yellow flag in retrospect that more can be done and needs to be done at this level.

The more talks I have given, the more varied my audiences, a clear signal is coming through when I listen to the audience. What children are exposed to between the ages of 7-10 thereabouts can have lasting impressions on them, that often can forge the careers they go into and transform them. I take polls in my Astronomy workshops as to any impacting experience a person may have had at any point in their life that brought on a lifelong interest in Astronomy. I was amazed how many of those experiences occurred between the ages of 7-10, notwithstanding my own experience of looking at the Moon with my father's binoculars at age nine and being transfixed at the three dimensional appearance the Moon's disk took on. Looking up became a lifelong passion since.

From this perspective, the children of the Caribbean have very little exposure to science museums, planetariums and astronomy events. We need to work harder in this area and is one of the motivations for building a planetarium in the Caribbean. If it comes to pass, it will be the first of its kind in the region.

Secondary school

Astronomy is not present in the Caribbean Examination (CXC) syllabi of physics. However, being in the opportune position of being the chair of the panel for the revision of the syllabus, we have included many aspects of astronomy in "Teaching and Learning activities" which expound principles of physics.

The Astroclub which was started in 2008, has really become a force to contend with and has definitely grown even more in the last triennium, and is the main avenue for high school students interested in astronomy. Mr Gerry Barrow, founder of the Astroclub has a lovely philosophy to promote astronomy. He wants to create a healthy and safe environment for young people aged12 to 17 to enjoy astronomy within a social context as well. Therefore, a camp out on the neigbouring island of Tobago or at a beach for the members of the club will always have astronomy viewing and competitions as part of the retreat. Christmas parties, a "lime" (local term for fun social gathering) are all well attended by students. The main big event is the annual astronomy quiz – this year 16 schools took part in the competition vying for the trophy.

College and University

While it may all seem like tiny steps, nonetheless it is steps in the forward direction. The course "Introduction to Astronomy" aimed at non science majors was launched in 2009 at the St Augustine campus at the University of the West Indies, and has run every year since. The Cave Hill campus in Barbados also launched a similar course in 2011. This has been a welcome development. Our next phase should be towards launching an online course in astronomy.

The open campus of the University of the West Indies also runs a course in astronomy for the public titled "Basic Astronomy".

In the area of research, only at the St Augustine campus of the University of the West Indies, astronomy remains active. In this triennium under review, two students graduated with MPhil degrees in astronomy, one in astrobiology and the other in exoplanets. At present, another student is completing his PhD in astrobiology. While these numbers may seem alarmingly small to other larger institutes, for us they represent

significant growth in astronomy. Prior to these three students, for decades, there were no research students in astronomy. This is a 300% improvement.

Education conferences

In the last report, we had very little to report under this section. The international School for Young Astronomers (ISYA) held in 2009 was deemed a big success with students from 17 countries from the Caribbean and Latin America participating. This ISYA was different. We ran a teachers' workshop in astronomy alongside the school, as well as a workshop for children at the National Science Centre. Several public lectures, television appearances, and newspaper features highlighted astronomy, especially as it was the International Year of Astronomy.

A workshop in Astronomy was held at the University College of the Cayman Islands (UCCI), in the Grand Cayman, Cayman Islands in March 2012. This was a spin off as an opening of the William Hrudey observatory which had been launched earlier in the year. After the workshop, a couple of days were spent visiting and giving talks on astronomy in primary and secondary schools in the Cayman islands. This was very rewarding as the students showed great excitement for such exposure which was not often forthcoming.

Out of the Astronomy workshop, was born the idea of holding a *Science Technology Engineering and Mathematics* (STEM) conference at UCCI in the Caribbean, Cayman Islands. This was held in October 2012, and while it was a STEM conference, due to the keen interest in astronomy on the part of the organizers, there was a strong astronomy aspect to the whole conference. Among the keynote speakers was Prof Edward Guinan of the IAU.

Observatories and planetaria

Observatories in the Caribbean region have been located in Jamaica, Barbados and Trinidad. The Cayman Islands now joins the group with the newest William Hrudey observatory housed with a 12.5 inch (317.5 mm) Newtonian built by Dr Hrudey and fully computerized. They are at the preliminary stages of identifying projects to be undertaken. It is outfitted with a Mallincam and some lovely pictures of the Sun have already been emerging.

The Jamaica observatory has not been revived since the onslaughts of hurricanes there. The Barbados observatory houses a 14 inch (355.6 mm) telescope and was operated by the Barbados Astronomical Society. At the time of writing, apparently vandalism has occurred there which has made it non-operational presently.

The observatory SATU, at the St Augustine campus, housing a 40-cm Meade LX200 and outfitted for CCD imaging, whose primary purpose has been to monitor the BLlac object OJ 287, was down for maintenance and effectively has been out of commission for some time. The loss of a volunteer student played a significant part in its demise. In small countries, one person can make all the difference in anything happening or not happening.

The good news is that SATU is back up, revamped on a new mount and there are some enthusiastic undergraduate students who cannot wait to get their hands on it.

The National Science Centre in Trinidad has now obtained two 12-inch (305 mm) telescopes and two bigger portable planetaria. There has been clear growth in Astronomy outreach at the Science Center in Trinidad. They regularly have observing sessions as well for the public.

Our dreams are bigger still. We want to establish a full scale planetarium in Trinidad. Most major cities in the world have one, yet there is not a single full scale planetarium in the Caribbean. A feasibility study has been done by The Caribbean Institute of Astronomy (CARINA) and UWI and a proposal prepared, and we are currently in dialogue with the Government of Trinidad and Tobago on this project. How we would love to report in the next triennium report that this project was complete or at least well underway!

Amateur astronomy

Amateur Astronomy is mostly facilitated by CARINA, the Astronomical societies in Barbados, Jamaica, Trinidad, the Cayman Islands, and the National Science Center in Trinidad. Cayman Islands Astronomical

Society has now joined CARINA as a member. The Trinidad and Tobago Astronomical Society continues to operate with membership, meetings and observation nights monthly with their 12-inch (305 mm) telescope.

