NEWSLETTER

IAU COMMISSION 46: THE TEACHING OF ASTRONOMY

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HAPPY NEW YEAR!

In a few months, the IAU will hold its 1994 General Assembly in The Hague, Netherlands. IAU members will have received a special issue of the Information Bulletin, containing the program. There will be a special Joint Discussion on new developments in astronomy education, the traditional one-day meeting with local school teachers (time TBA), as well as the triennial business meeting of IAU Commission 46. I look forward to seeing you there! - JRP

TABLE OF CONTENTS

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21ST INTERNATIONAL SCHOOL FOR YOUNG ASTRONOMERS

The 21st IAU International School for Young Astronomers will be held at Cairo University and Kottamia Observatory, Egypt, 18 September - 8 October 1994. Topics to be covered: Stellar astronomy and astrophysics; solar physics; galactic structure, external galaxies, and cosmology; practical astronomy. English will be the language of the School. Accommodations of accepted participants will be covered by local resources. Travel expenses will be the responsibility of the participants. A limited number of travel grants will be awarded upon justified request with the application. Applications with a recommendation from the head of the applicant's institution should be received before 10 June 1994, to be sent to both the Secretary for ISYA, Prof. Donat G. Wentzel, Department of Astronomy, University of Maryland, College Park MD 20742, USA (e-mail internet: wentzel@astro.umd.edu; fax 1-301-314-9067; telex 710-826-0352 ASTRONOMY CORK) and also to the Director of the School, Prof. R.A. Ghobros, National Research Institute of Astronomy and Geophysics, Helwan, Cairo, Egypt (fax 20 2 782683, telex 93070 HIAG UN).

THE EUROPEAN ASTROPHYSICS DOCTORAL NETWORK (EADN)

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In 1986, a group of university graduate institutes of astrophysics in eleven Western European countries established a federation called the European Astrophysics Doctoral Network (EADN). The aim of the EADN is to stimulate the mobility of graduate students in astrophysics who are preparing their doctoral theses within Europe, and to organize Predoctoral Astrophysics (Summer) Schools for graduate students at the beginning of their doctoral research in astrophysics. The network has by now expanded to included 27 institutes in 17 Western European countries, and ways are being actively sought for expanding EADN even further to include also the Eastern European countries. The co-ordinator has been Prof. Jean Heyvaerts (France) until 1992, when Prof. Loukas Vlahos (Greece) took over the responsibilities for one year. During 1993-1995 the co-ordinator will be Prof. Tom Ray (Ireland) and during 1995-1997 the post will return to Prof. Vlahos. The Network is financially supported by the EC "ERASMUS" and "Human Capital and Movement" programs as well as by national funds.

The Student Mobility scheme has been designed to encourage students to undertake part of their doctoral research at a foreign institute, which is part of the Network. It offers, on a competitive basis, financial awards intended to cover student travel expenses and extra expenses encountered by the student due to living away from the home institute. The grants are not full grants since it is expected that the student can retain the home grant while at the foreign institute. The duration of the visit is usually anywhere between 2 and 12 months and must be preceded by contacts between the student's regular thesis advisor and the foreign advisor. These kinds of interactions often lead to further collaboration and the program also includes the possibility for financial travel support for teachers in connection with the student thesis defence.

Each year the EADN organizes a Predoctoral Astrophysics (Summer) School for students at the beginning of their doctoral research in astrophysics. The School provides them with convenient opportunities for initial contacts with the international community of scientists. Students are exposed to major fields of astronomy at an early stage of their own research in order to deepen their scientific education and help them gain maximum advantage from the possibilities offered by European collaboration. Special pedagogical efforts are made to make the lectures (which are given by established authorities in the field) accessible to debutant research students. The level of the courses is normally intended for students having taken one year of advanced lectures in astrophysics (or physics). Young

researchers, having more than one or two publications, are generally not accepted, and there should definitely be no participants who already have their doctorate. As a rule, each School covers two closely related themes, one being astrophysical and the other more methodological, i.e. the field of technology or numerical studies.

The extensive series of lectures are subsequently published in Springer's "Lecture Notes in Physics" Series and by now exist as a significant pedagogical resource. Here follows a list of the seven Schools that the EADN has organized, as well as their topics, the Lecture Notes in Physics (LNP) Volume numbers of the publications and their editors:

1. Les Houches (1988). "Evolution of Galaxies. Astronomical Observations". LNP Vol. 333 - I. Appenzeller, H.J. Habing, P. Lena.
2. Ponte de Lima (1989). "Late Stages of Stellar Evolution. Computational Methods in Astrophysical Hydrodynamics". LNP Vol. 373 - C.B. de Loore.
3. Dublin (1990). "Central Activity in Galaxies. From Observational Data to Astrophysical Diagnostics". LNP Vol. 413 - Aa. Sandqvist, T.P. Ray.
4. Graz (1991). "Galactic High-Energy Astrophysics. High-Accuracy Timing and Positional Astronomy". LNP Vol. (in press) - H.M. Maitzen, J. van Paradijs.
5. Berlin (1992). "Star Formation. Techniques in Infrared and mm-Wave Astronomy". LNP Vol. (in preparation) - S. Beckwith, T.P. Ray.
6. Thessaloniki (1993). "Galactic Dynamics. N-Body Simulations". LNP Vol. (in preparation) - G. Contopoulos, N. Spyrou, L. Vlahos.
7. Cortona (1994). "Plasma Astrophysics: Basic Plasma Processes; Diagnostics of Astrophysical Plasma" LNP. Vol. (in planning) - C. Chiuderi, G. Einaudi.

The published lectures, although advanced, are aimed at a broad audience. They should, in general, be understandable by students who are still beginners in their field, and the large lists of references to the appropriate literature could function as guides to deeper studies in modern developments in astronomy and astrophysics.

