# COMMISSION 46
# THE TEACHING OF ASTRONOMY

# Newsletter 50 – March 1999

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**The mandate of Commission 46 is "to further the development and improvement of astronomy education at all levels, throughout the world".**

**Contributions to this newsletter are gratefully received at any time.**

**PLEASE WOULD NATIONAL REPRESENTATIVES DISTRIBUTE THIS NEWSLETTER IN THEIR COUNTRIES**

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**This newsletter is also available at the following website**
**http://physics.open.ac.uk/IAU46**

# EDITORIAL

By the time the next issue of this Newsletter is circulated, the 11 August 1999 total solar eclipse will be behind us. The path of totality crosses Europe and much of Asia. Whereas clear skies are expected from Romania east, there is only about a 50:50 chance in north west Europe, so do wish for clear skies for those of us who are risking these cloudier parts. The media build up in the UK and the rest of Europe is under way, and consequently it will be a particularly sharp disappointment if the weather prevents this most magnificent of spectacles from being seen in its full glory. I am involved in the UK in a nationwide set of activities, suitable for primary school children through to adults. I will include a report on the outcome in a future issue, and I would be glad to receive any other reports of educational activities linked to the eclipse. The main UK website for the eclipse is
http://www.eclipse.org.uk/

This issue contains the triennial reports that I have so far received from National Representatives. These make most interesting reading. It is clear that, though astronomy education is expanding and improving in some countries, in others, in spite of the best efforts of several individuals, it still plays a minor role in education, and it is alarming to hear that in one instance misconceptions are being propagated. There is certainly a need for the members of Commission 46 to continue with their good work.

In the previous issue of this newsletter I asked for opinions on whether this newsletter should be merged with the annual newsletter of the Working Group for the Worldwide Development of Astronomy. There was no groundswell of opinion in favour of this proposal, and therefore, at least for the time being, the two newsletters will remain separate.

In this issue there are several photographs. They can be seen in colour on the Newsletter website (see front page). Unfortunately the black and white reproduction in the distributed hard copy version does them little justice. Alas! the cost of colour copying is prohibitive. However, with the rapid spread of web access, the proportion of people deprived of colour is swiftly declining.

Happy reading!

Barrie W Jones

# MESSAGE FROM THE PRESIDENT

This has been a period of my life when I have pondered more than ever the problems relating to the teaching of astronomy. I have come to realize that we cannot generalize ways of teaching, because each culture perceives reality in a different way, and each student has his particular pace and approach to learning. I believe a wise education plan includes diversity, not only in the way teachers lecture but by providing students with a large variety of learning materials.

I have also realized that in the developed nations there are so many wonderful teaching materials that it is hard to choose which to use, whereas the developing nations have almost none. I think our Commission must find ways of conveying useful and meaningful teaching materials from the wealthiest nations to the more needy ones. Hopefully the spreading of the www will help us with this project. I wonder if we should try to help teachers from the developing world master English, or if we should concentrate in developing materials in their languages, which of course would benefit from being more meaningful; I suppose if we had more resources we should do both. Darrel Hoff has done a good job by mailing books to libraries and teachers in several needy places.

It is my strong feeling that we must concentrate on teaching science to girls especially in places where they are discriminated against. Discrimination begins at home by preferring one gender over another; if we learn to accept and use our differences starting with the family, we will accept other cultures more easily. I also feel women usually teach language to children, including scientific language. If we want our young students to be able to ask good questions they must be able to use their language fluently in order to be able to phrase their questions properly. We must remember that science progresses with unanswered questions. (In Mexico in the national admission examinations, the correlation was found between grade and social factors that the higher the mother's education the higher the grade. Grades were bad if parents made less than three times the minimum wage, but geographic locality, or father's job, did not make any difference.) Even if girls are not allowed to have

jobs as adults, due to the culture, it is important that they attend school and are not discriminated against during their science courses. Girls who love science will teach their children to appreciate the pleasure of understanding astronomy.

Of course I feel we should have more women involved in astronomical research especially since we are different from men and I am sure the approach we give to our field of research is a source of enrichment.

A total solar eclipse will occur this year. I expect it will be widely promoted, particularly because of the misconception that 1999 is the last year of the millennium and special things will happen. It is a unique opportunity to enhance public understanding and appreciation of astronomy. As you know, Jay Pasachoff has conducted a working group on eclipses, and has written many books and computer programs where we can find very good ideas. These include ideas for encouraging the general public to observe the eclipse safely, for understanding basic astronomy, and for taking advantage of the millennium frenzy to explore the history of time keeping.

I would like to thank our editor Barrie Jones. I am currently involved in planning a new university television station that will be dedicated to teaching, and I have tried to follow Dr Jones's example by bringing together a small group of happy, hard working people so that learning can become a pleasant experience. I am definitely convinced that astronomy education should be combined with the pleasure of understanding and I have tried to follow the example set by Dr Jones and his team.

I wish to acknowledge all the fine work that is being done on an everyday basis by the group of members of Commission 46 in order to make astronomy understood and appreciated worldwide.

Julieta Fierro

## THE 11 AUGUST 1999 TOTAL SOLAR ECLIPSE

A total solar eclipse is a wonderful vehicle for public education, since it grabs the attention of the local newspapers and the general public, if only for a couple of days. The total solar eclipse of 11 August 1999 will cross over Europe, so will be widely seen.

At last, we will really have the last total solar eclipse of the millennium (since there are no total eclipses in the year 2000), even though several of the last eclipses have been so billed. However, contrary to statements I have recently seen, it will not necessarily be the most widely observed total solar eclipse, given the passage of totality over Calcutta in 1995 and over Mexico City in 1991.


The 1998 total solar eclipse from Aruba, a compound image showing a wide range of coronal intensity surrounding the dark disc of the Moon.


The eclipse will start over the Atlantic off the coast of the north eastern United States and Canada, which will have a partial eclipse at sunrise. Totality will hit land near Lands End, England, and Cornwall is bracing for massive overcrowding. The path of totality will cross northern France, making a nice day-trip from Paris to Reims, and will include Stuttgart and Munich in Germany, Salzburg in Austria, Lake Balaton in Hungary, and Bucharest in Romania, which is very near the peak astronomical circumstances for the eclipse. Weather forecasts improve as you go to the east. Weather forecasts are better yet in Central Turkey, where the path will pass through Sivas. Few westerners will go to the eclipse path in Syria, Iraq, or Iran, where weather forecasts are at their best. The weather forecasts deteriorate for Pakistan and India, where it is the monsoon.

I am in charge of coordination for the IAU Working Group on Eclipses, and have set up a web page at
http://www.williams.edu/astronomy/IAU_eclipses

The page includes notes on eye safety from Fred Espenak, Ralph Chou (a professor of optometry who serves with Julieta Fierro and me on Commission 46's subcommittee on education at eclipses), and a Boston eye worker, Dick Land. The page also includes links to various professional groups who plan observing. One such link is to The Joint Organisation for Solar Observations (JOSO), a consortium of European solar astronomers, which is inviting participants. Another link is to the eclipse stamp already issued by the Romanian Government. The web page also links to Fred Espenak's maps of the eclipse path.

Our subcommittee provides information about the eclipse and how to observe it safely on request.

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(For the subcommittee on public education at eclipses of Commission 46)

## COURSES FOR THE DEVELOPMENT OF QUALITY ASTRONOMY TEACHING

The European Association for Astronomy Education (EAAE) is an association which joins European teachers and lecturers interested in astronomy. The EAAE was born under the auspices of ESO in 1994 in Garching (Germany), but started to run during the Founding General Assembly in Athens (November 1995).

One of the aims of the EAAE is to increase the education of European teachers in astronomy, because this produces a better level in astronomy for European students. Each year Workshop Group 3 of the EAAE (EAAE-WG3), the working group for training teachers, organizes an International Summer School for European teachers. For a week the teachers participating can exchange experiences, increase their knowledge, and discuss different ideas and aspects in a friendly atmosphere.

The first summer school was in 1997, in La Seu d'Urgell in Spain, a small town in the Pyrénées, near the border with France, in a good observational zone. The second summer school was held in 1998, in Fregene, Italy. This town, in the Mediterranean area, is near Rome, and this situation was used to offer the participants an interesting astronomical visit of Rome. In both cases there was a group of around 40 participants and 12 instructors from several European countries (Austria, Belgium, Finland, France, Georgia, Germany, Greece, Italy, Latvia, Portugal and Spain).

In general, the participants are European teachers from secondary schools, and to a lesser extent there are some teachers from primary schools and planetarium employees. The instructors are professional astronomers, professors, and teachers from different countries. The papers presented offer very practical activities, paying special attention to didactic aspects, delivered in general lectures to all 40 participants, and also to working groups and workshops of 20 participants. Additionally, there are day and night observations based on topics that it is possible to introduce in the classroom.

The summer school is conducted in three different languages to facilitate the participation of teachers. The languages are English, the language of the host country, and one other, which can be used by the majority of the participants. A printed document with the contents of all the papers in two languages (English and one of the other official languages) is given to participants and instructors so that they can follow the meeting more easily. This document enhances the understanding between all the participants.

The topics presented at the first two summer schools appear in Tables I and II.