Communication among the different bodies including across the islands is less than desirable. This has been a consistent challenge in promoting astronomy across the region. The Cayman Island group has been vibrant in this aspect and brought new blood to astronomy in the region.

Public education and outreach

Efforts at public outreach continued to be well supported by the general population and facilitated by all interested parties, including the societies and the university in the region. CARINA's annual star party has become a brand name and is highly subscribed to, with almost 500 persons attending, with CARINA cutting off at that point to keep the event manageable. Television breakfast shows continued to seek out and have us as guests for Astronomy matters from the issue of "2012" to the transit of Venus.

The transit of Venus in 2012 afforded a wonderful opportunity to forge our alliances and work together in the different islands. Coordinated by CARINA and the Cayman Islands Astronomical Society, Trinidad and Tobago Astronomical Society and the UWI, it turned out that the Cayman Islands was our best hope to see anything in the Caribbean. It was a sunset event in Trinidad. Therefore, a live feed on television and on the Night Skies network on the internet was brought from the Cayman Islands. For a small island, a turn-out of over one thousand persons was beyond expectation and did a great deal to promote astronomy to the public in the Cayman Islands and the region.

Public lectures in Astronomy continued as opportunities presented themselves from visiting academics and locally.

Undergraduate students at the St Augustine campus designed and built an astronomy themed peace park on campus. "Alcyone" peace park has scaled models of the pyramids with regard to their relevance to archaeo-astronomy. Peace pole and benches are within the 'peace sign' that delineates the park and a sundial is to be put in to finish the ambience.

Other public events

Short courses in astronomy of ten contact hours each were designed and run by the author at the National Science Centre over the summer period for the general public. They were "Astronomy- down to Earth", "Eyes on the skies – observational Astronomy" and "Astronomy – a search for ourselves".

CARINA hosted several sidewalk astronomy events where they would set up a telescope at the malls and other grounds, and show celestial objects to passersby. They also facilitated events in the sister island of Tobago. Some members of CARINA also facilitated astronomy outreach events in the island of Grenada in 2011.

A new event was undertaken by Digicel IMAX – the first IMAX cinema in the Caribbean where school students were invited for 3D shows like "Space Station 3D" and "Hubble 3D". Popular lectures in astronomy were held in the cinema at the start and viewing sessions afterwards on the terrace. This was very successful: CARINA and UWI was involved in these events.

Beyond IYA 2009

The purpose of designating a year an international year on a theme is to give particular focus and impetus to that particular theme. Needless to say, the IYA 2009 afforded such opportunities to us with the focus around the International School for Young Astronomers. CARINA was designated the IYA local node in the region. So, did the IYA with its impetus help us subsequently? There was a flurry of activities in that particular year which subsided in the following years. 2012 has actually seen a resurgence of activities on several fronts from teaching to public outreach.

CARINA applied to be a node in the region with the IAU Office for Astronomy Development. We were not successful as some further infrastructure still needs to be built in this region.

However, the same common theme is the underlying mitigating factor again. Motivated individuals are the people who make the difference in a region like the Caribbean. In the past, persons like Mr P Stahl of Barbados and Dr M Imbert of Trinidad kept the torch burning for decades almost single handedly. Presently, the torch burns bright with Mr Gerry Barrow in the Astroclub, Mr Isa Mohammed, president of CARINA, and Dr Wiliam Hrudey in the Cayman Islands. We must therefore support them as best as we can, the lone motivated enthusiastic individual who often has to overcome great odds to achieve the simplest of things in the Caribbean region but in doing so makes a big difference.

Kids at a primary school in the Cayman Islands after a talk on Astronomy by Dr Haque and facilitated by Dr Hrudey (in picture)

Telescope in the William Hrudey observatory in the Cayman Islands

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Denmark

There exists a network of professional and amateur astronomers that offers public talks, street astronomy, solar eclipse trips etc. for the public as well (see below).

The astronomy education is part of the science and physics education through primary and secondary school.

The University of Copenhagen and the University of Aarhus both offers bachelor and master degrees within astrophysics as part of their physics program.

Elementary school

In elementary school the pupils have a minimum of 600 60-minute lessons per year during years 1-2, and 660 60-minute lessons per year during years 3-6. Of these only 30 per year for years 1-2 and 60 per year for years 3-6 have to be spent on educating the pupils about science and technology. How much astronomy is included differs strongly from school to school and is highly influenced by the teachers.

However, at the end of elementary school the children must have acquired knowledge on the Earth as a planet, and the Solar System as a whole. This includes why we have seasons, how the Sun and the Moon move across the sky, why the Moon has phases, and how to observe planets.

During the last three years there has been a great innovative project called "Children of Galileo" (Børn af Galileo, http://www.boernafgalileo.dk/) where pupils were given the opportunity to build their own telescopes and explore the night sky.

Lower secondary school

In lower secondary school the pupils have a minimum of 660 60-minute lessons per year during years 7-9. Of these a minimum of 60 per year must be within physics and chemistry. How much astronomy is included depends on the teacher. Typically the pupils will obtain some insight into the history of the Universe from the Big Bang until today and have acquired some knowledge of the facts that stars make up galaxies, and that our galaxy is the Milky Way.

Half the elementary and lower secondary schools (these are mostly situated within the same building complexes) participate in the Danish Science week – a nationwide campaign (http://www.formidling.dk) with science activities that occurs every year in late September (week 39). The Science week has different themes each year but always with a broad focus on natural science. Here all amateur astronomers, professional astronomers, planetarium etc. are engaged, with talks, stellar nights, hands on experiments with real observational data etc.

Upper secondary education

Upper secondary education is not obligatory and only pupils attending gymnasia - to receive education qualifying for access to higher education - have the opportunity of choosing an astronomy course. Only a dozen of the approximately 140 gymnasia around the country offer an astronomy course. The astronomy course consists of 75 60-minute lessons out of the 2470 60-minute lessons that the full three-year education entails.