The EADN is progressing slowly and expanding at a controlled rate. It has obtained a good reputation among the approximately 500 students, who have already benefitted from the Mobility Scheme and the Predoctoral Astrophysics Schools. It is hoped that the Network will continue to function as a stimulus for future collaboration across the national boundaries.

VATICAN OBSERVATORY SUMMER SCHOOL 1993

Martin J. McCarthy, SJ.
Vatican Observatory

This year from June 7 to July 7 above the shore of Lake Albano in the Castelli Romani at the Papal Palace of Castel Gandolfo and, since 1935, the site of the Vatican Observatory, was convened the 4th Summer School for 26 beginning graduate students in astrophysics under the Deanship of Fr. Richard P. Boyle of the Observatory staff. Fr. George V. Coyne SJ. the Observatory Director arranged the local organization of the school. Fr. Boyle chose as Professors a husband-wife team of scientists from the Steward Observatory of the University of Arizona: George and Marcia Rieke and from the Max Planck Institute in Bonn, Germany Professor Peter Biermann. The topic of the school was "The Centers of Galaxies". These courses were quite concentrated and intensive as world schedules for graduation and summer terms required; in addition a most important limiting condition was present: the time of arrival of the Holy Father for his summer sojourn at Castel Gandolfo. The season selected (one month in late

spring) proved again this year to be a most happy one with very few hot days and the high likelihood of a "brezza del mare" - the refreshing sea breeze which arrives each morning about 11:00 am to keep things fresh and cool. Another refrigerant, intended for later summer days when audiences are held in the cortile of the Palace was the installation by the Vatican Fire Squadron, who drove the large red Mercedes firewagon from downtown Vatican for this purpose, of a large canvas awning which stretches across the courtyard where the visitors await the coming of the Holy Father for the recitation of the Angelus Domini on Sundays..

The 26 students came from 21 countries; there were 8 women and 18 men, approximately the same ratio as those in 1986, 1988 and 1990; the Holy Father pays for the transportation of students from developing nations, which this year numbered 65% of those enrolled. He also supports their living expenses with board and room. The Observatory furnishes a free lunch (one of the last places in the Galaxy to do so) for the Faculty, Students and the SJ Community.

Two classes were given each morning, each 75 minutes duration; these were separated by an "intervallo" for coffee and croissants, served (as was the lunch each day at 12:30 pm) on the porch overlooking the lake and just adjacent to the classroom.

Special emphasis was given this year to the study of galaxies, to regions of starbursts and to the molecular clouds; all these are best discerned in the far infrared region of the electromagnetic spectrum. Spectral studies offered at the summer schools in previous years all treated observational research in these regions but never before the longer infrared wavelengths from 1 to 30 microns which require observations from space or from high mountain stations such as the future site of the Vatican Observatory at 10,500 ft (Mt. Graham in eastern Arizona) or in the laboratory with special vacuum spectrographs.

In addition to the two regular lectures each day, a series of special lectures were offered by the Jesuit staff members who were assisting with VSS 93. These included our newest staff member Guy Consolmagno SJ, a Planetary Scientist and our expert in Meteoritics, our oldest Martin McCarthy and two Spanish Jesuits: Fr. Juan Casanovas, an alumnus of Weston in the Woods and Fr. Manny Carreira who teaches at John Carroll University in Cleveland, Ohio, and also at University of Commillas in Madrid. Besides these, the Director of the Vatican Observatory, Fr.G.V. Coyne and Fr. Richard Boyle SJ, Dean of VSS93, both offered lectures on Protoplanetary Discs and on Polarimetric Studies. Several days during the school this period was devoted to the presentation of 10 min. (exactly timed) presentations by the students themselves on familiar topics: their own observatories and their programs, or reports of beginning research projects already undertaken at their "home" observatories.

This year the afternoons were kept free for private study, for library work and assignments from the professors plus rest and recreation at the Lake, on Mountain paths and on visits to the neighboring hill towns. Students were housed in Pensione Bucci in Castel Gandolfo where breakfast was served each day. The Faculty were housed in special apartments attached to the palace which are administered by the Observatory Director.

One distinct feature of our Summer Schools is that no faculty salaries are offered; their teaching is a distinguished and special gift to the students enrolled. Besides housing and board and room for the Faculty members and their families, their air travel expenses are covered by the Vatican. No fees are charged to the students for instruction, laboratories or library use.

The Holy Father gave his permission for convening the Summer School in his own residence and added the special supports mentioned above. This year the long hoped for visit to the Holy Father by the students and faculty could not be arranged due to the pressure of years-end activities and especially the very heavy concentration of Bishops on their "ad limina" visits. Students and faculty were saddened not to be able to visit the Holy Father and to thank him for letting them use his home for their studies; tours of the Villa Barberini and the locale of the Emperor Domitian's Palace 69AD-96AD plus visits to the site of the Carte du Ciel and the Vatican Schmidt telescopes were arranged.

A special two day visit to Florence was made with special stops at the Arcetri Observatory and to the Museum of Science. Other trips on weekends took different small groups (of students and faculty) to Ostia Antica, to Tivoli, to Subiaco, Palestrina, Cerveteri and a few times also "ad mare": the welcoming and cooling Mediterranean.

While the normal research observations of the Specola Vaticana in recent years have been carried out in O.P. (Other Peoples') observing stations because of the light and smog of Rome and its Castelli, excellent use was made this year of the visual telescopes atop the Papal Palace. Fr. Manny Carreira, Brother Consolmagno and Fr. Sabino Maffeo, the religious Superior of the Jesuits at Castel Gandolfo, both demonstrated some of the wonders of the night skies for the students (and Faculty).

