

INTERNATIONAL ASTRONOMICAL UNION

COMMISSION 46 — TEACHING OF ASTRONOMY

NEWSLETTER

President :

A. Sandqvist
Stockholm Observatory
S-13300 Saltsjöbaden, Sweden
Tel : 46 87 17 03 80
Telex : 12 972 SOBSERV S
E-mail : ENEAI SLEIPNER/SANDQVIS (UCCP)

Vice-President :

L. Gougenheim
Representative to ICSU-CTS

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ASTRONOMY EDUCATION - NATIONAL REPORTS (CONTINUED)

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Reports from:

Editor :

J. Percy
David Dunlap Observatory
Box 360
RICHMOND HILL, ONT. CANADA L4C4Y6
E-mail : PERCY at UTORPHYS (Bitnet)

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L. Houziaux
Institut d'Astrophysique
Université de Liège
Avenue de Cointe, 5
4200 Cointe-Ougrée
Belgium
Telex : 41264 ASTR LG B
E-mail : U2141LH at BLIULG 11 (Earn)

ASTRONOMY EDUCATION IN ARGENTINA

Nidia Morrell, Universidad Nacional, Facultad de Ciencias
Astronomicas y Geofisicas, 1900 La Plata

Primary Schools. The situation here is not uniform. Astronomy is included in primary school programmes but teachers generally develop only a few topics concerning mainly the Solar System (Earth motion, lunar phases, eclipses, description of planets). In a few cases, subjects like stars, stellar evolution and galaxies are also included, but it depends strongly on the teachers' abilities, likes and dislikes.

Secondary Schools. Astronomy is not a separate subject but is included in Mathematics for students of the last course. One usually deals with astronomical systems of coordinates, planetary motion and description of the solar system. The curriculum includes some topics of astrophysics which are not frequently developed. The well known book "Astronomia Elemental" by Alejandro Feinstein edited about 20 years ago by Editorial Kapeluz, is still currently used for secondary school students.

University Education. Two of our National Universities offer astronomy programs. They are Cordoba National University and La Plata National University. Both of them offer courses of astronomy leading to the Ph.D. degree. People preparing to be mathematics or physics teachers in secondary schools usually take (at least in La Plata) a course on General Astronomy, or Introduction to Astronomy, at the end of their studies.

Public Education. Most of the Argentinian Observatories offer guided tours open to the general public. Schools and other groups may obtain special tours. This is the case at the observatories in Cordoba, La Plata, San Juan, Complejo Astronomico El Leoncito (San Juan), Instituto Argentina de Radioastronomia (Villa Elisa). The La Plata Observatory (or Facultad de Ciencias Astronomicas y Geofisicas) organized in November/December 1987 a course for secondary school teachers, "Introduction to Modern Astronomy", attended by about 50 persons (half teachers, half amateurs). Popular lectures offered at schools and public places are current activities for astronomers in all Argentinian Observatories.

All these activities have been intensified before and during the last visit of Comet Halley. Special commissions have been formed in all observatories, in order to deal with many questions; special tours and lectures were given almost daily. To give only one example, more than 5,000 people saw Comet Halley through the old 0.43m refractor of La Plata Observatory. A booklet "El Cometa Halley" published by the Halley commission from La Plata, had two editions during 1986.

In 1987 a special puppet show called "Ciencia, Illusion y Fantasia, otra vez la Astronomia" was arranged at the La Plata Observatory. This spectacle was sponsored by the University of La Plata, the Commission de Investigaciones Cientificas de la Provincia de Buenos Aires and the Facultad de Ciencias Astronomicas y Geofisicas and was performed in several Argentinian cities.

ASTRONOMY EDUCATION IN DENMARK

Hans J. Fogh Olsen

Copenhagen University Observatory, Brorfelde, DK-4340 Tolose

General Information. In Denmark there is increasing interest in teaching astronomy these years, although it is only taught as a separate subject at university level. The erection of a new planetarium in Copenhagen, Tycho Brahe Planetarium, is expected to give a renewed impact. A project of utilizing interactive video discs in the schools has been in progress up to now and will soon be ready for testing in schools. Available discs have been utilized together with Philips disc players and IBM computers.