University

Astronomy can be studied as part of a degree of physics at the University of Copenhagen and the University of Aarhus. Both universities offer a bachelor, masters and PhD program within astrophysics. On average around 10 PhD and 20 masters graduate with a degree in astrophysics per year. All bachelors continue onto a masters program.

From September 2012 the Danish Technical University will start up a new bachelor and masters program in geophysics and space technology.

The universities have a major focus on public outreach of astronomy as a way to inspire young people to study natural science at university.

Amateur astronomy

The majority of the professional and amateur astronomers are members of the Danish Astronomical Society (http://www.astronomisk.dk). The society publishes a magazine (Kvant) with the Danish Physical Society four times per year. It organizes lecture series all over the country, school visits, guided tours of the skies etc. There is very good coordination and relations between the professional astronomers, the amateurs, as well as the planetariums and natural science museums.

Public education and outreach

Most of the public education and outreach of astronomy is organized by the professional astronomers at university, the amateur astronomers within the Danish Astronomical Society, the planetariums and natural science museums. Typically there is offered around 100 astronomy talks/events per year throughout Denmark open to the general public.

Every four years an Astronomical Guide is published which is distributed free of charge to primary and secondary schools as well as public libraries. The cost is covered by donations from private foundations. The guide is published both as a booklet and in an online version. The current edition is from 2009 and a new version is planned for 2013: http://www.astronomisk.dk/?ASTRONOMISK_GUIDE

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Ethiopia

High schools

There is very little mention of Astronomy in Ethiopian high schools. The Ministry of Education (MoE) does not seem to be prepared to change its current educational policy on Astronomy any time soon. The main reason for the delay, according to my understanding, is the misconception that they have on the expenses that they think will be required to introduce Astronomy into the existing high school curriculum. There is some unfounded preaching being carried out in the country by some elements who try to portray astronomy as a discipline strongly linked to big telescope complexes and satellites.

Currently, the Astronomy-Astrophysics Group (AAG) at Addis Ababa University (AAU) is trying to change this image. This group is the only professional research group in the country and has now teamed up with AAU's Community Service Program managed by the Vice President's Office for External Relations to conduct a National Outreach Program in Astronomy (NOPA). The Community Service Program urges every staff member in the university to go out and give service in the field of his/her expertise be it in the form of teaching the public, advising and consulting firms etc. NOPA is now a part of this program and is hoping to give training in Basic Astronomy to thousands of preparatory school students throughout the country. NOPA, launched about a year ago, has already trained close to three hundred preparatory school students from schools in Addis Ababa (the capital). Beginning September 2012, NOPA will start training students in the other regions as well. NOPA is in a schedule to finish its campaign in the coming 7 – 8 years. **Any financial and/or material support from the IAU will be strongly appreciated.**

Universities

The situation with universities is somewhat different. A couple of years ago, the MoE suddenly decided to include four courses into the undergraduate physics program. This was rather a surprise because there was no *a priori* capacity building effort made by the government to take such an action. Out of a total of over 30 universities and some teacher training colleges in the country it was basically AAU which was teaching these courses officially within the BSc physics program. As already mentioned earlier, the AAG at AAU is the only group in the country officially training students for MSc and PhD degrees. So far it has trained over 40 such students in this program. Currently this group is training twelve MSc and four PhD students in Astronomy. Immediately following the decision made by the MoE, the AAG was contacted to supply the curriculum for these courses and, so far, it is this curriculum designed by the group that is being strictly followed by the rest of the universities and colleges in the country. Also, up until this moment, it is the former graduates from the group that came to the aid of teaching the newly inducted astronomy courses in the universities.

However, there is still reluctance on the side of government offices for higher education to introduce an undergraduate astronomy program at BSc level. The curriculum designed by the AAG and submitted for review/approval to AAU's Faculty of Chemical and Physical Sciences was rejected for a reason that there is no immediate need for introducing astronomy at BSc level. **If the IAU could partially sponsor the undergraduate astronomy program at AAU, I am sure this could influence the government to revise its current stand regarding astronomy.**

Currently AAU (Ethiopia) is heading to become a node for the OAD (Office for Astronomy Development). We hope to win the bid because of our long time experience in teaching astronomy to the Ethiopian public using all available means. Actually the AAG at AAU has been the only group involved in teaching Basic Astronomy to the Ethiopian public on radio, TV, daily papers and magazines etc. for the last ten plus years.

Civic societies and associations

There are a couple of organizations in the country, which are trying to help the development of astronomy in the country. The first is the Ethiopian Space Science Society (ESSS). This organization is a civic society striving to come to the level of being profitable to astronomy education in Ethiopia.

The other organization is the Ethiopian Students Astronomical Association (ESAA) which is formed from university students. Currently their number is about three hundred and they are well trained individuals in Basic Astronomy after passing through a four month thorough training in astronomy under the NOPA. They are all holders of a certificate in the field given to them by AAU after careful evaluation. ESAA is supported by AAU and the number of its members will immensely grow in the coming 6 – 7 years as NOPA proceeds to the other regions in Ethiopia fulfilling its promise astronomy training in all Ethiopian preparatory schools. By the end of these years ESAA is expected to have branch offices in all 30+ universities in the country. I expect it to be a formidable force in the development of Astronomy in Ethiopia in the future.

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Finland

General information

Interest in astronomy has been high in Finland for a long time. The number of members in amateur astronomical societies is steadily increasing.

Elementary and secondary schools

Astronomy isn't specifically taught in the Finnish elementary schools, but the topic is briefly discussed in the geography and physics courses during 2nd and 5th grades in elementary school. At the secondary level, many schools give advanced physics courses that deal with astronomy. The content of these courses is not regulated and depends largely on the teachers involved. Professional astronomers occasionally give brief courses in astronomy in several schools.

As part of the International Year of Astronomy 2009 (IYA2009), a collection of interesting do-it-yourself astronomical projects for school teachers and young people was prepared by Maija Aksela, Irma Hannula and Irene Hietala. The book is in electronic form and can be downloaded freely on-line. An English version is in preparation. It will soon be available on the internet.