A few "ex alumni", graduates of former Vatican Summer Schools returned during the month to visit and to greet the "spes gregis" of 1993. Here one could note the intercultural bonding under the auspices of the Holy See and with that, the spirit of good will and true ecumenism based on a fundamental mutual respect and a spirit of mutual helpfulness...all under the stars of Italy and beneath the motto given to the Observatory when the site of the Vatican Observatory was founded by Pius XI in 1935:: DEUM CREATOREM VENITE ADOREMUS.

ASTRONOMY AT DEGREE LEVEL: A MAJOR INITIATIVE IN THE UK

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With about 150,000 students, The Open University is the largest university in the UK. In February 1994 a new astronomy course will be launched that will admit about 1,200 students per year, giving the OU a greater number of students studying astronomy at degree level than in all the other UK universities combined!

The course (S281 *Astronomy & planetary science)* is at second year level and requires that its students have previously passed any one of the OU foundation courses in science, technology or mathematics, or have equivalent knowledge. It is only lightly mathematical - algebra and basic trigonometry are used, but not calculus. The course constitutes about 8% of an honours degree, but it can also be taken on its own.

Why should The Open University devote an appreciable slice of its limited resources to producing and presenting an astronomy course? Here, in no particular order, are the main reasons.

1. To meet the widespread interest in the sort of questions that astronomy addresses.
2. To attract people into science and technology, where (in the UK and elsewhere) there is a shortage of trained personnel.
3. To equip schoolteachers with the background needed to introduce motivating astronomical examples into their own subjects.
4. To develop transferable skills in a palatable context, skills such as problem solving, planning and carrying out a project, written communication, verbal communication (in our case via audiocassette), and so on.
5. To raise and sustain the interest of taxpayers who pay for astronomical research.
6. To disseminate the fruits of astronomical research - such research is empty if its results are not distilled into our culture.
7. To develop amateur astronomers' knowledge and skills.

A few of our students will go on to higher level astronomy courses and perhaps even undertake research in astronomy, but the numbers are sufficiently small that this is only a subsidiary reason for

producing the course.

The Open University is unusual in that it is a distance-teaching institution, with students spread all over the UK. The main teaching medium is the printed text. These are written specially by us and are produced well up to the standards of commercial publication. There are also broadcast TV programmes, video & audio cassettes, home experiment kits and home computer software. Though all of this material is delivered to each student's home, the students are not entirely alone: each student has a local tutor (contracted to us part-time from other universities) and many courses have summer schools. The formation of self-help groups is also encouraged. There are tutor-marked and computer-marked assignments throughout each course, plus an end-of-course written examination.

Distance-teaching is spreading around the world, and it has enormous potential, particularly in a subject like astronomy in which there is widespread interest yet a rather small body of people capable of teaching it at university level - particulary in the third world. In distance-teaching a single person can reach right across a country, to meet the needs of a vast number of students. This is because the texts, and the other teaching materials, are designed specifically for independent learning, thus reducing the local tutoring requirement to a relatively small task. This user-friendly approach is crucial: normal textbooks, even very good ones, are not suitable for the independent learner. The main problems with textbooks are

- they contain a lot more material than that required, and thus a tailor-made study guide is needed
- they make assumptions about previous knowledge and skills that are often ill-defined
- the author can work under the assumption that tutors are readily to hand to help the student through difficult (and obscure!) passages
- there is insufficient student-activity: the independent learner needs a text broken up by "stop and think" questions, and with frequent self-assessment questions, with answers and comments.

A question often addressed to us is whether distance-learning works for laboratory work and observational work. We have shown in non-astronomy courses that it does, and in S281 we have grasped the nettle! There are observational projects in which the student has to go out and make real celestial observations. Some of these are qualitative and some are quantitative. None requires optical aid or any special equipment that cannot be readily improvised. The observations are straightforward, and we anticipate that a few of the amateur astronomers on the course will, at first, think the project work trivial. They will doubtless change their minds when they perform a proper scientific analysis of their data, and then write up the projects and submit the write-up to their tutor.

Anyway, the course should soon be underway - watch this space about a year from now to discover how it went.

PUNE REVISITED

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In the second half of August 1993, I went once again to the Inter-University Centre for Astronomy and Astrophysics (IUCAA) in Pune, India, to represent IAU Commission 46 at a conference for teachers. The exact title of the meeting had been: Workshop on Teaching Astronomy in Secondary Schools on the Indian Sub-continent, August 22-23, 1993, and it had been organized by Alan H. Batten, Chairman of IAU Working Group for the Worldwide Development of Astronomy, and by Naresh Dadhich of IUCAA. About sixty teachers coming from all Indian states, and even Bangladesh and Nepal, attended the

workshop. Some of them had to travel by train for four or five days!!

The IUCAA director, Jayant Narlikar, welcomed the participants, and then the speakers presented the following seven topics: Darrell Hoff (USA), Activities in Astronomy for Science Teachers; Nirupama Raghavan (India), Use of Simple Models in Conveying Astronomy Concepts; Syuzo Isobe (Japan), Measurement of Sky Brightness and Sky Pollution; Syuzo Isobe (Japan), Collisions of Asteroids with the Earth; Jayant Narlikar (India), Teaching of Astronomy as a Paradigm of Science; Alan H. Batten (Canada), Using Astronomy to Teach History of Science; Cecylia Iwaniszewska (Poland), Some Practical Methods of Astronomy Teaching. There have been also 6 communications from the teachers themselves and two self-made telescopes have been shown to the audience. The meeting had been aimed at showing the teachers some simple teaching methods or devices. D. Hoff and N. Raghavan brought copies of some of their practical exercises, and have shown their didactic instruments (balls for Moon phases, Jacob's staff, etc.). S. Isobe gave the current issues of the Asian-Pacific Bulletin, and myself, I brought a big package of various didactic documents, mainly those issued lately by the French CLEA, with English translations especially prepared for that occasion. The teachers immediately asked for a possibility of getting copies of the French "Teaching Activity Files", which they have found extremely helpful, presenting a sort of practical guide, full of many didactic notes and remarks. It had been N. Raghavan who finally took the three volumes of "Files" to Delhi, and undertook copying them in the Nehru Planetarium, where she is Director. She will send them to those who will apply and pay the cost of copying and postal charges. Some teachers also asked for the texts of the comments to the sets of didactic slides. "We can take similar photographs here, in our own places, but we want to know what is the best way of using them" was their commentary. All lunch and coffee breaks were usually kept for lively discussions between the participants and the lecturers.