Elementary Schools and Secondary Schools. New physics curricula have been introduced at all levels and they now recommend to teach astronomy from low level (10 years old) about the Sun, Moon, and Earth to secondary school (18-19 years old) with projects about astrophysics and cosmology. This will be introduced from autumn 1988 and the main problem will be to get teaching materials which are useful for teachers not too familiar with astronomy.

University level. New improved introductory courses in astronomy have been developed for students in physics which have increased the number of students each year by a factor of four. In the coming years this will result in more Ph.D. degrees in astronomy, because, although the number of employed astronomers at the universities is not increasing these years, it has been easy to find jobs in other related fields.

Public Education. The possibilities in Denmark are very favourable because as long as a few persons (10-15) want a course they will get it paid by local authorities so it is just the problem of finding teachers who are willing to give courses. Unfortunately, a lack of teachers and teaching materials limit the number of courses.

ASTRONOMY EDUCATION IN GREECE

L.N. Mavridis, University of Thessaloniki

GR-54006, Thessaloniki, Greece

General Information. Elementary Education in Greece lasts for six years (6th-12th year). Secondary Education is divided into two cycles: The lower three-year cycle (13th-15th year), called Gymnasium, and the upper three-year cycle (16th-18th year), called Lyceum. Four different types of Lyceum are in operation at present, i.e. the General, Classical, Technical and Vocational, and the Comprehensive Lyceum. The syllabuses of both the Elementary and Secondary Education are fixed by the Ministry of National Education and Cults. Universities do have the right, on the contrary, to fix their own curricula.

Elementary and Secondary Schools. No special courses on Astronomy are taught in Elementary School, the Gymnasium and the Technical and Vocational Lyceum. Only preliminary astronomical notions are included in the courses of Geography and Physics. In the second class of the General, Classical, and the Comprehensive Lyceum, on the contrary, there is a special one-hour per week course on Astronomy under the name "Elements of Astronomy and Space Science".

University Education. Five Greek Universities, i.e. the Universities of Athens, Thessaloniki, Patras, Ioannina, and Crete include special Departments on Astronomy and/or Astrophysics. All these Universities offer an undergraduate programme in Astronomy (combined with Physics, Mathematics or Surveying Engineering) and graduate programmes leading to PhD in Astronomy on a tutorial basis. Most of these Universities do have a small observatory and / or access to a bigger research observatory for practical and research work.

Public Education. Public interest in Astronomy has continued to grow in Greece in the last three years. The Evgenidis Foundation Planetarium in Athens and the Greek Astronomical Society have greatly contributed to this growth. Also the major observatories (National Observatory of Athens with its observing stations at Mt. Penteli and Cryonerion, Stephanion Observatory, University of Ioannina Observatory, University of Thessaloniki Observatory, and University of Crete Observatory) have regular public observing sessions for elementary and secondary school pupils and the general public. Major national newspapers often contain astronomical feature articles and astronomical broadcasting and television programmes are broadcast.

EDUCATION IN ASTRONOMY IN HUNGARY

Dr. Gábor Szécsényi-Nagy
Department of Astronomy
Eötvös University of Budapest
H - 1083 Budapest Kun Béla tér 2

Elementary School Education. According to the present school system in Hungary children start their elementary-school studies at the age of six after a year of compulsory infant-school activity. They learn about the shape of the earth, the moon, the planets, the sun and their motions at the lower grades (1 to 4 level). At the higher grades (5 to 8 level) the planetary orbits, inclination of the axes, relative positions, eclipses and phases, geometry of the seasons, tides, celestial and geographical coordinates, solar and sidereal time and calendars are discussed, mainly during lessons in geography and physics. Many pupils attend special performances at the Budapest Planetarium (the largest one in Hungary) which can be visited during one-day excursions from about 40-50 percent of the country. Others may attend presentations at some smaller planetariums in the provinces or visit observatories (local and "URANIA" observing stations).