Table I: **1st EAAE International Summer School**
La Seu d'Urgell, Spain, 7–12 July 1997

- **General Lectures**
  1. The distances from stars – how do we know them?
  2. Astrophysical parameters from light analysis
  3. Fixing the position of a star
  4. Some aspects of the history of astronomy
- **Working groups**
  1. Brilliant stars on the screen by overhead projector
  2. Observing the daily path of the Sun
  3. Measuring the eccentricity of the terrestrial orbit
  4. Observing a rapid variable star
  5. Determination of Jupiter's mass
  6. Roemer and the velocity of light
  7. Determination of Kepler's laws by experimentation
  8. Determination of the Moon's orbit
  9. The orbital speed of the Earth
  10. The chemical composition of the Sun and stars
- Workshops
  1. Heliocentric planetarium
  2. Skymap and learning constellations
  3. Light and shadow
  4. Photographs of constellations

Table II: **2nd EAAE International Summer School**
Fregene, Italy, 20–25 July 1998

- **General Lecturers**
  1. The research in teaching astronomy and the learner's conceptions
  2. Searching for extrasolar worlds
- **Working Groups**
  1. About the measure of time
  2. An estimate of the number of stars visible by photography
  3. Heliocentric planetarium
  4. Moon, phases, eclipses
  5. Pupils' initial conceptions
  6. Ranking stars' brightness in a constellation
  7. Sunspots and rotation of the Sun
  8. The temperature of the Sun
- **Workshops**
  1. Building a rudimentary astrolabe
  2. Inexpensive astronomical tools
  3. Orientation inside and outside the celestial sphere
  4. The problem of teaching the origin of the seasons
  5. The revolving ecliptic
- **Astronomical Visits of Rome**
  1. Collegio Romano
  2. The monumental sundial of S Maria degli Angeli
  3. The Pantheon

The EAAE-WG3 is organising its third summer school - the "3rd EAAE International Summer School" - in Briey, France. This summer school will be held 9–14 August 1999 during the week around the Sun's eclipse of 11 August. Briey is a small village near the centre line of the eclipse. The participants can observe the eclipse and can take part in different activities to it. For the first two days there will be planning for the eclipse, and the results will be studied on the subsequent days.

WG3 is preparing yet more summer schools. We can announce that the "4th EAAE International Summer School" will be held in Portugal, on the Algarve, in July 2000, and the "5th EAAE International Summer School" will take place in Germany, near Bonn, in July 2001.

Of course all European teachers, members or not of EAAE can be participants at the summer schools. Teachers interested should contact Rosa M Ros, Chairperson of EAAE Summer Schools (fax 34 938967700, email ros@mat.upc.es). Proceedings of the 1st and 2nd EAAE International Summer Schools can be obtained via this fax number and email address.

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## HEALTHY GRADUATE IGNORANCE

Julieta Fierro struck a chord with her account (in NL49) of the ASP Workshop on the Teaching of Astronomy. Teaching methods are important, but as she observes, "people learn in different ways". Two things in my personal life have influenced me greatly: first, my wife, who teaches the innumerate numeracy very successfully, always insisting that "the usual teaching methods have failed with my students and I have to find a point of common contact with each individual student"; second, my son not learning his tables, that is until he realised that if he knew his tables he could calculate faster than his friends, thus learning, at a tender age, the immortal academic lesson of Lucky Jim – "he who is not one up, is one down".

What have the innumerate and learning tables to do with University Teaching? University Teaching is about the development of individual potential. That may sound elitist but I am not about to apologise – for me University Education

is about the development of individuals. University Education is a delicate balance. When I was an undergraduate, our Head of Department believed in sending out graduates into the world with a healthy level of ignorance – to maintain a high level sprit of enquiry! Today that would seem an anathema. Indeed, I can just see the reaction from our Teaching Quality Assurance Inspectors if one put down that a strength of one's degree work was to ensure a healthy level of graduate ignorance! But perhaps my old Professor of Physics had a point. He did sharpen our eagerness to enquire. He gave us enough to make us very curious and sent us off to the library sufficiently well informed to seek out and look at original sources. Yes we had the great good fortune to have odd hours each day to spend in the library – my undergraduate timetable was not filled up with desirable and dutiful things to do. I enjoyed my degree studies because I was not overburdened with taught courses; I had long periods in the laboratory (it sometimes seemed a mixed blessing!), and I had time to look at things for myself. There was a lot I was not taught it is true, but with one or two exceptions, I was well able to pick up what I needed during my career, and incentive is a hard driver.

Over the years I have noticed – yes I admit it – that I have succumbed to the modern tendency to fill up the undergraduate timetable. There are all these nice things they should know – computational methods, keyboard operations, ability to communicate and write coherent reports, problem solving, besides all the myriad detail of a modern degree course. Is it any wonder students see university education as a set of courses to be learnt or, in modern times, mastered? While we try to present courses in different ways, at university it is the "lecture" that is king. The despised lecture has many advantages: one of the greatest is that it assembles a respectable fraction of those registered for the course, gets them all in one place and they can have the content explained to them – arguments can be outlined in whatever degree of detail is appropriate and difficult points stressed and given special attention. It is a surprisingly efficient medium, given the patent inadequacies of both teacher and taught. One has to recognise that the performance of the teacher may not match the exalted nature of the topic, but then at any instant what teacher dares to claim that they had the undivided attention of >50% of the class? But it works now, just as a century ago. It is efficient in that something is conveyed quickly by (usually) one teacher with a large multiplication factor. This "efficiency" is not matched in any other teaching process. But if we are frank, we have all sat through some awful, boring, lecture courses – dare we admit it, we have (close the door and whisper) given some awful, boring, lectures. But, as with the medical profession, so teachers rely heavily on the fantastic powers of recovery of the human body and spirit. We do see students of calibre and vigour emerge from the process.

I am not defending the "lecture". We do need other teaching methods but we need to be able to devote adequate time for these methods to work. Therein lies the rub. We have to trust our students to use that time advantageously. If a student is sitting in a lecture room in front of us, that student may be asleep or doing The Times crossword – at least they are not in the Student Union Bar – we may hope for information transfer by ambience. But are we necessarily doing the students a favour by requiring them to attend a *very full quota* of lectures? If we do so require, we are thereby depriving the students of time to (a) think and (b) enquire for themselves. If we regard thinking and enquiring as the key hallmarks of a university education and we should not sell our students short in the only 3 or 4 years in their lives when they can enjoy this signal privilege to the full.

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## SWINBURNE ASTRONOMY ONLINE

At Swinburne University of Technology we are currently developing "Swinburne Astronomy Online", an online Graduate Certificate in Astronomy. Starting in 1999, the course will contain both general-interest and more specialist units. The course content will be rich in multimedia animations and simulations and incorporate newsgroup communications and discussion of up-to-date astronomy and space news.

Readers of your newsletter may be interested in finding out more about our course by visiting our web site, http://www.swin.edu.au/astronomy, and following the link to Swinburne Astronomy Online.

We are currently taking enrolments for Semester 1, March 1999. In order to help us design our units to best suit their potential audience, visitors can provide feedback via an online questionnaire at the above website.

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mmazzolini@swin.edu.au.

## CARTER LECTURE TOUR IN NEW ZEALAND

In December 1998, I toured eight New Zealand cities as the 1998 Carter Visiting Lecturer, organised by Wayne Orchiston, New Zealand delegate to Commission 46 and Executive Director of the Carter Observatory. Carter Observatory, founded 100 years ago, is located in a prominent height overlooking Wellington, the capital, and is the national observatory. It has both research and teaching functions. (Wayne is also on the Organising Committee of Commission 41: The History of Astronomy.)

Carter Observatory, with Wayne Orchiston and Brian Carter. In the foreground is a device used for astronomical sightings, to teach children.

My lecture included five cities on the North Island: Auckland, Napier, Palmerston North, Wellington, and Hamilton, and three cities on the South Island: Nelson, Christchurch, and, at the southern tip, Invercargill. I gave lectures on "The Triumph of the Hubble Space Telescope" at all these sites, and colloquia on "The Sun and Solar Eclipses" at Victoria University in Wellington and at Waikato University in Hamilton.

The Carter Memorial Lectureship was started four years ago, with Sir Ian Axford, Heather Couper, Sir Arnold Wolfendale, and Patrick Moore as previous holders. Though I seem to be the odd numbered lecturer, with previous odd-numbered lecturers both having knighthoods, I was not conferred with one on my arrival (nor, being an American citizen, could I have accepted it). Sir Ian Axford is Director of the Max-Planck Institute for Aeronomie in Germany and a former Chairman of the Government's Marsden (research) Fund in New Zealand and of the Foundation for Research, Science, & Technology of New Zealand. Sir Arnold Wolfendale is a former Astronomer Royal.

My wife and I landed in Auckland on 6 December, after the flight over the Pacific. We were amused to find only one hour of time difference from Hawaii, though the date was one day later; New Zealand has the time zone of the International Date Line, and will be the first substantial body of land to greet the new millennium.

We were met by Jim McPhillips, the chief executive of the new planetarium in Auckland. They have expanded their earlier educational observatory by the addition of the new Zeiss projector and star dome. We saw busloads of schoolchildren visit at various times during our stay, and the facility is already in heavy use, though its location at One Tree Domain out of the centre of the city, limits is accessibility by tourists.


Aukland Planetarium, with Jim McPhillips and Naomi Pasachoff.

The Observatory, as part of publicity for my trip, had arranged a morning interview for me on the country-wide breakfast television programme on their Channel One, as well as a radio interview

on a popular FM station. So I got to spread the gospel of astronomy beyond those who attended my lectures, a benefit of the arrival of a foreign visitor. My lecture was held at the Education College, and about 350 people attended. My hour long lectures were always followed by about a half hour of interesting questioning.