We hope that such meetings will bring more awareness of many possible teaching methods, not very expensive, to many of these teachers, who work all over this big country, a sub-continent really. The teachers rarely get an occasion to know each other, because of the great distances, and also because of the different organization of teaching in every state.

I am writing this still in Pune, sitting under one of the arcades of BHASKARA, the lecture halls constituting a part of the extended scientific complex of the IUCAA. On the large lawn before me I can see the stone figures of four scientists: Aryabhata, the Indian 5 c. astronomer, who believed in the reality of Earth rotation; Galileo pointing towards the Foucault Pendulum in the building behind him, as a best demonstration of "E pur si muove"; Newton sitting under a real, if not apple, tree, contemplating a stone apple at his feet; Einstein looking towards infinity over the roofs of the buildings surrounding the big square, over the IUCAA dome showing the overhead sky as on its Foundation Day, Dec.29, 1988 at 8 p.m. I was here two years ago, en route for a symposium in Hyderabad, when the whole IUCAA was swarming with building activities, and AKASHGANGA, the future housing colony, has been used for offices, library, lecture rooms, canteen, for everything. But now, great changes in the surroundings have occurred, and so many scientific activities are going on. A week ago it was here that the 6th sian-Pacific Meeting of the IAU took place; now, after the teachers meeting, a Miniworkshop on Cataclysmic Variables is going on, then another on Computers, then a meeting of Marathi Science Writers, a Workshop on Astronomy Curriculum in Schools, on Making Your Own Planetarium, etc., until January 1994, when the XX ISYA will be held here.

So I finish by walking along Meghnad Saha and Vainu Bappu Roads, which link together the living quarters of astronomers AKASHGANGA (=Our Galaxy) with the scientific complex DEVAYANI (=Andromeda), and with the big Auditorium ADITI, looking over green trees and flowers in full blossom, listening to birds singing very loudly all the day long. If only humidity would remain less and temperature lower!!

VISNJAN SCHOOL OF ASTRONOMY

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In Visnjan, a little medieval village situated on the west border of the highlands of the Istrian peninsula (West Croatia) the Visnjan School of Astronomy, an international astronomical summer workshop was held this year for the fourth time. Quietness, low light pollution, 245 m above sea level, astronomical and accommodation facilities, and teachers with educational experience in teaching astronomy are the reasons it was chosen for this scientific and educational activity.

The fields of astronomy that were studied theoretically and practically during these years were: asteroids, astrophotography, image processing, design and making of astronomical optics, meteors, occultations and spectra analysis.

Special stress is put on group and mentor work. The changes in the methods of work are so big that the word "school" as the place to learn dogmas, is used only because the word "astronomical workshop" is not often in use here.

Lectures and meetings with professional astronomers and educational excursions to astronomical facilities are organized for all participants. In order to maintain the high level of the programme, the number of participants is limited to 16-18, age from 15 to 20.

The founders of such activity are the AMIL (Academia Minor Ingeniorum Leonardo) and the Visnjan Observatory.

This school was founded as a non-official and non-profit organization in the aid of the existing system of identification and support of scientifically gifted and talented students. This activity, after three years of successful work, was recognized, and now it is partially supported by the Ministry of Education of the Republic of Croatia.

The School is also strongly supported by various donors, so the participants pay only the difference between the real expenses and the amount donated by the sponsor. In spite of the difficult situation in the Republic of Croatia in recent years, the continuity of this scientific and educational activity shows the needs and interest for such manifestation. The most interesting results obtained are published in the **VSA-Bilten** and specialized journals.

Year after year our experience, the number and quality of instruments supporting astronomical and educational hardware grew. Now for the supporting of programs we have: Newton-Ross telescope 410 mm, Dobson telescope 410 mm, Celestron 8" on AVRA mounting, Astrocamera AVRA 4.5/500 mm 6x9 cm, two All Sky cameras 6x6cm, five computers with connections to networks, CCD camera, digitalizer of images, optical and mechanical workshop, library, etc.

University students also participate in our workshops working on research projects, and supporting the work of group mentors. These projects are not limited to the duration of the school.

Educational groups supervising the school activity pointed out some new specificities in the field of education of gifted students. The influence of students' past educational experiences and their interaction with mentors and other members of the group in a free environment, and the methods to motivate gifted students are particularly observed. The comparison of the student curriculum, school success and their motivation and creativity was also very interesting. Such comparison shows us that the existing system of competitions and motivation of gifted students in the Republic of Croatia is partially wrong and counterproductive, notwithstanding possible aspects of inhumanity.

We hope that detailed study of these problems will lead us to define a better model of motivation and education of gifted students and their introduction to science through astronomy workshops. In the Republic of Croatia, the newly formed **Astronomical Society of Croatia** has ambitious plans in these directions.

By methods of brainstorming and questionnaires that are to be used we outlined the new profile of the Visnjan school of Astronomy in the next years.