With the organisational support of the teachers, young people competed in 2009 for participation in observations at the Nordic Optical Telescope on La Palma, Canary Islands, as a member of an observing team of professional astronomers. The winner in each of the five countries (Denmark, Finland, Iceland, Norway, and Sweden) visited La Palma in late 2010. The project was organised and mainly financed by astronomy departments of the universities in the Nordic countries.

University education

Astronomy is taught in three universities, in Helsinki, Turku, and Oulu. Some courses are taught in half a dozen other universities. Annually a few PhD theses are accepted.

Public education

Relative to the country's population, the number of amateur astronomers in Finland is exceptionally high. With its steadily growing membership of over 16 000 members, Ursa Astronomical Association (www.ursa.fi)

is the largest astronomical association in Finland. Ursa functions to advance astronomical education and to promote interest in astronomy. Activities include courses on astronomy, as well as astronomical camps and clubs for children and adults. Nowadays Ursa is also a notable book publisher in Finland, concentrating on astronomy but publishing also books in other, related fields.

The International Year of Astronomy 2009 (IYA2009) was a tremendous outreach effort in Finland among the general public, schools, and young people through special events, and many other activities through public lectures, press and other media. IYA2009 made a great contribution to the popularisation of astronomy in Finland, an ongoing enterprise for more than a century. Its impact and experiences will be used as efficiently as possible during the years to come. The estimated number of people who attended or were reached by IYA2009 was 15 000, plus 25 000 through the internet, live radio and TV broadcasts.

The Finnish astronomical associations actively participate in The National Astronomy Week each October 4-10. In 2011, a successful two-day public event was organised in the Helsinki metropolitan area. Public lectures and special planetarium shows among other attractions drew in about 1000 visitors. The main collaborators in the event were Ursa Astronomical Association and The Finnish Science Centre Heureka.

Currently there are four planetaria in Finland. Two of them (in Helsinki and Tampere) show mainly foreign films of varying topics. The other ones (in Turku and Jyvsky) concentrate more on astronomical material. The planetarium in Turku is connected to the physics and astronomy department of the university, and it is also producing its own programs. They have made four films on astronomy, two of which are directed to children. They also produce every month a short (15 min) program telling what can be observed in the sky.

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GERMANY

Germany presents a rich and diverse landscape of astronomical activities. This offers chances for advances in many outreach activities, but also occasional problems, often in coordination. In this overview, as in the last report from 2009, I report on the structure of German astronomy, as well as formal and informal aspects of astronomy education.

Astronomy in Germany: The players and the general structure

The educational system in Germany continues to be defined by the federal structure of the country. The situation in formal astronomy education (especially on a high school level) varies greatly from state to state, but generally leaves much to be desired (see below).

Professionally, astronomy is taught at 37 research institutes and universities that submit annual reports to the German Astronomical Society (Astronomische Gesellschaft, AG) and thus consider themselves to be part of the professional astronomical community. Isolated lectures on astronomical (or planetary science) topics exist at a number of other universities. Usually, astronomy is a part of physics, and many 'Departments of Physics and Astronomy' are found at major universities. Max-Planck-Institutes and a few state observatories focus more strongly on research, but are still involved in teaching.

A major reorganization of the landscape of professional German astronomy is in the process of being concluded in 2012. The German Astronomical Society (AG), founded in 1863 and one of the oldest scientific societies, is the association of most German astronomers, mostly researchers, but including a number of teachers, amateurs and planetarians. After World War II, East German astronomers continued to be members of the AG, until they were forced to resign by East German state authorities. During the time of the division of Germany, the West German government needed an official and clearly West German contact. Thus, the 'Council of (West) German Observatories (RDS)' was founded as a loose association of the professional institutions, while the AG continued to be the organization of the individual astronomers.

This dual structure persisted for 20 years after reunification in 1990 and led to complications, since it was difficult to say who actually represented astronomy and astronomers in Germany. In 2012, finally the two parallel organizations were unified. The joint organization is still called AG, but now includes the RDS as an (executive) committee.

It can be hoped that this structural unification will also help astronomy education, since the AG has a dedicated committee on school astronomy and education ("Astronomie/Astrophysik in Unterricht und Lehre") (Astronomy/Astrophysics in school and teaching, AAUL) as well as a working group on didactics in astronomy (AKAD), which may gain more official backing within the new, joint structure. However, there are several, sometime rivaling lobby groups promoting school astronomy, not all under the roof of the AG, which is a division that should to be addressed in the future, but is difficult to resolve.

Many amateur astronomers are organized in clubs. An incomplete list, published in 2012, shows 117 astronomy clubs and public observatories all over the country, ranging from large, well equipped observations – two run 1-meter-telescopes – to small associations consisting of a few people only. The true number, including small clubs with only a few, but possibly dedicated people, is likely to be closer to 200. Most amateur organizations, besides pursuing sometimes quite sophisticated observational programs – are involved in informal outreach at some level. The umbrella organization of German amateur astronomers is the 'Association of Friends of Astronomy', with about 4000 individual and institutional members. The association has 18 sections, ranging from meteor observations, studies of planets, comets and deep sky objects, to astrophotography and spectroscopy. The association organizes the annual National Astronomy Day. German amateurs have excellent resources for teaching in terms of expertise, knowledge and instrumentation. However, one has to keep in mind that almost all amateur astronomers are working on a voluntary basis and have other obligations.

Similar to most European countries observational astronomy in Germany is plagued by light pollution. Truly dark skies are virtually impossible to find. Clearly, this affects the ways students – and the population in general – relate to the sky.

On this background, German amateurs, both amateur and professional, promote dark sky reserves in the framework of the International Dark Sky Association, trying to raise the awareness of a dark night sky as a valuable cultural heritage. This also defines a basic goal of astronomy education: Make people aware that they are missing an important aspect of nature that their grandparents still took for granted.

Formal Astronomy Education

Kindergarten and Elementary Schools

Astronomy education on the elementary level (kindergarten to grade 4, which defines "elementary school" in most German states) is not formally organized or part of any official curriculum. However, social studies in elementary should include some basic science, and some basic astronomy, too.