We next flew to Napier, a city on the broad Hawkes Bay, famous for the uniform Art Deco buildings built after an earthquake of magnitude 7.9 destroyed the whole city in 1931. A Zeiss planetarium, purchased 30 years ago and long installed in a waterfront pavilion until its closure a half dozen years ago, had recently been reinstalled in a new facility built by the Hawkes Bay Planetarium Trust. The facility is on the grounds of a local school. My evening lecture was held in the local museum, near the centre of town, and about 200 attended. We lodged with Jack Dunlop, a long-time mainstay of the local astronomy club. Arrangements were by Stuart Roper of the Planetarium Trust.

Hawkes Bay Planetarium, with Jay and Naomi Pasachoff, Jack and Marie Dunlop

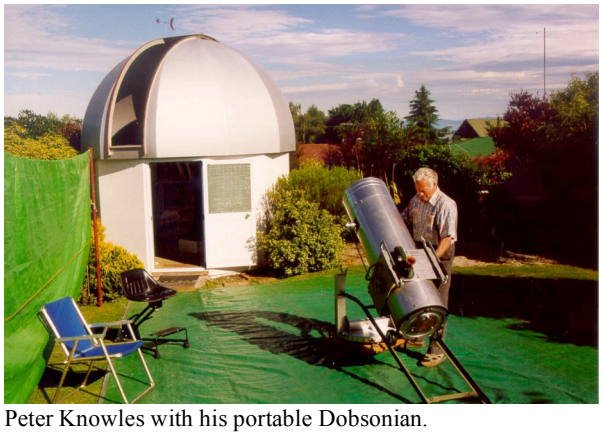
We then book a bus for about 3 hours to Palmerston North (to distinguish it from Palmerston on the South Island), where we were received by Noel Munford, an active member of the Palmerston North Astronomical Society and a professional photographer. My evening lecture was held jointly with the local science centre, which swelled the attendance to 350; it was located at the College of Education that had recently been merged with Massey University. Afterwards, we visited the Society's observatory, just far enough out of the centre of town to have reasonable skies.

The next day, we were driven about 3 hours to Wellington, the capital and the headquarters of Carter Observatory. Brian Carter (no relation), Senior Astronomer, had worked with Wayne Orchiston on the logistic details. The views of Wellington and its beautiful harbour were spectacular as we approached town, since the city is built into a hillside overlooking a broad bay and facing dark mountains. The Observatory is on top of a city park, and is adjacent to the top end of a funicular (cable car) from downtown. My evening lecture the next night to an audience of 350 was held at Victoria University nearby, one of two universities in New Zealand with substantial academic astronomy programmes, of which more later. Wellington boasts the recent new major national museum, Te Papa (which means "Our Place"), which contains exhibits of geology, art, and Maori culture, and which also had entries from the winners of a recent national schools science fair, who I addressed when they visited Carter Observatory.

In the course of our two visits to Wellington, we spent time with all the members of the staff, including Frank Andrews, Senior Education Officer (and a fellow member of Commission 46), and Glen Mackie, a senior research astronomer whom I had met while we were both at the Harvard-Smithsonian Center for Astrophysics in 1993-94 and had offices opposite each other. Glen works on a variety of theoretical and observational problems, including Hubble observations of clusters of galaxies. He is the New Zealand liaison to the South African Large Telescope Project, which the New Zealand astronomers hope to get the funds to join. Other members of the Carter Observatory staff I met included Richard Dodd (former Director and Principal Astronomer), Richard Hall (Senior Public Programs Officer), Tony Fisher (Education Officer), Mike Reid (Research Scholar), John Field (Public Programmes Officer) and Sacha Hall and Katrina Leather (Administration Officers). We received a demonstration of one of their fine planetarium shows, about the search for life in the Universe. We also saw a video they made about the Maori and astronomy. Other Carter Observatory 'educational outputs' that they generate or offer include various publications; a monthly Newsletter; a newspaper column and radio programme; "Overnight Extravaganzas" for schoolchildren; special children's holiday programmes; and evening astronomy courses.

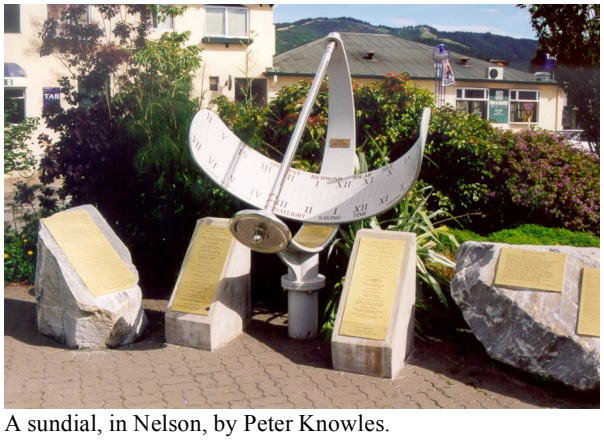
Naomi and I flew on Air New Zealand Link in a sleek 18-passenger Saab propjet over the straits separating the North and South Islands, the two major islands of New Zealand, to Nelson. We were met by a delegation of amateur astronomers, including Albert Jones, the long-time variable star observer who was one of the three independent co-discoverers of Supernova 1987A almost a dozen years ago (afjones@voyager.co.nz). Albert was honoured by both the AAVSO and the BAA last year for his 500000 variable-star observations.

We were shepherded by Guyon Warren and lodged with Peter Knowles, who has an observatory in his back yard, and who has recently added a 12-inch Dobsonian to his suite of instruments. I was particularly intrigued by the set of rails he has built to allow him to wheel the tube of the Dobsonian out of his observatory and over to the base, and then to mount it on the base, without the need of the help of his wife Joan or of any other person.



Peter Knowles with his portable Dobsonian.

My talk was held in the historic village of old buildings, and over 75 people showed up, somewhat in excess of the number of chairs available. Earlier that day, we had been treated to a lunch in a restaurant overlooking the fertile countryside by a committee of astronomy club members. Peter Knowles's mechanical knowledge, so useful for his telescopes, was honed on farm machinery, and I enjoyed the encounter with a boysenberry farm on which he had been advising, and the tasting that was necessary.



A sundial, in Nelson, by Peter Knowles.

We continued, starting our second week in New Zealand, to Christchurch, the largest city on the South Island. An interactive science centre, Science Alive!, took over the old railway station a few years ago, and is making a go of it, though the city subsidy of their NZ$1 000 000 (US$500 000) yearly budget is only about 10%. Christchurch is a university city, with Canterbury University the major site of academic astronomy in New Zealand. Peter Cottrell is not only an astronomer but also Head of the Department of Physics and Astronomy, and I took tea with his group of a dozen postdocs and graduate students. Studies of Asymptotic Giant Branch stars and of stellar chromospheres are major activities. Will Tobin is also at the university. David Lambert from the University of Texas had been visiting for several months.

One of the projects they do at Canterbury, with their Mt John Observatory farther south on the island, is a MACHO search. The MACHO search is part of the MOA Project, a collaboration among all NZ astronomical institutions and seven different Japanese institutions. Associate Professor Phil Yock of Auckland University, with whom we had had dinner earlier in the trip, is the co-ordinator of the NZ 'arm' of the Project; most of the analysis done in New Zealand is done at Wellington by Richard Donn, Brian Carter, Mike Reid, and Denis Sullivan (Associate Professor at Victoria University). As well as Yock, the team includes Post-doctoral Fellow Ian Bond at Auckland, and John Hearnshaw and Pam Kilmartin (at Mt John itself) from the University of Canterbury. Pam has shared the observing with Ian Bond, Brian Carter, and a number of Japanese collaborators. They hope soon to be able to set useful limits on planets around the lensing stars. Soon after I returned to the United States, I saw reports on this work at the January 1999 meeting of the American Astronomical Society.

My lecture, at the Science Alive! facility following a pot-luck supper, attracted over 200 people of all ages and backgrounds. We lodged at the home of Philip and Pamela Butler; Philip is the former Head of the Department of Physics and Astronomy, and is now a Vice Chancellor. I was gratified that Peter Cottrell, David Lambert, and others from University attended the talk. John Hearnshaw and William Tobin are astronomy faculty members there, and Jack Baggaley of the Physics side of the department studies radio reflections of meteors and participates in the teaching of undergraduate astronomy course. Joy Adams of the Science Alive! Friends Association ushered us around; Brian Taylor, Director, had been called away to Kuala Lumpur to arrange a future exhibit.

We proceeded to Invercargill, at the southern tip of the South Island, in an Air New Zealand ATR72 66-seat propjet. We were surprised when the check-in person of Air New Zealand inquired, at Christchurch Airport, why we were going to

Invercargill since Americans hardly ever went there. In the event, we found it to be a very interesting stop. We were hosted very nicely by Bob Evans, a high-school teacher with a physics degree from the University of Canterbury.

My evening lecture, at the Southland Museum, was planned for a room of 60 but when we arrived after dinner we found people carrying chairs and benches to a nearby gallery, where over 160 of all ages attended. I was introduced by Lloyd Esler, the President of the Southland Astronomical Society. The next day's tour included Bluff, where a high viewpoint looks south over Stewart Island and the ocean south of the South Island, and where a visit to the periphery finds a kilometre post with distances given to a wide variety of locations, including the South Pole.

Jay and Naomi Pasachoff at Bluff.

Our next-day stop at the museum brought us to see the tuataras, a lizard-family animal with a lineage dating back 225 million years. The curator, Lindsay Hazley, has succeeded, over the last decade, in raising his success rate in mating tuataras from 10% to over 90%, largely by increasing the ultraviolet flux in the first weeks; the ultraviolet had been filtered out by overhead glass and plastic. He is concluding that ultraviolet may play an important role in the pineal gland, prominent in young tuataras, and that human babies may well require more ultraviolet early on to prevent Sudden Infant Death Syndrome (SIDS; crib/cot death) and other health problems.