Astronomical subjects are often demonstrated and explained making use of the smallest personal computers called school-computers. Children may finish and leave elementary schools at the age of fourteen but if they are unsuccessful they have to stay there up to sixteen. Approximately 80 percent of Hungarian citizens complete their elementary-school studies nowadays.

Secondary School Education. The two kinds of secondary schools providing academic courses in Hungary are the so-called gimnázium (gymnasium or grammar-school) and the special secondary school which provides technical courses as well. Their students are between 14 and 18. Astronomy is taught as a section of physics mainly during the second (level 10) and fourth (level 12) years. The first part contains a bit of history of astronomy (from Eratosthenes to Newton), Kepler's laws, the law of gravitation, angular momentum, proofs of the rotation of the earth, kinematics and dynamics of the solar system. The second contains some astrophysics (stellar colours and temperatures), spectroscopy (classification of stellar spectra, Doppler-shift etc.), theories of stellar evolution, radioastronomy and cosmology. Unfortunately all of these subjects are scheduled in the last semester of the secondary school's curriculum and they only seldom get the necessary emphasis because in that period both schoolchildren and teachers are concentrating upon the final examinations.

In order to give up-to-date information to secondary-school teachers the Educational Branch of the Eötvös Physical Society organized a meeting at Kaposvár (Hungary) in 1987. Professors of Eötvös University and research fellows of other institutes and observatories contributed to the success of the conference: "The Teaching of Astronomy and Space Research in Secondary Schools". Secondary-school teachers and Urania observatory staff led laboratory practices and workshops which were very popular.

Recent changes in the curriculum of our secondary schools made it possible to increase somewhat the number of lessons dealing with astronomical subjects. Teachers are allowed to choose from different units to be taught (these can be about atomic or biophysics etc. as well) but they may also omit these extra units and use the surplus lessons to prepare schoolchildren for the final examinations and university entrance exams.

University Education. Some courses of astronomy (in the first place general astronomy and astronomical geography) are offered in all Hungarian universities to students in mathematics/physics and geography/geophysics but the Eötvös University of Budapest is the unique institution of higher education in our country which has its own Astronomy Department and is able to offer a large choice of astronomy and astrophysics courses.

During the 1985-87 period we provided 26 lessons (a week) per semester to science undergraduate students and 34 lessons to science graduate students (some of them are would-be astronomers). Subjects like Celestial Mechanics, General Astrophysics, Astronomical Spectroscopy, Astronomical Instrumentation, Astronomical Photography, Cosmic Ray Physics, Solar Physics, Galactic Astronomy, Extragalactic Astronomy, Cosmology and History of Astronomy, are taught regularly. The staff of the Department of Astronomy also led Astronomical Laboratory practices (24/18 lessons a week per semester - first/second respectively). Astronomers of the Konkoly Observatory assisted us in this work too. During the above period four students graduated in astronomy each year, as usual. The Eötvös University also runs a postgraduate program in astronomy and astrophysics; besides that eleven lessons a week are offered in English to foreign and Hungarian students. The number of Ph.D. degrees awarded during the period in question is six.

The Gothard Astrophysical Observatory of the Eötvös University (which is situated near the western border of the country) is equipped with a 600 mm Cassegrain reflector which can be used for photographic and photoelectric observations too. Our students regularly participate in this work. During these years the personal computer control of the uncooled photoelectric photometers was constructed and tested. The necessary computer programs were written by postgraduate students.