There are a numbers of initiatives promoting scientific literacy among kindergarten and elementary school teachers. Some of these are specifically geared toward astronomy. But these efforts are not yet comprehensive and far from all educators benefit from them.

However, most kindergarten educators have no academic education at all – until recently they were considered to be nannies more than teachers. There is an intense discussion going on in Germany on whether an educator of 3 – 5 year olds should have academic training. Even if the answer turns out to be "Yes", basic science will not necessarily be included in this training. Indeed, scientific concepts are quite alien to many educators on this level, since they never felt comfortable with these topics during their own education. Therefore, they do not feel competent to include science, or astronomy specifically, in their work, even though it has been shown conclusively that even young children are quite capable of grasping basic concepts und are intensely curious about them.

Similar "cultural" problems persist in elementary school. Still, most 4th graders do know the sequence of the planets in the Solar System, and some pick up tidbits of knowledge, usually without structure, from various sources, including documentaries of varying quality on TV and the internet.

The "Doomsday 2012" predictions are an instructive example of the effect: from personal experience and the account of a number of colleagues active in astronomy education, the reporter can attest to the fact that almost all German elementary school children have heard of rumors that the world is supposed to end on December 21st, 2012. While only few children seem to be afraid that the world will really end, they are largely unable to evaluate what they have picked up. Often, their teachers lack the knowledge to help them.

Of course, there are excellent examples of individual projects promoting astronomical knowledge on an elementary school level. For example, the international "Universe Awareness for Young Children (UNAWE)" project focuses on disadvantaged children from families where educational achievement is low. The German section of this project, which was initiated by IAU Vice President George Miley in 2006, is located in Heidelberg and received support from the European Union for a three year period from 2011 – 2013.

The "Haus der Kleinen Forscher" ("House of Little Researchers") is a large non-profit foundation promoting scientific education in kindergarten and elementary schools. While the focus is on science and technology in general, astronomy plays a part in the foundation's work.

Many universities run highly successful "children's universities", where 8 – 12-year-olds are invited to visit the campus and attend special lectures once or twice per year. In most cases, the lecture halls are filled to capacity and beyond. Astronomy is a popular subject on these occasions.

An example for a local project is "Astronomy on-site", where a professional astronomer visits elementary schools. The initiative was started by a single individual, who found that the demand was enormous. Somewhat reluctantly, he was provided with a few university students as teaching assistants. Now, the team visits more than a 100 classrooms per year.

While all these initiatives are successful and rewarding, they reach only a minority of elementary school children.

High Schools

The situation at high school level is similar: a few schools run exemplary observatories and engage actively in their own successful observations. Ideally, an astronomical working group draws in the entire school by running public observations for all students.

Work in schools can include the use of robotic telescopes in other parts of the world. An example for this is the MONET project based at Göttingen University. Supported by a private foundation, two 1.2 meter robotic telescopes were erected in Texas and South Africa. 50% of the observing time goes to high schools. The students run the telescope in real time through a simple web interface and are also in charge of data reduction, thus learning basic skills in image processing, and, more importantly, how to plan and carry out a small research project.

These efforts usually depend on one or two highly motivated teachers. Often, they are discontinued when the teachers retire or move to another school.

As at the elementary school level, the problem is that these excellent projects reach only a minority of high school students.

In most cases these landmark projects are located at "gymnasium"-type schools. In the complex German educational system, gymnasium leads to a qualification allowing entering university. It is possible to achieve the same type of graduation when attending other types of secondary schools, Gesamtschule (comprehensive school), Realschule (up to grade 10), Hauptschule (up to grade 10) and a few others in an ever-changing educational landscape that is in a continuous process of reform, confusing even the experts, with different outcomes depending on the federal state. Still, "higher" academic education is mostly associated with gymnasiums, which less than 50% of the students attend, and a well-equipped school observatory is rare (though a few examples exist) at schools of types that are generally considered to be less academically ambitious. Thus, students from families where education is not regarded as of high value are even less likely to be exposed to astronomy at school than students from more academically minded families, who might have a bigger chance to learn about astronomy in an informal context, too. The disadvantaged students are therefore likely to not be reached by any kind of astronomy education at all. This is a problem that almost certainly arises in a similar way in many countries.

In the five states that made up the German Democratic Republic ("East Germany") before unification, astronomy was a compulsory, independent subject in 10^{th} grade. While the motivation of this was ideological, trying to prove that a religious heaven is not found in the sky, the regular presence of astronomy in the

curriculum led to a large number of fairly well equipped school observatories and small planetaria. Many of those are struggling for survival after reunification, with fewer resources available.

Astronomy is still taught as an independent subject in three states (Thuringia, Saxony-Anhalt and Mecklenburg-West Pomerania). Saxony and Brandenburg abandoned astronomy as an independent subject (over the loud protests of motivated teachers) and now include it in physics or allow individual schools to teach it in the senior level classes. The same possibility exists in the South-Western states of Bavaria and Baden-Württemberg, but only a few schools realize them. The remaining nine states do not include formal astronomy in their curricula at all, even though it may enter at a very low level in physics and/or geography if the teacher is interested. School observatories, if they exist, are part of extracurricular activities in those states.

This uneven situation makes comprehensive action to improve the situation of formal astronomy education on a high school level difficult in several ways. The situation is very complex and the problems are different depending on the state and the type of school. An educator in one of the nine states without any astronomy in the curriculum might strive for the situation in Saxony, where astronomy is at least fixed as a topic within physics. At the same time, a teacher in Saxony, who just has lost astronomy as a independent obligatory subject, might find his situation very unsatisfactory.

Thus, it is understandable, but still annoying and not helpful, that the organizations and individuals trying to lobby for more astronomy in (high) schools do not speak with one voice, but seem to pursue different agendas, depending on their background.

In a 2009 resolution, the German Astronomy Society AG together with the RDS tried to formulate the goal to introduce more astronomy into curricula nationwide by whatever means are appropriate locally. This was promptly misunderstood by a very active group based in Saxony as being a statement “against” astronomy as an independent subject. It turned out to be very difficult to convey to this group that a demand for an independent subject nationwide would “damage the cause” in a number of Western states, where this goal is entirely unrealistic. This is even more so since these states are in the process of reducing the time gymnasium is attended from 13 to 12 years. This goes along with tightening the curricula, and the demand to introduce a new subject is not even taken seriously, let alone considered, by the state authorities.