Back in Wellington, I gave a colloquium about the Sun and my solar research to about 30 people at Victoria University. Denis Sullivan is the main astronomer there, and I also met Ed Budding from the nearby Central Institute of Technology, who is also a member of Commission 46.

The final lecture stop was at Hamilton, where Carol Thompson of the Hamilton Astronomical Society was our host. I gave a colloquium on the Sun for about 25 physicists, astronomers, and mathematicians at Waikato University in the afternoon, hosted by Professor Howell Round of the Physics Department, and a lecture on Hubble to about 25 people in the evening. Among those we met were Ernie Kolnins of the Maths Department, who does theoretical work on black holes, and Jeff Wynne-Jones, the President of the Hamilton Astronomical Society. The University and the Astronomical Society are jointly completing a 24-inch optical telescope. Robin Holdsworth of Information Technology at Waikato Polytechnic is building a 10-m fully steerable radio telescope to work at the 21-cm wavelength. Alfred Sneyd is also at the University.

The next day, my wife and I drove about 2 hours to Rotorua, where there are remarkable thermal areas with geysers, boiling mud pots, hot sulfur springs, and so on. It is a mini-Yellowstone, and a remarkable place to see, hear (since one can hear noises of matter moving underground), and smell.

A final drive via Hamilton to Auckland, and an overnight stay, brought us to our Air New Zealand 767 and back to the United States. I found the New Zealand audiences, with their good size and excellent questions, to be eager for more news about astronomy. I can see the importance of IAU Commission 46 and of travelling lecturers (I wound up speaking to over 1700 people) in spreading word about astronomy and current research.

The Carter Memorial Lecturer for 1999 will be Brian Warner of South Africa.

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# NEWS OF MEETINGS

## ASTRONOMY IN EDUCATION WORKSHOP, CAPE TOWN 12 September 1998

The aim of this workshop (held in the South Africa Museum & Planetarium) was to show teachers and others how to use astronomy as a vehicle to stimulate an interest in science, rather than just the teaching of astronomy, something for which South Africa is not ready yet. Astronomy has been re-introduced into the SA schools curriculum, but it will be some time before there are enough resources and teachers with some astronomical knowledge to bring this to reality. This workshop was seen as a bridge to the future.

The Workshop was held immediately following Symposium 192 enabling those astronomers attending, and who had an interest in education, to contribute to the workshop. It lasted for the whole day and the programme included full presentations by

1. David Malin "The Colour of the Universe"
2. Julieta Fierro "Astronomy in Education"
3. Case Rijsdijk "Astronomy and Curriculum 2005"

And several short presentations:

1. Thebe Medupe "Marking time in pre-Colonial Africa"
2. Barbara Cunow "Teaching Astronomy at UNISA"
3. Robin Catchpole "The Birth of a Star"

One of the highlights of the workshop was a short playlet presented by V Maka and T Nafemela on some aspects of African starlore and performed by some pupils from a local school. This demonstrated the integrated approach of Curriculum 2005.

These presentations were interspersed with hands-on workshops on the following topics using resources, materials, and demonstrations developed by the Science Education Initiative of the South African Astronomical Observatory and the Hartebeesthoek Radio Astronomy Observatory outreach programme.

1. Making a simple telescope out of cardboard tubes
2. Modelling the Solar System
3. Sun, Moon and Earth interaction
4. Making a simple spectroscope
5. Earth and beyond
6. Making planispheres
7. Seasons

The workshop ended with a show at the Planetarium followed by a short social gathering.

The workshop formed part of the "Friends with the Universe" project: a SA government initiative to promote astronomy and space science in SA during the Year of Science and Technology. It was attended by about 75 senior teachers from all over South Africa as well as some members of the local astronomical community. Feedback received after the workshop was extremely positive and it seems that there is a need to organise one major workshop such as this on an annual basis.

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## OMP/OHP SUMMER SCHOOL IN ASTROPHYSICS, FRANCE, September 1998

This week long summer school, which I organised, was the first Observatoire Midi-Pyrénées (OMP)/Observatoire de Haute-Provence (OHP) summer school. It was aimed at early graduate level students in the physical sciences from countries around the Mediterranean that do not yet offer astrophysics courses in their universities. Thirteen students came from Jordan, Lebanon, Libya, Mauritania, Palestine, Syria, and Tunisia.

The programme was devoted to basic astrophysics, and to stellar variability, because these countries are among those interested in the project "Network of Oriental Robotic Telescopes", of which I am the Principal Investigator. The 1.5 m, 1.2 m, and 0.8 m diameter telescopes were reserved for the summer school students for four nights. The 1.5 m telescope was equipped with a high-resolution spectrograph, and the others with CCD photometers. The observations were reduced with traditional packages. Some students will publish their results in the newsletter African Skies/Cieux Africains, which I edit, and which is published by

the Working Group on Space Sciences in Africa (ISSN 1027-8389, http://www.saao.ac.za/~wgssa

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## CRISES & OPPORTUNITIES IN UNDERGRADUATE ASTRONOMY, RAS, LONDON 8 January 1999

This discussion meeting of the Royal Astronomical Society was organised by me and by Derek McNally. The crises include the declining numbers of students in the UK pursuing degrees in the physical sciences, and the likelihood that, should student numbers increase, the numbers of university teachers and teaching resources are unlikely to increase to match. One opportunity is the chance to increase student numbers by offering a wider range of physical science courses, less specialised, and incorporating attractive elements such as astronomy and allied subjects. Another opportunity is to adopt teaching methods that can handle larger student numbers with no diminution in the quality of the learning experience, such as self-study methods based on interactive texts and electronic media.

Electronic media are very resource-intensive to develop, and therefore use of existing materials, and the collaborative production of materials, is a 'must'. A good deal of material already exists on the world-wide-web, but it is of variable quality, and some of it is junk, even if prettily presented.

One important and interesting notion that emerged is that there might well be a narrow age range over which school students see astronomy as a strong attractor to physical science degrees.

Fuller reports of this meeting will appear in forthcoming issues of "The Observatory", and "Astronomy & Geophysics".

Barrie W Jones

## THE 5th CENTRAL AMERICAN COURSE IN ASTRONOMY (V_CURCAA), NICARAGUA, 21-25 June 1999

Central American courses in astronomy have been held annually and are hosted by countries of the region. They are supported by the IAU. This year the course will be held in Managua, Nicaragua, 21-25 June, and will be hosted by the Universidad Nacional Autonoma de Nicaragua.

We are inviting participants to come and share their experiences in teaching astronomy, particularly, though not exclusively, at pre-university levels. One of the goals of the CURCAAs is to promote astronomy and astronomy teaching in Central America, and therefore contributions on how to teach astronomy to school teachers would be highly valued. Other areas to be covered in this 5th CURCAA include how to do research and teaching with small telescopes, and how to create a regional community of professional astronomers in the medium term.

For more information you can visit the CURCAA website
http://www.astroscu.unam.mx/~vcurcaa
where you can also find details of how to register. This website will be updated from now until June.

Although the official language of CURCAA is Spanish, contributions in English will be most welcome.

If you have questions, or doubts about whether your planned contribution will be suitable for the 5th CURCAA, please do not hesitate to contact me.

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## ASA-RASNZ MEETING (SCIENCE MEETING), AUSTRALIA, July 1999

An astronomy education meeting "Astronomy Education for the New Millennium", is being supported by the Astronomical Society of Australia, the Royal Astronomical Society of New Zealand, and the Nepean Observatory of the University of Western Sydney Nepean. It will be held at the University of Western Sydney Nepean, Australia, 11-13 July 1999. For further details email gwhite@uws.edu.au , or see
http://www.nepean.uws.edu.au/astronomy/asa99

Barrie W Jones

# TRIENNIAL REPORTS 1996-1998

## BULGARIA

*General information* An educational reform is going on in Bulgaria, and astronomical education will probably be included. Usually astronomy is ignored as a subject in secondary school curricula. There is a tendency to include astronomy with physics, but an attempt to integrate astronomy with physics has had no success for about ten years. However, the position of astronomy in university education has been improved during the process of reform.

*Elementary Schools* Students in elementary schools in grades three and four study natural science where they acquire general knowledge about the Earth, the Solar System, and the planets. Students in grade seven study geography where they gain some information on the Solar System, on seasons, and on geographical coordinates. In grade eight students learn astronomy and astrophysics within Physics.

*Secondary Schools* Astronomy in secondary schools in grades nine and ten is a part of physics. However, in the final exam there is not enough astronomy. It is more than 50 years (1945) since astronomy was a separate course in the school curricula in Bulgaria. Now, astronomy is taught to eleventh grade students during 30 hours per year. However, the student can choose astronomy as an extra course too. There is a good textbook of astronomy for secondary schools.

*Astronomical Olympiads* We are preparing an Astronomical Olympiad in Bulgaria. The winners will receive privileges in studying physics or astronomy in Sofia University.

*Public Education* There is a good system of public education in Bulgaria. There are nine public observatories, six of them have small planetariums. There are also two modern planetariums in Bulgaria. They have about 100 000 visitors per year. The visitors can do sky observing and attend lectures. There are special programmes for the young.