ASTRONOMY EDUCATION IN INDIA

S Ramadurai

Joint Astronomy Programme, Department of Physics, Indian Institute of Science
Bangalore 560 012 India

General Information Popular interest in Astronomy in India recently received a boost due to the appearance of Halley's Comet and the associated public enthusiasm to know more scientific facts about comets, as opposed to the traditional beliefs. Further the Department of Science and Technology has declared Astronomy as a Thrust Area and hence the funding for new imaginative projects in Astronomy is very liberal. This, combined with the enthusiasm of the astronomers to push ahead with several new ventures in building facilities and vehicles for observations nearly spanning the entire electromagnetic spectrum, has resulted in a favourable situation for the spread of astronomy education in India. The Department of Space has a special interest in astronomy education and has come out with a comprehensive report on the astronomy educational opportunities in India at all levels. Given below is a concise report of major advances in the area of astronomy education.

High Schools Though astronomy is not taught as a separate subject in Indian Schools, through the sustained efforts, it has been possible to include some elementary ideas about our solar system and general ideas about the universe in the curricula of middle and high schools run by the Department of Education, called Kendriya Vidyalaya. Since the syllabus in these schools are followed by most other schools in due course of time, it is believed that in a few years' time, astronomy education will be an integral part of school training. This has been helped by a low cost dome designed by the National Council of Educational Research and Training, which is hoped to become commercially available in the near future. Further several senior well known astronomers have been participating in the lectures to the school students about major astronomical topics of current interest. Astronomical centres like Indian Institute of Astrophysics, Raman Research Institute, Tata Institute of Fundamental Research, Indian Space Research Organisation, Nizamiah and Rangapur Observatories of Osmania University and astronomy department of Punjabi University, Patiala, Positional Astronomy Centre at Calcutta as well as several amateur astronomy organisations have involved quite a few school students in their cometary expeditions. In this respect the role of planetaria like the Nehru Planetarium in Bombay in organising essay, poetry and painting competitions for the schools on astronomical topics, have to be especially mentioned.

Universities Though only two universities in India have full fledged astronomy departments separately, efforts have been made recently to incorporate astronomy teaching as a part of physics and mathematics curricula of several universities. The Departments of Astronomy at Osmania University, Hyderabad and the Punjabi University, Patiala award degrees in astronomy at post graduate level. Research level teaching incorporating a regular graduate course in astronomy is in existence at Indian Institute of Science, Bangalore in collaboration with the other astronomical centres like Indian Institute of Astrophysics, Bangalore; Indian Space Research Organisation; Physical Research

Laboratory, Ahmedabad; Raman Research Institute, Bangalore and Tata Institute of Fundamental Research. First batch of students from this programme have obtained their Ph D degrees recently and are carrying out their research at various places. A summer school for students who have completed their undergraduate education is held on an annual basis in the Indian Institute of Science with the financial assistance of the Government of India. These schools are extremely successful in generating an abiding interest in astronomy. As a means to increase the astronomy interest in the colleges, a new Inter University Centre for Astronomy is being set up at Pune and it is hoped that with the establishment of this autonomous seed institution close to the proposed giant metre wave radio telescope will increase the astronomy education in India substantially.

Public Education The public has been interested in astronomy almost by tradition since time immemorial. However scientific interest in them was kindled by the recent astronomical events like the Total Solar Eclipse, Comet Halley and the establishment of the new Vainu Bappu Optical Telescope at Kavalur. The Television network broadcast during prime time, the popular Cosmos series with an introduction by Jayant Narlikar. Further several new planetaria have come into operation at several major cities. In addition museums like the Visweswaraya Industrial and Technical Museum in Bangalore have opened a separate gallery for astronomy. Several conferences on general astronomy for the public, like the one attended by our President C Iwaniszewska at Hyderabad, are arranged with participation by the general public and some astronomers. The one important feature of Public Education of Astronomy in India is the dissemination of knowledge in several languages in addition to English. These come in terms of TV Programmes, radio talks and public lectures under the auspices of several organizations and schools.