Unfortunately, internal disagreements like these among the promoters of formal astronomy education bind capacities that would be better invested in working on convincing authorities that astronomy is a worthwhile topic that all students should learn about in some way.

Universities

Whatever the local or state-wide solution may be, a root cause for the general lack of astronomy education on a high school level is the corresponding lack of trained teachers. In most cases, these should be physics teachers who have received some training in astronomy during their studies.

Astronomy teachers are trained at four German universities only (namely in Halle (Saxony-Anhalt), Jena (Thuringia), Rostock (Mecklenburg-West Pomerania) and – since 2012 - Potsdam (Brandenburg)). Obviously, these universities are all located in the Eastern states where astronomy still has a much stronger standing in high school. The recent addition of Potsdam University is an excellent sign for the future of high school astronomy in Brandenburg, where the existence of an astronomy class is up to the decision of the individual school.

Introducing the training of astronomy teachers in universities in the western states proves difficult, since a vicious circle exists: There are no astronomy classes, therefore there is (supposedly) no demand for teachers, but the lack of teachers is the main reason why there can be no astronomy classes…

Still, exposing physics students, especially those aiming to become teachers, to astronomy remains a goal at the 18 universities in Germany where (some) astronomy is taught, usually in a joint “physics and astronomy” department. Due to the Bologna process, this task has become more difficult. Students have less freedom to pick the courses they like, and there exists a lot of pressure to “finish quickly”, “collect credit points” and “study efficiently”. Students tend to shy away from classes that have no immediate and obvious benefit, and this may be the case for astronomy classes aimed at future physics teachers.

On the other hand, it can be shown that departments offering astronomy attract many students for this reason. Astronomy has the potential to be a very popular topic, and is used by universities to raise interest among high school students. A number of universities also offer introductory classes for non-physics students (similar to the “Astronomy 101” classes in the USA) that are quite popular with students from other sciences and even humanities. The intention is to provide these students with at least one positive experience in astronomy (and more generally in physics) that will hopefully be remembered when these students have become (influential) professionals in a different field.

The motivation of astronomy (and physics) departments at universities to collaborate with high schools is – at least to some degree - self-interest. The number of physics students is stagnating at a level that is too low to meet the demand of the job market outside academia. This is a consequence of the low popularity of high school physics, and can be partly remedied by allowing the students to do more hands-on work and introduce them to astronomy.

Since many high schools do not seem to be up to the job, universities try to do it themselves, by running ‘project weeks’ for interested students or offering classes, sometimes on astronomy, in dedicated labs located on the campus of a major university or a national research institute like the German Center for Aerospace Research. Sometimes the projects are geared especially toward girls, since the percentage of female students in physics and astronomy is still alarmingly low and rising only slowly.

Informal Astronomy Education

There are a number of nice examples of collaborations between institutions of formal and informal astronomy education.

Two landmark projects are briefly described below:
In 2011, the “Haus der Astronomie” (“House of Astronomy”, HDA) opened in Heidelberg. The HDA was financed by the private Klaus Tschira Foundation and is operated by the Max-Planck-Society. It is a unique Centre for Astronomy Education and Outreach in Heidelberg, Germany, bringing together a number of activities (continuing education for teachers, the editorial office of a journal for popular astronomy, organization of various outreach activities) under one roof.

Another example is the Reiff Preis (Reiff Award), founded in 2009 after the death of Hans Reiff, an amateur astronomer who bequeathed part of his estate to the promotion of school astronomy and the collaboration of amateur and professional astronomers. Four outstanding school projects are awarded each year at a conference of high-level amateur astronomers taking place at Bochum University. This is an example of a collaboration of many different partners in astronomy education: amateur astronomers, schools, and professional astronomers.

Public Observatories

A visit to one of the roughly 150 public observatories in Germany can be a memorable and motivating experience for students of all ages. However, organized activities by schools are often hampered by the necessity to be at the observatory late at night, requiring the cooperation of parents and also the willingness of teachers to work at hours well outside their normal schedule. Thus, the obvious problem described above also plagues astronomy education at public observatories: Only a small minority of students is reached.

The number of students visiting a public observatory with their parents outside the context of schools may be higher than the number of students visiting with their class. Of course, social selection takes place again: It is unlikely that a visit to a local public observatory occurs to many families of low social status.

Planetaria

This problem is less pronounced in planetaria. The 21 professionally run planetaria in Germany attract 1.5 to 2 million visitors per year. It can be estimated that at least a quarter of those visitors are students visiting as a group during a field trip. Furthermore, a significant number of visitors are constituted by families with children. Visits are possible at all times, not just at night. Attending schools are not restricted at all to gymnasiums, and it can be said that students from all educational backgrounds (even including many handicapped students!) are reached.

Thus, planetaria are by far the most visited out-of-school places of learning about astronomy. In addition, small school planetaria, which exist here and there, mostly in the eastern states, are almost exclusively catering to schools. However, in many cases one field trip to a planetarium may be the only exposure a student (ever) has to astronomy. This singular event is unlikely to leave an enduring impression, especially if the field trip is not accompanied by at least some preparation in the classroom.

Similar to academic astronomy, the planetarium landscape has been restructured in 2011/2012. The "Council of German language planetaria (RDP)" has joined with the informal "Working Group of German Planetaria" to form the "Gesellschaft deutschsprachiger Planetarien" (Society of German Language Planetaria, GDP) to promote the cause of astronomy outreach and planetaria more effectively. This society is so young that no evaluation of the success of planned joined activities is possible yet. A working group on astronomy didactics in planetaria under the umbrella of the GDP is about to be formed, but has not been constituted yet.

In any case, all planetaria are dedicated to astronomy education.The means by which this can be accomplished are being discussed vigorously among planetarians. Planetaria walk a fine line between education and entertainment, and they have the unique chance to reach a wide audience by combining the two.