*Universities* There are four universities in Bulgaria with faculties of physics. The Ministry of Education have obliged each faculty of physics to have a minimal course of astrophysics with 60 hours of lectures and 15 hours for practical observations in their educational curriculum. All students who are training to be physics teachers in secondary schools have an exam in astronomy. The biggest university in Bulgaria - Sofia University - has an astronomical observatory and a specialisation in astronomy. The aim is to produce professional astronomers. The students have to successfully complete two years education in general courses of mathematics and physics, and then there is a further three years of education. Students during their study make observations with a small telescope (60 cm) and a CCD camera. Sofia University has 10-20 graduate students per year. The best ones embark on postgraduate studies. The Department of Astronomy presently has two postgraduates. The Institute of Astronomy at the Bulgarian Academy of Sciences has four postgraduates.

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## CROATIA

*General information* The school system in Croatia consists of obligatory elementary school (8 yr), secondary schools and gymnasiums (4 yr), and universities (studies usually last 4 yr). A new educational curriculum is gradually being developed with the intention of it being similar to the curriculum in the states of the European Community. Astronomy has kept its status as a non-obligatory course in most schools. Croatian astronomers and teachers involved in teaching astronomy are mainly members of the Croatian Astronomical Society (CAS).

*Elementary school* Basic astronomical facts are included in courses of geography, physics and mathematics. Astronomy can be offered as a non-obligatory course in the last four years of elementary school. A curriculum for such courses is prepared by CAS in coordination with the Croatian ministry of education and sport.

*Secondary school* Again, basic astronomical facts are included in courses of geography and physics. Astronomy can be offered as a non-obligatory course, and the curriculum produced by CAS is of modular design, starting with basic astronomy and covering celestial mechanics, Solar System, galactic astronomy and astrophysics (a total of 8 modules). Each module takes one third of the school year to complete. The modules can be freely chosen by the teacher so that (s)he can adjust the content and the level of the lectures to the students.

*Teacher training* is through several days long courses co-organised by the Ministry of Education and CAS. There are 1-2 such courses yearly.

*Gifted children* These are being cared for by special programmes supported and supervised by the Ministry of Education and carried on by CAS staff, and in many cases also by members of the National Association of Amateur Astronomers. Astronomy contests for pupils from elementary and secondary schools are organised yearly. The contests have three levels (municipal, regional and state). Children are required to show their knowledge of astronomical facts and to present their own practical work at the regional and state contests. Most successful pupils at the state contest are awarded participation in the summer school of astronomy where they are exposed to a lot of observational activities.

The public observatory of Visnjan organises the Visnjam School of Astronomy, which is targeted to more advanced pupils and students. This school is international in character and accepts participants and lecturers from Croatia and abroad, mainly from the neighbouring states of Slovenia and Italy.

*University education* Astronomy is an optional course in the study of physics at the four universities in the country: Osijek, Rijeka, Split, and Zagreg. The astronomy course is obligatory for future teachers of physics. Astronomy is also an obligatory course at the Geodesic Faculty of the University of Zagreb. Astrophysics can be studied in the 4th year of the study of physics at the University of Zagreb. Although there is no independent study of astronomy, students can achieve astronomy-related MSc and PhD degrees under the study of physics. Some observational work is possible at the Hvar Observatory. The public Observatory of Visnjan offers access to the equipment and professional support free of charge.

*Public education* Croatia has one planetarium (Zagreb) and three public observatories (Visnjan, Kutina and Zagreb). In addition there are about a dozen amateur astronomical societies scattered all over the country. These societies are partially supported by the state and they also offer observations and other astronomy related activities to the general public from time to time. Croatia also has a long tradition of an Astronomy Day with many activities organised for the general public, CAS, and amateur societies countrywide.

*Internet* As more and more schools and all universities can use internet resources (their use is free of charge for all educational and scientific institutions), an internet site devoted to the natural sciences, including astronomy, is under development. It is mostly targeted at pupils of the primary and secondary schools. Current information about astronomical events, observational techniques, basic astronomical facts, and the possibility to ask scientists questions (through e-mail) is currently available and being expanded on a daily basis.

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## ESTONIA

*General information* Traditionally, Estonian people have been interested in astronomy. There are far more than 20 popular Estonian names of constellation known from ancient times. Professional studies began in the early 19th century in Tartu. The present-day Tartu Observatory employs about 25 professional astronomers, while a few astronomers are working at Tartu University and other universities. Due to the political and economical changes in the 1980s and 1990s, the popularity of astronomy was somewhat "shaken" by astrology, UFOlogy etc. However, it seems that astronomy does have increasing appeal amongst the Estonian people. Astronomy alone cannot stand against the tendencies of economics, marketing, law and other fields of "easy income" prevailing in society, but teaching astronomy is one of the most effective ways to bring science to the general public.

*Public understanding and outreach* One of the indicators of interest in astronomy is the number of visitors to Tartu Observatory (at Toravere, about 20 km from Tartu). Most of them are school students, but there are also many groups of adults. In 1996 this number was 1400, in 1997 3500, and in 1998 5000. Additionally, about 800 people came to the Observatory to see comet Hyakutake in 1996, and almost 3000 for comet Hale-Bopp in 1997. A special exhibition room – Stellaarium – equipped with posters, models, astronomical instruments, real piece of iron meteorite etc was established in 1997 and further furnished in 1998.

The Old Tartu Observatory, which now belongs to Tartu University, is very active in dissemination of astronomical knowledge. An active group of associates organises lectures and shows the night sky to interested visitors. Together with activists from Tallinn they have organised summer schools for amateur astronomers every year since 1996.

A 400-page book "Universe", complied by

Estonian astronomers and first published in 1997, gained unexpected popularity. The first edition was sold out very quickly and the second edition was printed in 1998.

There is still no permanent planetarium in Estonia. The necessary equipment, however, exists, and planetarium shows were held at the science exhibition in Tartu during two months in 1998.

*Primary and secondary school education* The main change in the primary during recent years was that elements of astronomy (mostly Solar System) were moved from the programme of 5th grade to that of 4th grade. Content of the subject did not change essentially. Many teachers of the 4th and 5th grades all over Estonia bring their students to Tartu Observatory in order to deepen their astronomical knowledge. Such students form about half of the observatory visitors.

At the secondary school level, astronomy (mostly astrophysics) is taught in the final, 12th grade as a part of physics. There are signs that sometimes astronomy is being neglected by the teachers, referring to the lack of time and/or good textbooks. The situation seems to be improving, however, with a new original textbook being available on the Internet. Hopefully this book will be printed soon.

*University education* Tartu University is the only classical university in Estonia. Undergraduate and postgraduate studies in astronomy can be carried out in the department of physics of this university, where scientists from Tartu Observatory are involved in teaching too. A few MSc and PhD students are preparing their theses at the observatory. We hope that at least some of them will become professional astronomers. Many of the staff members of the observatory are quite aged, and the lack of descendents could be a major problem in the development of professional astronomy in Estonia in the near future.

A course of general astronomy is taught also to the future teachers of natural sciences at Tartu University. Optional courses of astrophysics are occasionally taught at Tallinn Technical University and at Estonian Agricultural University.

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## INDIA

The vastness of India ensures that all aspects of teaching of astronomy receive attention, although there is a wide variation in the level of activity, outreach and effectiveness.

*Formal teaching* As far as formal astronomy education is concerned, there is hardly any cause for optimism. School texts dutifully contain astronomical descriptions, often as an over-kill, without any reference to the actual sky visible from outside the classroom. Astronomy almost entirely disappears from the post-school curriculum so that students doing BSc and MSc in most universities do not have a chance to study astronomy. Some universities/colleges have made efforts to introduce astronomy or space physics courses, but the number of senior students studying astronomy remains a minuscule fraction of the total number.

In any case these days very few students opt for a degree in science; most prefer to go in for engineering or management courses. In some of the professional colleges, students have set up astronomy clubs for instruction and amusement.

*Planetariums* There are about two dozen planetariums in India, mostly in big cities. There does not seem to be any movement towards increasing their number. Although the first planetarium in India, opened in 1954, was attached to a school it has remained an exception rather than the rule.

Planetariums cater for laypersons and, what is encouraging, an increasing number of students from schools and colleges. Planetariums (including those at New Delhi and Bangalore) offer interactive shows, curriculum based shows, and public lectures specifically meant for senior students. Some planetariums offer practical training also.

*Leonid showers* The 1998 November non-event of the Leonid meteor shower is an instructive example of the dynamics of popular astronomy. There was an unusually large interest in the media about the shower. The media usually depend on the internet for initial information and then seek out local experts for comments. The emphasis was to present the showers as a cosmic spectacle and as a drama, with a stray satellite running the risk of being decapacitated by a hit from a meteoroid. Interestingly, before the shower, no interest was shown in the important question as to how the predictions are arrived at. It was only after the showers failed to live up to the hype, some defensive attempts were made to understand or explain why eclipse predictions are more dependable than predictions of meteor showers.

Increasingly in the public eye, research institutes seem to have a higher credibility than planetariums. However, very few research centres have a popularisation programme.

*IUCAA* The Inter-University Centre for Astronomy and Astrophysics (IUACC), Pune, has a multi-layered outreach programme. It has developed a low-cost photometer suitable for observing variable stars. It also runs summer programmes for students where they can work on projects like observation of solar limb darkening.

The expertise available in India can be put to good use in neighbouring countries. India was thus able to put the local telescope into working order at Zanjan, Iran, during the International School for Young Astronomers July 1997, and helped local enthusiasts get some hands-on experience.

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## LATVIA

The past three years were very fruitful for astronomy education in Latvia. Major changes happened in several fields.