PUPILS' KNOWLEDGE OF ASTROPHYSICS AT SECONDARY SCHOOLS IN CZECH REPUBLIC, POLAND AND RUSSIA

Vladimir Stefl, Masaryk University, Brno, Czech Republic
Juliusz Domanski, Torun, Poland
Vasilij I. Zinkovskij, Moscow, Russia

This paper summarizes the results of a didactic test of astrophysics which was parallely administered in selected 4th year classes of gymnasium in the Czech Republic, in 4th year of lyceums in Poland and in 10th year of secondary schools in Russia, in 1988-89, 1989-90 and 1990-91. The test was based on the analysis of the relevant teaching matter dealing with astrophysics in the textbooks of the schools in the comparison countries.

The main objectives were to find the pupils' knowledge and skills in astrophysics, which was taught at gymnasium for the first time according to the new curricula and a new textbook from and a new textbook from 1988-89, at lyceums according to a new textbook from 1990-91, and at secondary schools according to a revised textbook. A secondary objective of the research was the comparison of the results of girls and boys. The total number of students was 533 in the Czech Republic, 473 in Poland, and 218 in Russia.

In the test we verified students' astrophysical knowledge and skills concerning the methods of determining distances and fundamental characteristics of stars, the H-R diagram of stars, regularities concerning the evolution of stars, and the interpretation of the Hubble law.

The items of the test were elaborated in such a way as to verify particulary the knowledge of pupils and the skill in applying them to the respective relations and functional dependences expressed in them. We verified such astrophysical information as can be considered a part of secondary general education. We did not verify the memory knowledge containing numerical data. Also we carried out modifications with respect to some differences in the content of the astrophysical teaching matter in the three countries.

The test contained 20 items; in each, students chose one of the five answers offered. The time required for the test was 40 minutes. The results were evaluated by means of a simple system of points, where each student received one point for each correct answer. In processing the results, methods of mathematical statistics were used which were applied to pedagogical tests. The calculations of the results of the test were determined according to a programm by V. Stefl in PASCAL on the PC.

By calculating chi-squared of the test in all statistical groups it was verified, whether the distribution of points of pupils is normal. If not, the median instead of the arithmetic mean, was determined which would better characterize an abnormal distribution of points. The validity of the test was sufficient, since the individual items of the test correspond with the content of the teaching matter in the curricula and the textbooks of the comparison countries. The test can be considered sensitive in Russia and Czech Republic, since the value of the standard deviation of the two groups reached 15 to 20 % of the variation range of the whole maximum of number of 20 points. The value of the standard deviation is smallest in the Poland group. The reliability of the test, determined from the Kuder - Richardson relation, was sufficient for the Czech Republic and Russia; for Poland the test was not sufficiently reliable in the year 1990-1991. The sensitivity of the test was evaluated by means of the differentiating effectiveness of the individual items of the test. The correlation of the results in pairs of items was tested by a four-fold correlation coefficient.

Particular items of the test can be distributed in accordance with the contents of astronomical

themes. Students in Poland showed the most uniform results in all themes. Pupils in the Czech Republic and Russia documented the worst results in astrophysics theme, which is the most difficult one. Pupils in the Czech Republic had the worst overall results in the photometry theme, evidently for the reason that this theme is not compulsory.

The lowest percentage of correct answers was found out with students in Russia (27%) and in Czech Republic (38%) in item 8, which verified the knowledge of important information on the dependence of the character of spectra of stars on temperature. In the astrophysical teaching, it will be necessary to deepen the correct interpretation of the dependence of the character of spectra of stars on temperature in those countries. The knowledge of the definition relation of the Pogson equation, verified in item 4, was demonstrated by only 45% of the students in Czech Republic. But this is not compulsory teaching matter in the textbook at gymnasium. The highest percentage of correct answers in all compared countries was in item 10 concerning the interpretation of the H-R diagram.

The significance test of the differences between two arithmetic means (so-called t-test) was applied to the analysis of the results obtained for girls, boys and all students in comparison countries.

The didactic test used is suitable to verification of knowledge and skill of pupils in astrophysics in all compared schools.

For more information, please write to Dr. Stefl at the address given.

A SCIENCE SCHOOL

Since 1982, the *Science School* has been providing students the opportunity to study for a semester in the dynamic atmosphere of the Ontario (Canada) Science Centre, a world leader in the "hands-on" philosophy of science "museums". The goals of the program are not only to provide a solid basis in the academic subjects but in a non-competitive and co-operative atmosphere, stimulate the students' interest, imagination, initiative, creativity, and ability to communicate. About 25 students are selected each semester from across Ontario to share in this experience.

Five pre-university courses are offered: *Science in Society (Compulsory)*, *Biology*, *Calculus*, *Chemistry*, *Physics*.

The classes are small and informal, the teachers experienced and imaginative and the environment stimulating. Extensive use is made of computers and experiments which are both instructive and fun. Students do more than just cover the material of the Ministry guidelines: they are also involved in the life of the Centre, acting as hosts, working with children, and using resources such as the electron microscope, and rotating room. Creativity and initiative are stressed as well as cooperation and social responsibility. During their stay at the Science Centre, the students become a closely knit group.

One of the many benefits of the *Science School* is that it exposes the students to the excitement of communicating science to children and the public. Despite the fact that students are exposed to teachers throughout their education, they tend to focus on careers in research, engineering or the health-care professions, with teaching looked on as a second-class profession (at least in North America). We need to do more to expose students to the challenge and satisfaction of teaching. For more information about the *Science School*, contact John Percy.