However, finding the "right" balance has become more challenging in the age of digital projection technology, where the night sky is not necessarily the focus of the planetarium presentation anymore. This opens the opportunity to make the dome into a showcase for a dynamical universe, thus making concepts of modern astrophysics visible and accessible. It also makes possible pure shows without any astronomical or even educational content. Adding these (popular) shows to the schedule helps planetaria survive and cross-finances presentations for students, that should be (and usually are) priced at a level that is affordable to every school and every student.

Also, show production has become complex and costly. A promising approach is the collaboration between a number of planetaria. As an example, in 2012 a production on extraterrestrial life and exoplanets was realized by a consortium of six planetaria.

The legacy of the International Year of Astronomy in Germany

The IYA 2009 largely took place at a "grassroots" level in Germany, since there was very little official support by the German government. Thus, the IYA consisted of many local activities and was quite successful at this individual level, even though there was no large, national impact changing the landscape of astronomy and boosting the popularity of astronomy and astronomy education in a lasting way.

As a legacy, a number of players in astronomy outreach got to know one another better and started collaborations that sometimes still endure. These collaborations may bring together e.g. professionals and amateurs, or planetaria and teachers. Thus, the effort many people put into the IYA was certainly not lost but persists in many small, local ways.

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Greece

Overview

Astronomy education in Greece is the result of the effort of all the institutions, organisations, and people, both in professional and in voluntary basis. This report concludes the general trends and the efforts that have been undertaken through 2009-2012.

Elementary and Secondary School

Astronomy is typically taught in elementary school (6 years obligatory learning) when students are 11 and 12 years old, through specific topics in environmental education sessions. In secondary education as well since astronomy is taught in the Greek schools as an optional lesson in the 2nd year of Lyceum, age 17 years old.

Some teachers also find ways to include some astronomy into physics classes, or find connections to the humanities – history and philosophy suggest themselves. Thus, most secondary school students are taught at least a little astronomy, but the exposure is sketchy and highly dependent on the individual teachers. In that way kids are given a refreshing new look at the latest discoveries in astronomy and space science. Chances are given for a deeper approach through various projects that are organised from the European Union at the Comenius level. It is well known that astronomy and space is the most popular and fascinating part of science for many students at high-school level. Thus, educators aim to use astronomy as a gateway to raise interest in science in general.

The whole Greek system is centred on the final exams, again leading to less freedom in the choice of topics. It remains to be seen what consequences these trends will have in the future. Thus, Greek teachers report that they feel under considerably more pressure to stick to core curricula, which do not include much astronomy.

Since 1996 the National Observatory of Athens organises a summer school for high school students which had a duration of 3 days including night observation. The aim is to foster an awareness of the fascination of physics and astronomy that the classroom with its traditional physics lessons often fails to communicate.

Undergraduate and Graduate Education

Every university offers a course in Introductory astronomy, designed for physics students (obligatory) and mathematics students (optional).

Astronomy is offered as a part of physics in Greek universities. The universities having dedicated professorships and research groups in astronomy usually have joint 'departments of physics and astronomy' offering integrated courses allowing students to focus on astronomy while obtaining a diploma (or masters degree) in physics. 18 German universities offer this opportunity, i.e. are active in astronomical research. In addition, there is the Academy of Athens focusing on basic research which also trains students, at the graduate level.

Dept of Astrophysics, Astronomy and Mechanics, National & Kapodistrian University of Athens

The staff of the Department consisted of 20 professors (2 full professors, 7 associate professors, 11 assistant professors), 3 lecturers, 4 secretaries and 1 technician. There were 3 postdocs, 15 PhD students and about 25 masters students. Faculty members were involved in teaching undergraduate and graduate courses in the University of Athens, whilst doing research in the fields of theoretical and observational astrophysics, as well as in solar and space physics. Their work has been funded by national and international research grants, and in 2005 it resulted in several tens of papers published in international refereed journals and in the proceedings of international conferences. Moreover, the laboratories outlined below belong to the Department of Astrophysics, Astronomy and Mechanics, and their infrastructure is used for educational and research purposes.

Laboratory of Astronomy The Astronomy laboratory supports education with laboratory exercises in the following courses: Astronomy I (for mathematics students), Applied Optics (for physics students), and Methods of Astronomical Observation & Data Processing (post-graduate). More than 200 students are educated annually.

Laboratory of astrophysics This laboratory serves the educational needs of the physics students (approximately 400 annually) within the compulsory course, Introduction to Astrophysics. The students are educated by conducting specially selected laboratory exercises, on the basic topics of astrophysics, and familiarize themselves with all astronomical objects, and the methods of study applied to astronomical phenomena.

Laboratory of the Gerostathopoulion University Observatory At the dawn of the new millennium the National and Kapodistrian University of Athens obtained his own window to the Universe. The new telescope is located on the top of the building of the Faculty of Physics on the Zographou campus. The new telescope is a basic tool for high-standard astronomical education, at both undergraduate and graduate level. The new telescope is also used for basic acquaintance with astronomy of pupils and lay persons, since the Faculty offers guided visits to the observatory including night-time observation, seminars and talks during special

Open Nights. For more information see http://www.uoa.gr/uoauk/uoaindex.htm

Section of Astrophysics, Astronomy, and Mechanics at the Department of Physics of the University of Thessaloniki

This Section consists of two independent and closely collaborating units: the Laboratory of Astronomy, and the Division of Mechanics. The staff of the Section consists of 3 emeritus professors, 3 professors, 7 associate professors, 4 assistant professors, 2 lecturers, 28 postdocs and graduate students, and 5 technicians. Members of the Section are involved in teaching undergraduate and graduate courses in the University of Thessaloniki, while doing research in the fields of theoretical and observational astrophysics. Their work has been funded by national and international research grants. Once a month, when the Moon is between 4 and 8 days old, the Observatory of the University of Thessaloniki, opens its gates to the public. If the sky is clear, for a series of observations of the Moon, the bright planets, and several other astronomical objects, galaxies, stellar clusters, etc. These can be marvelled through the 0.2 metre refractor of the Observatory. Four conferences were organised and more than 30 lectures were given. For more information see http://www.astro.auth.gr