*Public understanding and outreach* The Latvian Astronomical Society, which unites professional astronomers, amateur astronomers and astronomy teachers, continued its work and was growing in size. Sky demonstrations at the Astronomical Tower in Riga, equipped with a 22 cm reflecting telescope, were going on. The period of Hyakutake and Hale-Bopp comet visibility were the golden hours of sky demonstrations. During that time the Astronomical Tower usually was overcrowded. Summer star parties "Aquila" were held each year in August, when the activity of the Perseids meteor shower is the highest. Star parties became very popular. Some activities in the fight against light pollution were started. The popular science magazine "Starry Sky" is published four times per year and the Astronomical Calendar is issued yearly. Great interest toward cosmology was reflected by the translation into Latvian of Stephen Hawking's "A Brief History of Time". Two new Constellation Guides for general publics also were published. Local press, television and radio stations are often interviewing astronomers, asking them about comets, eclipses, near Earth asteroids, daylight saving time, astronomy versus astrology, etc. But they also ask questions like "When will the end of the world come?" or "When will the third millennium begin?"

*Primary school education* In the first grades of primary school some themes of the Basics of Science course are related to astronomy. A new textbook for this course, including a considerable amount of astronomy topics, was introduced in schools. In the last grades of primary school the situation is not so good. Only some elements of astronomy (Earth – our home planet, eclipses, Sun – our star) are taught within physics and geography. No new astronomy or space science teaching aids were developed during this period. Changes at this stage of education are awaited in future – a new curriculum, oriented towards skills development, will be introduced soon.

*Secondary school education* Latvia is one of few countries where astronomy is a separate discipline at the secondary school. A course of 70 hours is given to students. In 1996 a new textbook was published. It replaced an old textbook, used at schools for almost 50 years. The textbook was followed by an exercise book, dealing with astronomy problem solving. A new course – General Science for Humanities – was introduced. This course includes astronomy elements. An experimental textbook covering astronomy topics of this course was published. Astronomy contests for advanced students were held each year. Some students also took part in the "Astronomy On-Line" project, organised by the European Association for Astronomy Education. The level of activity of astronomy teachers was raised.

The local Association of Astronomy Teachers organised several teachers' workshops. Two teacher-training courses were held. One of them concerned astronomy education method, the second the use of the internet and multimedia in astronomy teaching. Some teachers visited European Community teacher training courses. One person took part in the 1st International Summer School of the European Association for Astronomy Education in Spain. This is the bright side of the situation. From the other side, astronomy at secondary school is a discipline by choice and is chosen only by 12% of students. This number has not grown during the last three years.

*Undergraduate and graduate education* General astronomy courses are given at universities for BSc in physics and geodesy and. A course of navigational astronomy is given to future marine specialists. MSc and postgraduate astronomy studies are available only at the University of Latvia, the central university of the country. Several astronomy teachers received the MSc in physics, and one person completed his

PhD thesis on astronomy education. The home page URL is http://www.astr.lu.lv.

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## MEXICO

*General Information* The quantity of astronomical information available to the general public has increased since 1994, largely due to the increase in web sites available to the general public. Another reason is that several Science Centers have opened within the country, which include astronomy exhibits. The average education is six years of elementary school in larger cities and three years in the country. There are nine small, university related observatories and twenty government and privately sponsored planetaria.

The National Academy of Sciences organizes public lectures on astronomy throughout the country.

Several collections of astronomy books are available at low cost, making them easily accessible to the 300 public libraries and to all elementary schools. Four major newspapers publish science sections. There are several magazines that regularly publish astronomical articles appropriate for all ages. The astronomy community gives about 150 public lectures each year and
also participates in summer research programmes for high school students.

*Elementary Education* Astronomy education is limited to phases of the Moon, general aspects of the Solar System, the seasons and tides. These last two items are difficult to teach because there are only two seasons in most of the country and scarcely any tides, save for the coastal areas.

Many misconceptions are taught, with phases of the Moon, the seasons, and tides being attributed to monthly eclipses, variable Earth-Sun distance, and rotation of the Earth, respectively.

*Middle Schools* Middle school covers the same topics as elementary school and unfortunately transmits the same misconceptions. General aspects of the stars and galaxies are also presented. Astronomy is taught as part of geography, and regrettably the most abstracts topics are presented at the beginning.

*Undergraduate Programmes* More than fifteen universities throughout the country have well-established undergraduate courses in physics, but only six offer regular general astronomy courses on a regular basis.

*Graduate Programmes* Two institutions offer graduate studies in astrophysics: the Instituto Nacional de Astrofísica, Óptica and Electrónica in Puebla, and Mexico´s National University, UNAM, which has three campuses, at Ensenada, Mexico City and Morelia. At Guanajuato´s University a new group will be able to direct theses for graduate students. The total staff is 100 professors with PhDs in astrophysics. There are two 2-m telescopes and several smaller ones in the country; all are equipped with CCDs, spectrographs and photometers.

*Astronomy education at a distance* Educational television programmes on astronomy have been elaborated by the Public Education Ministry and by the National University. They include programmes for elementary, middle and high school, as well as programmes for teachers.

*Astronomy for teachers* Mexico's National University has just started a 180 hour course for high school teachers. Its purpose is to enhance their astronomical culture and to encourage them to use examples from this field during their physics courses.

Julieta Fierro

## PARAGUAY

Dr John R Percy, then President of IAU Commission 46, visited Paraguay for a week early in August 1997. He delivered four public lectures related to astronomical teaching, the need of a Center for Astronomy for Paraguay, and variable stars. He invited everyone involved in astronomy to work together to make the Centre for Astronomy a reality. The goal is to let young people learn about and train in space science at all levels of education. He also did his best to obtain support for the observatory from Universidad Nacional de Asunción administrators, and he contacted Japanese astronomers for a donation from the Cultural Grant Aid of the Japanese Government for an astronomical telescope and its parts.

A committee supporting this project comprises the National Astronomical Observatory of Japan at Mitaka, the IAU, and the UN Office of Outer Space Affairs.

Efforts were successful. So, a 45 mm GOTO Cassegrain reflector telescope, an accurate photoelectric photometer and a CCD camera system are coming this year, to give life to the

proposed Center for Astronomy and become the first National Observatory in Paraguay.

Last September, Dr M Kitamura visited us for a week. He delivered two lectures, mainly on the photometry of close binary stars. He gave useful advice about the site for the telescope, a moving-roof building, and care for the instruments. Another task was to interview two physics students selected for training at Bisei Observatory in Japan.

Some plans for the use of the telescope are: training in the use of telescopes and peripheral instruments; and astronomical observations for instructors and students from the science and technology faculties of the Universidad Nacional de Asunción and other universities. Also, teachers and younger students from primary and secondary level should have opportunities to receive a basic training in astronomy. We recall that astronomy encourages young high school students to enter the science and technology professions. Interactions with astronomy club members is essential for the life of the Center. So, interested amateurs must also receive training and telescope time. There are four groups of amateurs, mostly in the area close to Asuncion.

The exchange of astronomers and students from Paraguay, Japan and elsewhere is another goal. Joint observations are essential for certain observations that need different latitudes and times. A library with a database and data analysis techniques is a must. A PC was donated thanks to IAU funds, and some books and magazines are being received. So there is a small library for the Center. Your cooperation is welcome.

The Facultad Politecnia of the Universidad Nacional de Asunción is willing to contribute to the observatory building and offices for the Center for Astronomy. A convenient place for the observatory is the UNA Campus at San Lorenzo.

A group of former IAU-VLP students organised the Sociedad de Estudios Astronomicos, open to interested amateurs. They publish a magazine "Antares" and they are working on a project building a small radio telescope with support of some staff and students of Facultad Politecnica.

Astronomy is being taught mainly as part of natural science courses through secondary school. Thanks to one of the amateur groups, the Asociacion da Amigos de la Astronomia, some astronomy elective courses are delivered to some high schools and there are also some courses in astronomy for the general public.

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## POLAND

*General information* On 1 January 1 1998, our two astronomical magazines "Urania" – monthly, published by the Amateurs Society, and "Postepy Astronomii" – quarterly, published by the Astronomical Society (professionals) merged into one magazine. It is now named "Urania – Postepy Astronomii" – published bi-monthly in Torun. The editor-in-chief is Professor Andrzej Woszczyk from the Center for Astronomy of the Nicolaus Copernicus University in Torun. It is printed in A4 format, with many colour photographs. In every issue there are a few pages on astronomy at school – articles, lesson projects, exercises, information on computer programmes, etc.

*Public understanding and outreach* The Torun Planetarium takes every year more and more visitors. It is now an educational and cultural institution well known in the town as well as in the neighbouring provinces. Every year 3-4 new performances are arranged for the general public, and didactic programmes are adapted for different school levels. They are now based not only on the planetarium project, but on video-cassettes, etc.

*Primary school education* Mr Andrzej Owczarek, teacher in an elementary school in the small town of Potarzyca in the province of Poznan, has made a small planetarium in his school. The 5 m dome (made out of 36 hard cardboard triangles) is installed inside a classroom. It can take 36 visitors. The projector – a ball of 32 mm – has 24 objectives for showing 24 parts of the sky. Simple sky shows are conducted in this planetarium for the neighbouring schools as well as for grown-up visitors.

*Secondary school education* A reform is taking place this autumn: the last two years of primary school plus one year of lyce are to form a "gymnasium" for all children. After finishing, the pupils will have a choice of a lyce or a technical education. An experimental Academic Gymnasium has been operating in Torun since 1 September 1998. The school has a liaison with the University: some staff members are teaching at the University; the programme has been discussed by teachers and University professors. The first students have been chosen by means of a severe three-step selection process; from about 180 candidates from the whole country only 40 have been selected.