THE SOLAR SYSTEM AND OUR REGION

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Abstract

This work is meant to be a combined activity of two subjects such as astronomy and history/geography and is intended to establish a parallelism between the Solar System and our geographical region. Having fixed a point of departure, the relative position of the planets is determined for a date chosen: a historical event. The Solar System is fitted to the region and also the proportional orbits that the planets would hypothetically follow. This allows us to work in the Solar System dimensions and its characteristics at the same time that a historical event is analysed, which widens the knowledge of the region.

Introduction:

The activity was done at Technical School in the town of Puigcerdà, (latitude 42°26′, longitude 1°56′ W.) placed in the Catalonian region of Cerdanya, in the Pyrenees. It should be remarked that, in general, one of the problems that teachers encounter in this sort of school, in which pupils are educated for specific jobs, is that everything that has to do with basic general knowledge is considered a waste of time. By means of this combined activity, teachers have tried to get the pupils' attention and awaken their curiosity.

The activity:

It was started by choosing a representative central place in the region that was fixed as the origin and where the Sun was to be set; then the farthest place in the region in relation to the Sun, immediately its distance is determined, taking into account the average distance from Pluto to the Sun, a proportion is established in order to fit the Solar System to the region. The radius and the mass of each planet are calculated proportionally and the places where their orbit would pass are studied. This gives us a natural way of deepening our knowledge of Cerdanya, the region.

At the same time, the pupils collect data about physical and orbital characteristics of each planet (density, rotation period, gravity, acceleration...) and also data from observation (colour and if possible its different phases...), then qualitatively find out if there is any relationship. The latter was done with the help of computers. The pupils had to create a data base and had to answer a thorough test in which concepts related to astronomy had been previously introduced. Also the possible observation periods during the year were set with the help of graphics.

The next step was to choose a significant event in order to set the relative position of the planets and establish the places that they have in the region. The fact or event chosen was 7 November 1992, that is 333 years after the "Pyrenees Treaty" which parted the region between Spain and France. This gives us the opportunity of studying the historical event and its consequences.

The relative positions had been set through the graphs of the heliocentric positions that are published in the "Anuario del Observatorio de Madrid" which, although it isn't so accurate, was thought to be clearer than using the position charts. At this moment of the activity, the rising and setting of the planets and the possible time of visibility were also established by means of the graphs got from the "Anuario" mentioned before. The last part of the activity was the making of a wall map where the Solar System was superposed on the map of Puigcerdà and its region. In it, the relative position of the planets

are those corresponding to the date previously chosen, indicating for each its proportional mass and radius and also a piece of fruit is chosen to represent each of the planets.

Conclusion

The fact of being a combined activity surprised the pupils, predisposing them to working in both astronomy and geography/history from a different focus. The fact of using computers makes the work go quicker and the pupil learns techniques to solve questions.

The comparison between the Solar System and Cerdanya and the similitude of the planets with pieces of fruit has been basic to understand the proportion of the Solar System. Placing the planets has allowed us to study their positions and their relative movements and at the same time to analyse a historical event "The Pyrenees Treaty"

Deducing in a qualitative way the relations among the magnitudes has helped to deepen and widen the knowledge of the pupil about the Solar System, and the making of the wall map synthesizes the work done and emphasizes its most important characteristics.

To end with, we believe this activity may be improved by a simple observation of the sky at night time, through which the pupils can learn to orientate himself or herself in the stars, observe their movements and identify the planets. A photograph for example would show us their movements.

This work can also be completed with a study of the locations where the planets have set.

SUNDAY PAPER NEWS FOR YOUNG CHILDREN

Julieta Fierro
Instituto de Astronomía, UNAM

One of the major newspapers in Mexico, Excelsior, has started a Science section dedicated to young children, ages 6-10. It is one page long, and published on Sundays, which is the day most people buy the newspaper. The main purpose is that parents will read to their children and discuss with them the subject at hand. Children can send letters about any related subjects or asking specific questions.

The Instituto de Astronomía of Mexico's National University has been asked to contribute to the section with a weekly article. The procedure is simple since one can fax the text and a small sketch of suggested illustrations. The newspaper staff has a style corrector and a professional artist, so the final product is quite good.

Astronomy is a very popular subject. The variety of articles that can be written is enormous. The first one we included was on contamination by these Mylar advertisements that might wander across our night skies. Other articles have included: names of the days of the week, planetary rings, a prize that was given to Dr. Manuel Peimbert, the M81 supernova, dwarf galaxies, a lunar eclipse, etc.

The astronomy articles have been very successful. Children have enjoyed them.

Also elementary school teachers have responded to them. Because this latter group uses the articles for school purposes we will include an article on fundamental astronomy at least once a month. For developing countries this is a way school teachers can get up to date information on astronomy that they can use during their teaching. These articles are specially useful due to the difficulty they have for purchasing books which are not necessarily written for lower grade levels.

Publishing these small articles in a newspaper is also useful to promote local astronomy. At least in Mexico many people think that science, apart from being evil, is produced by researchers in First World Countries. These articles talk about astronomy created all over the world including Mexico. They also talk about "real" science, and not what is shown, for instance, on many TV fiction shows, which children "learn" from.

FROM A TO Z

ARGENTINA. Professor Nestor Camino is developing a project consisting of the construction of an educational centre, with a planetarium, a sundial, and games designed to teach astronomy, located in a public square in his city. Astronomy has a special appeal to the public. The exhibits in the public square all have a dual role - educational and recreational. The educational buildings include a sundial, traverse board (compass rose and wind direction indicator), earth globe, solar system, southern cross, planetarium and cultural mall; the games are "asteroids round"(like a maypole), annual movement carousel, earth-moon carousel, solar system game (like hopscotch), Voyager mock-up, and "playing with terrestrial gravity". The Goto Optical Manufacturing Co. (Japan) has donated a small planetarium, and the project is in the "final drawing" stage.