ASTRONOMY EDUCATION IN MONGOLIA*

D. Haltar, N. Tugdzsuren
Mongolian State University, Ulan Bator, MPR

Edward V. Kononovich
Sternberg Astronomical Institute, Moscow, USSR

College Education. A sound knowledge of the field of astronomy is most helpful for young people entering the world of professional activity for the development of their outlook and their ability of logical thinking. A truly educated man of the 20th century cannot escape knowing some essentials in the field of astronomy.

The birthday of the teaching of astronomy in Mongolian colleges coincides with the foundation of the Mongolian State University (MoSU) in 1942. It was the Soviet specialist L.S. Baranovskaja who delivered the first lectures in astronomy. Astronomy is also a subject in the State Pedagogical Institute (MoSPI) in Ulan Bator from its foundation in 1951, and in the new Pedagogical Institute in Hovd from 1982. The staff employed as teachers of astronomy in the above mentioned institutions comes mostly from the Academy of Sciences, Astronomical Observatory or from the Chair of Physics of the State University.

Astronomy training in Mongolian colleges met at first with a series of difficulties, since there was no solid tradition of such training before. The main problem arose from the lack of laboratory equipment necessary for high level experiments. During the first years the textbooks of the Soviet authors were used, for example, "The Course of Practical Astronomy", by S.N. Blazhko, "Astronomy", by P.I. Popov, etc. The first Mongolian monograph on astronomy written by S. Nindgbadjar was published in 1968.

Today in Ulan Bator astronomy is part of the curriculum at the departments of physics and mathematics of MoSU and MoSPI and at the geodetic branch of the Polytechnical Institute where the specialists from the geophysical observatory of MoSU are employed as teaching staff. The students of these institutes carry out their practical tasks in astronomy at the special laboratory organized by the geophysical observatory staff. They are given astronomical and geophysical problems as subjects of their diploma and work under supervision of their teachers whose pedagogical work is combined with the scientific activity. The vast foreign experience in the field of astronomy teaching is studied carefully in Mongolian colleges.

It must be emphasized that the authorities' anxiety for the development of an educational system impels an improvement of the methods of teaching, particularly in the field of astronomy. In December 1972 MPWP and the Council of Ministers adopted an enactment "About the measures for further improvement of the specialists training system in the state colleges", which says, in particular, that it is necessary to introduce all available technical means and intensive technique all over the country. It is essential for teaching purposes that the students should be attracted by the subject. That is why the teaching staff are working hard to get them really interested. They prepare a variety of special films and coloured placards; they do their best to make lectures as clear and exact as possible.

*Editor's Note: Since Mongolia is not a separate country adhering to the IAU, this report is published for interest and information only.

In the process of astronomy teaching, an important role is played by laboratory practice. The programme provides a certain compulsory amount of laboratory work. Part of it is essentially research. This fact is of utmost importance for the development in students of certain qualities, such as alertness, keenness of observations, etc. Moreover, it implies the practical use of the acquired theoretical knowledge.

Much attention is paid to the outlining and development of scientific interests of the students. For this purpose a special scientific club is organized under the auspices of the observatory.

A great amount of work is carried out to raise the professional level of astronomy school teachers. Special lectures and laboratory practice are provided for this kind of audience.

The main sections of the astronomical curriculum for students of the department of physics and mathematics of MoSU are as follows: 1. Introduction, 2. Essentials of Spherical Astronomy, 3. Planetary Motions, 4. Determination of Celestial Bodies' Distances, Sizes and Shapes, 5. The Earth as a Planet, 6. Problems of Practical Astronomy and Astrometry, 7. Essentials of Astrophysics, 8. The Solar System, 9. The Stars, 10. Our Galaxy, 11. Principles of Cosmology, 12. Cosmogonical Problems.

We are most thankful to the IAU for the Information Bulletins and other materials dealing with astronomy teaching regularly sent to us which are of great value.