Secondary school teachers have attended two more workshops organised by the Polish Astronomical Society and the Committee for Astronomy of the Polish Academy of Science. The workshops become more and more practical, with the teachers themselves presenting their own lesson projects and methods.

*Undergraduate education* There is now a tendency to divide university education into two parts, the first 3 years leading to a bachelor degree, and two more years for the masters' degree. Astronomy studies are now more linked to physics; in Torun students have to take "physics" for the first year, and later they have a choice of taking either "physics" or "astronomy".

*Postgraduate education* In some Polish universities, like Poznan and Gdansk, there is a possibility of specialising in astronomy in the last year of physics studies. Otherwise, a masters' degree in astronomy can be obtained in Cracow, Torun, Warszawa and Wroclaw. Nearly all universities take a few students for postgraduate, predoctoral studies.

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## PORTUGAL

*General information* In the period covered by the present report the activities in astronomy have increased in all the areas: public education, school education and research. Special programmes supported by the Ministry of Science and Technology for the promotion of science have created good opportunities for direct contact between astronomers, both professional and amateur, and students, teachers and the public in general, giving rise to a great interest in astronomy at all levels. Also, special programmes for funding science research allowed important developments in university education as well as in astronomical research projects.

*Public understanding and outreach* One of those programmes, called *Alive Science*, includes two subprogrammes "Astronomy on the Beach" and "Astronomy in Summer". The first one is intended to reach the large number of people that in summer come for beach holidays along the Portuguese coast; astronomers, equipped with portable telescopes in excellent weather conditions, organise public sessions for sky night observation. The second one allow similar activities, but now all over the country, since in summer the weather is usually good and the people have more time available to enjoy looking at the sky. A third subprogramme is a "Scientific Week". Among many events during the week, there are several astronomical activities, including lectures, open discussions, and practical observations. Also to be stressed is the increase in the number of people visiting the astronomical observatories and research centres, mainly at the time of some remarkable celestial phenomena, and the increase in the number of mobile planetaria. For this, the involvement of some local administrative authorities deserves mention.

*Primary school education* There are no great curriculum changes since the previous report. However, the programme *Alive Science* mentioned before has stimulated cooperative projects in astronomical subjects between astronomers and primary school teachers, giving rise to much more popularisation of astronomy amongst students.

*Secondary school education* The main curriculum changes at this level were announced in the previous report. Now, it should be mentioned the great increase of interest in astronomy as a result of the large number of projects developed within the scope of the *Alive Science* programme. These projects brought a much closer cooperation between secondary school teachers and astronomers and, as a consequence, there was a great increase in astronomical activities: visits, lectures, demonstrations and night sky observations. Also, more and more schools are now getting their own astronomical telescopes. Special courses about the Universe, stellar astronomy, the Solar System, the Earth, and outer space, are still being organised on a regular basis, at the University, as a way of continuing education for secondary school teachers.

*Undergraduate education* As mentioned in previous reports, there are specific undergraduate degree courses in astronomy in Portuguese universities. Also, astronomy is taught in several other degree courses, including courses in military schools. It is important to note the interest in astronomy in some recently created universities.

*Postgraduate education* As mentioned also in the previous report, master's degree courses in astronomy are now offered by two of the Portuguese universities. The number of PhDs in astronomy have increased greatly in recent years.

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## SINGAPORE

*General information* Astronomical awareness in Singapore has come a long way since the apparition of Halley's comet in 1986. Prior to Halley's comet, astronomy in Singapore was very much limited to a handful of amateur astronomers. Several events have helped change the local astronomical scene. In 1989, the first public observatory was opened at the Singapore Science Centre. The observatory has a 5.5 meter dome and houses a 40 cm cassegrain reflector, with a sitting capacity of about 300 people. In 1992, several keen amateur astronomers formed The Astronomical Society of Singapore (TASOS) which currently has 200 members. TASOS has been involved in organising activities for every major astronomical event for the public ever since. Among others, basic astronomy courses and astronomical exhibitions have also been conducted for the public at many of the local libraries and schools. Weekly observing sessions for schools and the public are also held at the Science Centre Observatory.

*Public understanding and outreach* In recent years, many events have created profound awareness of astronomy. On 22 March 96, a public comet Hyakutake watch was organised and attracted several hundred viewers. On the 11 and 12 April 97, another public event organised by TASOS and the Singapore Science Centre attracted several thousand participants. On the 17-18 Nov 98, TASOS, Singapore Science Centre and Sentosa Corporation organised a public Leonid watch on Singapore's Sentosa Island. A record 35 000 people jam-packed the beach that night. Although we had organised many public events that attracted thousands of participants before (events such as SL9 impact on Jupiter, partial solar eclipses etc.), 35 000 participants at a single location was a record and represented more than 1% of the entire country's population. For many of these activities, there were also public exhibitions, talks, lectures, and information at our websites to generate more awareness and interest in astronomy. In view of growing public interest in astronomy in recent years, the media such as the local newspapers and TV news stations are also now beginning to provide far more coverage into astronomical events than at any previous time. We hope that such trends will continue and eventually become persuasive in the introduction of an astronomy syllabus and astronomy as a formal subject in the local schools' curriculum.

*Primary and secondary schools* Astronomy is currently not taught as a subject in Singapore from primary through secondary schools and tertiary institutions. There are but two pages in the current Primary 3 science text that covers descriptions of the Moon, Earth and Sun relationships, with a brief mention of the Solar System. Students who are in the Scouts and Girl Guide groups do some constellation recognition but relatively little partly because Singapore is very severely light polluted and clouded at most times. There is however, a primary school astronomy activity card programme by The Singapore Science Centre whereby primary school students complete the projects outlined in the card to score points and exchange them for completion certificates. This activity card programme also covers 11 other science topics such as geology, mathematics, ecology, chemistry etc, and must be administered by a school teacher. The popularity of the astronomy card programme is somewhat limited because many primary school teachers are unfamiliar with astronomy and are thus unable to administer the programme for their students.

*College and tertiary institutions* Although astronomy is not taught in colleges nor in tertiary institutions, almost all colleges and tertiary institutions in Singapore have an astronomy club. All the clubs (about 15 of them – all affiliated to TASOS) have members within their own school or institution and own telescopes of average 20 cm aperture. Annual country wide astronomical quizzes for Secondary schools and Junior colleges have been organised by the astronomy clubs of Nanyang Polytechnic and Nayang Technological University respectively since about 1996.

*University and postgraduate level* The Physics Department of The National University of Singapore has an astrophysics department. There is a 5 meter fibreglass dome built previously by students, sitting atop of the Physics building, but this dome has been abandoned as it was found to be leaking. Currently no instruments are housed in the observatory. In 1997 the Physics Department purchased about 30 portable telescopes, and a few 20-23 cm instruments, and incorporated astronomy in the degree in physics. At the moment however, anyone aspiring to a formal degree in astronomy still has to look overseas. Neither are postgraduate courses in astronomy offered locally. I have therefore no choice but to do my own master's degree in astronomy through the University of Western Sydney in Australia.

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## SOUTH AFRICA

The South African Government has recognised the need for a scientifically literate population and, in its support for the construction of a 9-m class telescope, acknowledged the power of astronomy to excite the imagination and to attract young people into scientific careers. Nevertheless, the practical problems of teaching astronomy, or even science, in a country with 11 official languages, typical pupil/teacher ratios in excess of 40 and many classrooms without books and electricity, are considerable.

*Public Understanding and Outreach* The Department of Arts Culture Science and Technology declared 1998 "The Year of Science and Technology" and financially empowered the various science councils to do something meaningful in public outreach during the year. In particular the Foundation for Research Development was asked to take "Astronomy and Space Science" to the people. The project, eventually known as "Friends of the Universe" was managed by Case Rijsdijk at the South African Astronomical Observatory (SAAO), but involved many people from other observatories, planetaria and universities. Four highlights are as follows.

A minibus decorated with stars, planets and comets became a "Starbus". It was equipped with materials ranging from low-tech telescope kits and cardboard cutouts to hi-tech digital data protections. The "Starbus" toured remote rural areas where many children encountered the Universe for the very first time.

Nine posters were designed, printed and distributed to schools throughout the country. The subject matter ranged from "Our Milky Way", through "Telescopes" and "Impacts" to the "Earth-Moon System". But by far the most popular was "Starlore of Southern Africa", which even made a hit with one or two cabinet ministers.

Astronomy Workshops were held at individual schools, science festivals and other events - including IAU symposium 192 held in Cape Town in September 1998. The main aim of these was to show how astronomy could be used to generate an interest in science among young people.

An essential upgrade to equipment has enabled the planetaria in Cape Town and Johannesburg to produce new programmes. These organisations have provided an important link between science and the public, particularly schools, for many years.

*School Education* South Africa is in the process of transforming to an outcomes-based education system. Astronomy has been incorporated into the new "Curriculum 2005" within the learning area known as Natural Sciences under the theme "Earth and Beyond". Astronomical teaching materials are being developed at the SAAO and elsewhere. The implementation of the new programme is progressing slowly and is greatly hindered by the paucity of properly qualified science teachers.

*Undergraduate Education* Two SA Universities offer degrees in astronomy, Cape Town and the University of South Africa (UNISA - which offers courses by correspondence). A number of other universities, including Potchefstroom, Rhodes, Natal (Durban), Witwatersrand and Pretoria, offer astronomy as part of their physics or mathematics courses. The numbers graduating in any of the physical sciences are small and have been declining in recent years.