For more information, contact Professor Camino at the Depto. Fisica, Universidad Nacional de la Patagonia, Alvear 1021 (9200) Esquel, Chubut, Argentina. Phone/Fax 0945-3729.

AUSTRALIA. The Board of Studies for New South Wales [Policy and Planning Branch, P.O. Box 460, North Sydney NSW 2059] has developed course outlines for three Higher School Certificate Distinction Courses, intended for appropriate accelerating (highly gifted) students in year 12. These are challenging, broadly-based courses approximately to first year university study. One of these courses is Cosmology. This course would occupy 120-140 hours of school time in year 12. Science and math are <u>not</u> prerequisites. There is much emphasis on assignments, essays, projects and seminars. The content covers the scale and content of the universe, the historical and observational background, current models and their justification, and likely future developments.

NEW ZEALAND. During my July 1993 visit to NZ, I was introduced to "Pipehenge", a compass, sundial, calendar, observatory and climbing frame. Looking at first like a standard playground "jungle gym", Pipehenge is actually a teaching tool for astronomy education. It can be used during the daytime to teach students a structured and consecutive regime of concepts such as time cycles, Earth rotation, Sun's position, as well as positional astronomy. The emphasis is on understanding concepts through investigation, thereby teaching a range of process skills. For more information, contact NZ Education Foundation, C.P.O. Box 3443, Auckland, New Zealand.

PERU. The Boletin Informativo SAA (Seminario de Astronomia y Astrofisica), Faculdad de Ciencias Fisicas, Universidad Nacional Mayor de San Marcos, is tangible evidence that astronomy is alive and well in Peru. It lists meetings and lectures in 1993, a summary of SAA activities in 1992, resources and publications, and short articles. For information, contact: SAA, Apartado 20077, Succursal 51 Colmena, Lima 1, Peru; e-mail saa@unmsm.pe, Fax: (51)14-521343.

U.S.A. The Museum of Science, Science Park, Boston, MA 02114-1099, U.S.A., announces the publication of the second edition of "Touch the Stars", a unique astronomy book that brings the visual wonders of astronomy to the fingertips of the visually impaired. Nineteen tactile illustrations of constellation patterns, planet and meteor showers along with braille and large type text enable the exploration of celestial wonders and astronomical folklore. price: $19.95 U.S.; ($10.00 each for orders of 10 or more).

The American Astronomical Society's Education Working Group continues to broadcast a useful electronic newsletter on a monthly basis. For information: SHAWL@KUPHSX.PHSX.UKANS.EDU.

ZIMBABWE. Professor Tony Fairall (Cape Town, Commission 46 representative for South Africa), reports that astronomy teaching in Zimbabwe is flourishing. He visited his old high school in Harare - Prince Edward School - and found a well-equipped observatory, with a telescope which he had helped to build. Two teachers, in particular, have prepared students for the (British) O-level examination in astronomy. The school was also one of six selected worldwide to receive a Global Village Station to receive satellite imagery from both geostationary and low-orbit spacecraft. The school also serves as a venue for meetings of the local astronomical society. With so much of sub-Saharan Africa going through difficult times, it is a great joy to find a pocket of interest in astronomy.

IAU WORKING GROUP FOR THE WORLDWIDE DEVELOPMENT OF ASTRONOMY

Newsletter No. 2, August 1993

Alan H. Batten, Chairman,
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I am trying to keep in touch with all those who have expressed interest in the work of the Group - primarily those who signified their interest by attending our meeting during the Buenos Aires General Assembly two years ago, but also others who have become interested as work progresses. There is as yet no formal membership of the Group and I am giving some thought as to how that should be defined.

Last year I mentioned plans for a meeting of schoolteachers from the Indian subcontinent, to be held in conjunction with the IAU Asian-Pacific Regional Meeting in Pune this month. Thanks to the financial support of the IAU, and some hard work by Profs. Naresh Dadhich and Jayant Narlikar in Pune, this meeting is about to become a reality. I myself leave for India later this month, and we have seven speakers from six countries lined up for the meeting. I am not sure how many schoolteachers will come (the maximum is sixty), but we hope for one each from Nepal and Bangladesh, the rest coming from India itself. This is not entirely a new venture for the IAU, since Commission 46 has, for many years, done something similar at General Assemblies. I have profited from their experience. It is the first time, however, that this has been done at a Regional Meeting. I hope we have pointed the way. Both the Asian-Pacific and Latin-American regions might consider such a session a regular part of their meetings. In the latter case, since the session should be held in Spanish or Portuguese, it would be best that the astronomers in the region should organize it themselves.

I continue to follow up the initiative taken by Prof. Kozai, when he was IAU President, in keeping contact with our colleagues in Viet Nam, and I expect to go there early in October. Their chief concern is to discuss with me the prospects for Vietnamese students to pursue studies at graduate level in the West, but we shall discuss all aspects of astronomy in Viet Nam. Prof. Kozai himself also continues to keep in contact with IAU members in Viet Nam. I hope to use the two trips that I am making to visit colleagues in Estonia, Russia, Malaysia, and Indonesia. For different reasons, our Group has an interest in all these countries, so I will be representing the Group there even though my prime reasons for going are personal.

I have made contact with Dr. H.J. Haubold of the UN Space Applications Programme. He is holding a series of workshops on space science in developing countries. The next is to be in Lagos, Nigeria, October 18 - 22 of this year. I may be going to that, but I am not yet certain since my

arrangements with Viet Nam have priority. It is clear, however, that this Group and Dr. Haubold's office should work together closely. He will be taking part in our meeting at the next General Assembly. The IAU Executive has approved a half-day session for us, devoted to "Problems of Astronomy in Africa". I have invited astronomers from every country on that continent that has IAU members. If any of you have a special interest in this meeting, please let me know. Provisionally, the session is fixed for the morning of Saturday, August 20th, 1994. I will send out a detailed programme as soon as possible. Otherwise, unless something unexpected occurs, there will be no general newsletter next year. I hope that as many of you as possibly can will attend the General Assembly.