University of Crete, Dept. of Physics, Section of Astrophysics & Space Physics

The staff of the Section consists of 7 faculty of the Physics Department, 3 postdoctoral researchers, 3 graduate students, and 4 technicians. Two additional tenured researchers were also affiliated with the Section. Members of the Section were involved in teaching undergraduate and graduate courses in the University of Crete, while doing research in the fields of theoretical and observational astrophysics, as well as in atmospheric and ionospheric physics. Their work has been funded by national and international research grants, and in 2005 resulted in 38 papers published in international refereed journals. Significant efforts were also devoted to the operation and improvement of the infrastructure and hardware at Skinakas Observatory and the Ionospheric Physics Laboratory. More information can be found at http://www.physics.uoc.gr/en/menu/astro.php

University of Ioannina, Dept. of Physics, The Section of Astrogeophysics, Laboratory of Astronomy

The staff of the Section consists of 4 faculty of the Physics Department, and 1 technician. Members of the Section were involved in teaching undergraduate and graduate courses in the University while doing research in the fields of theoretical and observational astrophysics. Their work has been funded by national and international research grants. Significant efforts were also devoted to public and student education, and around 500 people benefit from these activities annually. More information can be found at:
http://www.physics.uoi.gr/home/?q=node/56

Institute of Astronomy and Astrophysics of the National Observatory of Athens

The staff of the Institute consists of 9 researchers, 5 postdoctoral researchers, 4 graduate students, and 8 technicians. Members of the Section are doing research in the fields of theoretical and observational astrophysics. Their work has been funded by national and international research grants. The Institute operates a 1.2 metre Cassegrain telescope, currently the main observing instrument. It is located in the Astronomical Station Kryoneri in the Northern Peloponnese. The station is on the top of the mountain Kilini (1000 metres above the sea level), at about 110 km westward from Athens. The new telescope of the IAA, a 2.3 metre Ritchey-Chretien reflector, is under final tests by Carl Zeiss Jena. The new site that hosts the telescope, is located on the top of Chelmos mountain (2350 metre) in Northern Peloponnese, at about 150 km westward from Athens.

The Institute of Astronomy and Astrophysics effectively performs a number of educational activities. These activities are oriented to young astronomers, to physics teachers, and to students from high schools, as well as to lower level schools. There is also a visitor centre at the National Observatory of Athens, which attracts almost 1500 visitors a year. It has presentations, and night-time observation.

The Institute also organises open days for schools/general public to visit the facilities of the Institute. More information can be found at http://www.astro.noa.gr/iaa_main.htm

The Observatory as well has an on- line astronomy newsletter begun in 2000 by the personnel for educators and the general public and includes various topics.

Public Education and Planetaria

In Greece, there are two planetaria, the Athens *Planetarium*, Eugenides Foundation and the Noesis *Thessaloniki Planetarium*, Science Center & Technology Museum.
http://www.eugenfound.edu.gr
http://www.noesis.edu.gr/

They have lot of astronomy exhibits and programs for students of all ages, and the public. More than 800 000 people visit Greek planetariums each year.

Amateur Astronomy

In Greece there are more than 25 amateur independent clubs across the country. Among other things, they organize over 10 major star parties, which attracts up to 1000 participants. Most of them have published relevant *Journals* for many years, and has sought a balance between the needs of its largely non-professional readers, and its aim to provide a forum for Greek astronomy at large. These clubs also organise summer schools for the students and the public and a lot of activities all over the year aiming to educate in astronomy, giving a great service.

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JAPAN

Through the International Year of Astronomy 2009, the IYA 2009 Japan Committee held its own international projects supported by the IAU, such as the 'You are Galileo! 'project, 'Stars of Asia' project, etc. And the IYA 2009 Japan Committee also did a lot of domestic projects.

Beyond the IYA, the Astronomical Council of Japan was established on September 9, 2010. Members of this council are the Astronomical Society of Japan, NAOJ, JAXA, the Japanese Society for Education and Popularization of Astronomy, the Japan Planetarium Association (JPA), the Japan Public Astronomical Observatory Society (JAPOS), the Coordinating Committee for Amateur astronomers, and the Association of starry sky in Japan.

IYA 2009 Japan Committee http://www.astronomy2009.jp/ (Japanese only)
You are Galileo! http://kimigali.jp/index-e.html
Stars of Asia http://www-irc.mtk.nao.ac.jp/~webadm/StarsofAsia_E/
Astronomical Council of Japan http://www.astronomy2009.jp/ja/beyond/index.html (Japanese only)

School Education

The new National Curriculum Guideline in Japan will start in the 2012 school season. Between 2009-2011 school seasons, the Japanese school curriculum was in force during a transition period. Under the new national curriculum, the study of Astronomy will be increasing slightly. For example, the waxing and waning of the Moon has come back in elementary schools (in 6th grade).

Planetariums

The Nagoya City Science Museum has established in March 2011 the world's biggest planetarium with a diameter of 35 meters dome screen.
http://www.ncsm.city.nagoya.jp/en/index.html
The planetarium industry in Japan is being revitalized. Tokyo Sky Tree, which is a new Landmark Tower in Tokyo, also has a big planetarium theatre. The International Festival of Scientific Visualization has started from 2010.
http://image.sci-fest.net/2011/en/index.html

Science Communication

The Ministry of Education, Culture, Sports, Science and Technology in Japan have edited every year the White Paper on Science and Technology. You can read the white Paper 2009 and 2010 on the MEXT web site,
http://www.mext.go.jp/english/whitepaper/index.htm .
In the White Paper on Science and Technology 2011, you can know the policy of Japanese Science and Technology after 3.11 2011.

In order to overcome the earthquake in East Japan, the Japanese government promotes Science Communication with the public. The Japanese astronomical community must lead the Science Communication in domestic and international arenas with the IAU 'Astronomy for the Developing World Strategic Plan 2010-2020'.

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