We are continuously searching the solution of the present day problems of astronomy teaching. Among our plans for the near future are further improvement of teaching, preparation of up-to-date astronomical textbooks for colleges. There are also plans to change the present specialty "teacher of physics and mathematics" into "physics and astronomy". The great Soviet experience in the field of astronomy teaching indicates that the foundation of the council for physical and astronomical training under the auspices of the Mongolian Academy of Sciences and the Ministry of Public Education would be of considerable value.

ASTRONOMY EDUCATION IN URUGUAY

Julio A. Fernandez

Departamento de Astronomia, Universidad de la Republica
Tristan Narvaja 1674, Montevideo

Elementary and Secondary Schools. The basics of astronomy are studied in the 6th grade of elementary school. Guided visits to the Montevidean Planetarium are arranged for schoolchildren. At the secondary school level, there is an annual course of general astronomy at the 10th grade (children aged 15-16).

University Education. There is a programme in Astronomy at the Faculty of Humanities and Sciences. The study programme requires four years and ends with a short thesis somewhat equivalent to a Master's Degree.

General Public Education. The Planetarium at Montevideo (founded 1955, 320 seats, 18 meter dome) offers five weekly lectures. The programme is changed frequently. The Planetarium also organizes open astronomy introductory courses. It operates an astronomical library.

The Amateur Astronomers Association was founded in 1952. It has several small telescopes and a library. There are groups devoted to variable star observations, occultations by the Moon, observations of the Sun, etc. The Montevideo association (A.A.A.) is a member of the national organization of amateur astronomers.

ASTRONOMY EDUCATION IN VENEZUELA

Nuria Calvet
Centro de Investigaciones de Astronomia
Merida 5101-A, Venezuela

University Education. Formal studies of Astronomy in Venezuela are concentrated in the city of Merida, in two centers: (1) the Centro de Investigaciones de Astronomia (CIDA), which runs the National Observatory located at 50 km from the city, and (2) the Physics Department of the Universidad de Los Andes. The Astrophysics Group of the Universidad de Los Andes (GAULA) has in its staff six members with Ph.D. or Master degrees. CIDA has three members with Ph.D. in its staff, as well as four engineers in the Technical Department.

Since its creation in 1977, GAULA has offered two optional courses in Astronomy for students enrolled in the Physics Department of the University, who wish to do their thesis work with one of the members of the group. These are General Astronomy courses. The students obtain the degree in Physics. So far, 13 students have graduated in Physics following this option, and 11 are presently doing their thesis work.

Since 1983, CIDA has maintained informal agreements with universities in Caracas, the Universidad Central de Venezuela and the Universidad Simon Bolivar, as well as with the Universidad de Los Andes, by means of which students enrolled in the Physics program can come to CIDA, after finishing their physics courses, take Astronomy courses and work on their thesis project with an advisor from CIDA. In addition, CIDA maintains similar agreements at the graduate level, for students enrolled in the Doctorate Physics programs in the Universidad Central de Venezuela and the Universidad Simon Bolivar. In all these cases, students get their degrees in Physics. Courses offered at CIDA are: Extragalactic Astronomy, Stellar Structure and Evolution, Stellar Atmospheres, Galactic Structure, Astrometry, as well as specialized research seminars. Seven students have graduated so far in Physics with advisors from CIDA, and three more are working on their thesis. In addition, five students are working at the graduate level.

The Technical Department of CIDA enables students from the Engineering and other Technical Departments of the universities in the country to work at CIDA in problems related to astronomical instrumentation. Six students have been involved in this type of program.

A proposal for a Doctorate program in Astronomy, offered jointly by CIDA and the Universidad de Los Andes, is presently being considered by the authorities of this university.

General Public Education. Little has been done so far concerning general public education in Astronomy. Astronomy courses are not taught in primary or high school. There is a Planetarium in Caracas, Planetario Humboldt, which is run by the Navy. They offer elementary courses in Descriptive Astronomy, generally taught by members of one of the several Amateur Astronomy associations in the country.