*Post-graduate Education* The major new development in this area is the possibility of undertaking research training at one of the National Research Facilities (SAAO and Hartebeesthoek Radio Observatory) while registered at a University. By early 1999 several students trained in this way have graduated with MSc degrees. The project should have a good future, although the shortage of physics graduates may require future recruiting to be done from among mathematics and engineering students.

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## SPAIN

*General information* It is very important to remark on the activity of different institutions in training teachers. Some private associations offer courses to teachers, with financial support from different banks and building societies. This is the case for Astronomical Associations, Science Museums, and Planetariums. Also, in some cases these institutions offer residential courses for students to learn astronomy combined with more scientific and sporting activities, for several days. For example the Circulo Astronomico Mediterraneo, CAM, which has the financial support of the Caja de Ahorros del Mediterraneo, organises teacher training courses each summer

for teachers. This year a truck with astronomical instruments in the dome-shaped roof was built as a moving observatory to visit countryside schools and to offer to teachers and students some facilities that otherwise they could not have.

Some Institutes of Science Education (ICE) related to universities, or Teacher Training Courses (CEP) related to the Ministry of Education of central or regional government, organise special teacher training courses. These courses are attended especially by secondary school teachers because primary school teachers are hindered by the administration. Teachers are compelled to cover their absence from school by finding a substitute teacher, whose wages the teachers themselves have to pay.

The national conference organised by ApEA Association for Astronomy Education in 1997 in Pamplona is also important. This conference was attended by one hundred teachers of all different levels. This was an excellent opportunity to exchange information between a big group of teachers interested in astronomy. It is repeated every two years.

On the other hand, the participation of Spanish teachers in Summer Schools organised by the European Association for Astronomy Education is an annual event, and covers at different levels, including instructor teachers and attending teachers. Every summer the quota of Spanish participants is filled, and a waiting list offers places that have not been taken up by teachers from other European countries. These courses offer chances to make contact with teachers of other countries, and as a natural consequence some European projects on astronomy , and the exchange of teachers and students have been set up.

*Elementary school* Astronomy in primary schools continues to be distributed in different subjects, with the problems that this situation causes. There are astronomical topics in social sciences, natural sciences and even in language classes. Sometimes the teachers who teach these subjects do not have appropriate training. Sometimes astronomy is given a low priority relative to the rest, or explained in a single visit to a planetarium where in one session the total information on astronomy is offered.

In the best cases the teacher presents the contents using only the students' book, which has the normal reduced details for this kind of text. This situation causes an inadequate conveyance of information. Primary schools should be more sensitive and precise in the treatment of these topics.

*Secondary School* Central government's control of education in Spain is limited according to different areas of the country. In secondary schools the Ministry of Education has introduced a compulsory subject in the zone of Spain that it controls. This subject has a formal structure of workshops in astronomy for students of 14-15 or 15-16 years old. These workshops offer two hours per week for a complete academic year. Although this is the general situation, there are some regions of Spain which are in a different situation: sometimes more Astronomy is offered in the curriculum, but sometimes less. Astronomy does not appear at all in a small area of Spain.

*Public education* It is appropriate to mention the conferences conveying general information about astronomy topics organised by various associations connected with the university programme, University Classroom for the Elderly People. Its role in the spread of astronomy in society is interesting. Also, in spreading information, the role of planetariums is important, as is the activities carried out by two astronomical journals which have a high readership. Also these magazines offer papers to teachers relating to the presentation of astronomy in the classroom at different levels, and also offer didactic materials on observations and practical experiments. In general, the activities on astronomy have increased during these three years in Spain and the situation is positive

*University education* The situation regarding the teaching of astronomy at universities in Spain is similar to the description in previous reports. Astronomy is especially studied in physics and mathematics degrees as optional subjects. Also, some universities offer astronomical topics included in optional subjects like the history of science and technology, computer simulations in physics, etc. Although these subjects are offered to all students, they are normally chosen by students of science degrees and by future engineers.

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## SWITZERLAND

*University education* Regular astronomy courses are given at the Universities of Basel, Bern, Geneva, Lausanne, Neuchâtel, Zurich and in the Swiss Institute of Technology, Zurich.

Geneva and Lausanne participate in PhD teaching in collaboration with the Universities of Grenoble and Lyon. This curriculum is called L2G2. It offers exchange facilities for teachers and students between the different universities, and it leads to an International Certificate of Astronomy and Astrophysics.

The Swiss Society of Astronomy and Astrophysics (SSAA) organises the Saas-Fee Advanced Course every year. About a hundred doctoral and post-doctoral level participants attend these courses given by three lecturers. The topics of the last three conferences were: Galaxies: Interactions and Induced Star Formation, 1996 (R C Kennicutt Jr, F Schweizer, J E Barnes); Computational Methods for Astrophysical Fluid Flow, 1997 ( R J LeVeque, D Mihalas, E A Dorfi, E Müller); Stars Clusters, 1998 (B Carney, W E Harris, C Pryor). These lectures are published by Springer.

*Secondary and primary schools* In Switzerland every canton (there are 23 of them!) benefits from great freedom in the organisation of its own educational system. Nevertheless, one of the common points throughout all systems is the flagrant absence of teaching in astronomy! Isolated efforts are made by some teachers, but they concern only a small fraction of pupils and students.

In order to coordinate these efforts and to help teachers who are not familiar with astronomy but interested in teaching it, the "Liaison Enseignants Astronomes" has been created at the Geneva Observatory. This structure offers pedagogical modules (applicable in classrooms), two web sites, as well as various formations and collaborations for the teachers. The websites are http://obswww.unige.ch/~raboud/AdLAE.html (which describes the LEA), and http://obswww.unige.ch/Questions_Responses/qr.html ('ask an astronomer').

In the French part of Switzerland the LEA is going through a phase of evaluation, during which the pedagogical modules are tested and modified and where the structure as a whole is being experimented.

As at secondary level, there is no official teaching of astronomy in the Swiss primary schools. However, there are some optional formations in astronomy accessible to teachers of this level (Geneva Observatory).

The LEA collaborates with about 30 teachers in order to introduce astronomy in primary schools of the Geneva area. Next year, this pilot experiment should be extended to other parts of Switzerland.

Though there is no official teaching of astronomy in the present curriculum of secondary school in Switzerland, this curriculum is presently being reformed and there may be some opportunities to teach astronomy in the new one. In order to point out such tracks, the LEA organised a meeting between teachers and astronomers in November 1998 on the topic "The place of astronomy in the curriculum of lower and upper secondary courses in Switzerland". Ninety participants attended this meeting. During this conference it became obvious that, despite the fact that astronomy is not officially recognised as a teaching matter, it is possible to teach it within different courses or even to introduce it as an option (for a report of this meeting see the URL http://obswww.unige.ch/~raboud/AdLAE/Programme_final/Report.html ).

This meeting in 1998 "Teachers – Astronomers" was the second of its kind since the workshop on "Teaching Astronomy", held in 1997 during the 86th Spring Meeting of the AAVSO (American Association of Variable Starts Observers) in Switzerland.

During the past three years, the Astronomical Institute of the University of Basel has organised two courses and public lectures for the continuous education of secondary school teachers. This Institute also offers advice and consultancy to semester and annual astronomy projects at various secondary schools.

The Geneva Observatory and, independently, the University of Lausanne organise every year a course in astronomy for teachers of secondary schools.

*Public information*. Several astronomers from different Swiss institutes are involved in public information. They use various methods.

1 Public Courses: the Astronomical Institute of the University of Basel organised 15 lecture series during the past three years.

2 The University of Geneva organises an astronomy course for the general public every year. It is given by a professor of the Geneva Observatory.

3 The Astronomical Institute of the Swiss Federal Institute of Technology, Zurich, offered in 1998 a course (8 lectures, by eight different lecturers) about "The Sun" to a large audience that paid a fee for attending.

4 Popular universities: two astronomy courses have been given in 1996 and in 1997 by astronomers from Geneva and Lausanne – "General Astronomy" and "Cataclysms in the Universe".

5 Conferences for amateurs, commercial firms, and other organisations, are regularly given in every part of the country.
6 Visits: the Astronomical Institute of the University of Basel organises Observatory tours and public lectures (3580 visitors during the last three years).
7 The Geneva Observatory, with its show room, is open to the public (2000 visitors per year).
8 Post doctoral and PhD students of the Astronomical Institute of the Swiss Federal Institute of Technology, Zurich, participate in running a public observatory (Urania).
9 For major astronomical events, Hyakutake, Hale-Bopp, partial solar eclipses, lunar eclipses, special observations were organised at the Geneva Observatory.
10 Mass media: articles in popular reviews and journals are regularly written by the Swiss astronomy community. The astronomers also participate frequently to radio and television broadcasts.

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## FURTHER CALL FOR TRIENNIAL REPORTS

So far I have received triennial reports from about 15% of those countries with national representatives, and all of these are in this issue. Please would national representatives send me the remaining triennial reports by 1 September 1999. These should be organised under the following headings

*General information*
*Public understanding and outreach*
*Primary (=elementary) school education*
*Secondary school education*
*Undergraduate education*
*Post graduate (=graduate) education*

Additional headings can be added if essential.
The total length should be within half a magnitude (1.6 × ) of 400 words, and I would be grateful if you could email me a either a simple ASCII text or a Word attachment, or send me a floppy disc (PC or Mac) with a Word file in 'Normal' style. If none of these forms is possible, please mail or fax me hard copy.

Barrie W Jones

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