ON THE FOUNDATION OF THE VIETNAMESE ASTRONOMICAL SOCIETY

Pham Van Dong
Hanoi Pedagogical Institute, Hanoi, Vietnam

The Vietnamese are now busy overcoming the difficulties created by the aftermath of long drawn-out wars for national defence. The State budget allotted to the development of science and technology is understandably very limited. As a result of an erroneous conception of astronomy as a science with little impact on everyday life, astronomy in Vietnam is paid almost no attention.

At the present, astronomy is not officially taught in secondary schools, only in Teachers' Training Colleges and a number of vocational schools. There is no planetarium in the country. The former observatory was completely damaged and has not been restored. The teaching of astronomy only deals with theories - no practice and no tours are organized, yet students have shown no small interest! It is a pity that we have no way to do better for them!

With a deep sense of responsibility, Vietnamese astronomers convened on April 22, 1993 a general assembly in Hanoi to found the Vietnamese Astronomical Society, with a view to providing initial elements to change the above-described situation. The general assembly elected an executive committee, with Professor Pham Viet Trinh as its president, Doctor Le Minh Triet as Vice-President, and Researcher Nguyen Mau Tung as Vice-President-cum-secretary.

In the actual state of things prevailing in Vietnam, the target set for the activities of the Society at this stage is not high. The Society is to muster its members and the lovers of astronomy to promote and give assistance:

- The popularization of knowledge on astronomy among the people, the building of a planetarium;
- The teaching of astronomy in general education schools and the establishment of a centre for training specialists in astronomy;
- The mobilization of international assistance to build an observatory as a basis for the development of astronomy in Vietnam.

Since the general assembly was held, the Society has been credited with a number of achievements. The popularization of knowledge on astronomy in mass media has increased. The proposal on teaching astronomy in general education schools has been accepted for consideration.

The Society has determined an appropriate place for the building of an observatory. It will be on the top of Mount Bana located at longitude 106° East, latitude 15° North, 1600 m above sea level and 30 km away from Da Nang City on the Eastern Sea. It will enjoy a very large number of clear days in a year. Our Society would like to present this location to the international community in the hope of receiving assistance in the building of the observatory, also to fill a gap in the system of observatories in the world.

We are looking forward to receiving assistance and support from the International Astronomical

Union and national astronomical societies in the building of the science of astronomy in Vietnam. Documents to popularize astronomy, and on the teaching, conducting research on and training experts on astronomy would be welcome. Address: Astronomy Society of Vietnam, T.T.V.L. Ly thuyet, Box 429, BO HO 10000 Hanoi, Vietnam.

ADVERSE ENVIRONMENTAL IMPACTS ON ASTRONOMY

The following declaration emerged from an Exposition on this topic, 30 June to 2 July 1992, UNESCO, Paris, France. For more information, see **Science International** #49-50, Sept. - Dec. 1992.

We the participants at the IAU/ICSU/UNESCO Exposition on Adverse Environmental Impacts on Astronomy declare that the Night Sky with its beautiful stars and its message of our place in the Universe is a precious treasure of all humanity, on which we rely for our knowledge and understanding of our origins and destiny and that Astronomy is one of the most fundamental, appreciated and accessible of sciences.

However, we find that the effects of the civilisation which nurtures our science is producing an environment which is having a desperately serious negative influence on astronomical science. The skies which have been, and are, an inspiration to all humanity, are becoming obscured and even unknown to the younger generation. An essential element of our civilization and culture is rapidly becoming lost and this loss will affect all countries of the Earth.

We believe that this is a global problem to be addressed by intergovernmental organizations and accordingly request UNESCO and ICSU to use all means at their disposal to assist the science and Astronomy to preserve the finest astronomical observatory sites by the additional protection of designation as World Heritage Sites; to urge Member States to afford legal protection to their major observatories in their efforts to preserve unpolluted observing conditions; to urge the Space Agencies and the United Nations Committee on the Peaceful Uses of Outer Space, to agree to the stabilisation of levels of space debris and to seek feasible ways to remove that threat to astronomical observation: to urge all governmental, intergovernmental and non-governmental bodies whose activities may impact the astronomical environment to use their best endeavours to ensure that such impact is minimal and to pursue the investigation of potential international legal protection.

As part of the same meeting report in **Science International**, there is a comprehensive article entitled "Speech May Be Silver, But Silence is Golden" by Derek McNally (formerly General Secretary of the IAU, and a leader in astronomy education). It concludes as follows:

It is easy to be depressed by the range and size of the adverse environmental impacts which currently face astronomy. Their anticipated growth is frightening. There are doubtless many other adverse impacts yet to be recognized. Yet amid that gloom, there is also concrete evidence for good will towards observational astronomy. Consideration is being given to reducing light pollution by lighting engineers; the ITU still maintain frequency protection for the passive services; there are open meetings being held on space debris. The astronomical community cannot relax its vigilance; however, as the hopeful evidence is but a precursor of what could be achieved. There are many who remain unaware of why their activities are a problem for astronomical observation and who are resentful of apparent privilege for astronomy. But the science of astronomy can make a contribution to the understanding of the Earth and its evolution; the view of the heavens is part of the birthright of all of us and it is only in recent times that this cultural experience has been denied to very many worldwide. With the help of ICSU and UNESCO we have made an excellent beginning in presenting our case. It is now up to us as a community to press forward the presentation of astronomy's deep-seated disadvantage from the growth of the technology of modern modes of living.