

46. TEACHING OF ASTRONOMY
(ENSEIGNEMENT DE L'ASTRONOMIE)
(Committee of the Executive Committee)

PRESIDENT: E. A. Müller.

VICE-PRESIDENT: D. McNally.

ORGANIZING COMMITTEE: E. K. Kharadze, J. Kleczek, E. V. Kononovich, V. Kourganoff, E. Schatzman, T. L. Swihart, D. G. Wentzel.

The Commission suffered an inestimable loss with the death of Professor Marcel G. J. Minnaert on October 26, 1970. As a leading scientist, a great educator, and a very open minded and human personality, M. Minnaert was known by a great many scientists and science teachers all over the world. Apart from his important scientific work and achievements he encouraged and helped young astronomers throughout the world in their scientific careers, he promoted the exchange of astronomers, and he developed the teaching of astronomy at all levels. It was thanks to his initiative and great efforts that the Commission on the Teaching of Astronomy was formed during the XIIth General Assembly of the IAU in Hamburg in 1964. His many excellent ideas and suggestions concerning astronomy education will continue to be guide lines for the work of this Commission.

By means of *Circular letters* the President reported to the Commission members information on special teaching materials and on the Commission's activities and services it offers. The Commission members were encouraged to co-operate in the various projects, and were asked for advise in matters concerning the teaching of astronomy. By the end of 1972 six such circulars were mailed to all Commission members since the last General Assembly. H. E. Jørgensen proposed to translate the information and reports of the Commission into Danish and have them published in the elementary astronomy journal *Astronomisk Tidsskrift*, and possibly make some announcements in journals for physics teachers, thus establishing contact with interested Danish science teachers of different school levels. The President suggested that all Commission members should take similar steps in their respective countries.

WORK OF THE COMMISSION

1. *Collaboration with international science teaching organizations*

A. *The ICSU committee on science teaching*

The Executive Committee appointed E. A. Müller the IAU representative for the Committee on Science Teaching of ICSU. The aims of this ICSU Committee, as established in 1969, are (a) to further on an international scale progress in the teaching of science at all levels, (b) to co-operate with other organisations concerned with any aspect of the teaching of science, and (c) to facilitate co-operation among the Teaching Commissions of the International Scientific Unions.

The full Committee has met once a year. Brief reports of these meetings are published regularly in the *ICSU Bulletin*. For each annual meeting the Union representatives are asked to submit written reports on the activities of their respective teaching committees. The remark in the *ICSU Bulletin*, No. 24 (October 1971, p. 12) may be quoted here: "Particular interest was shown in the activities of the IAU Teaching Commission and the use of astronomy as a focal point for courses in integrated science".

A Symposium on Educational Technology in Science and Mathematics Teaching was held in Paris on September 13–16, 1972. It represents a joint effort between the UNESCO Division of Science Teaching and the ICSU Committee on Science Teaching. The Proceedings of this Symposium will be available as a UNESCO publication.

An international Conference on Education of Teachers for Integrated Science ("Teaching Science

for Today's Society') is being organized in collaboration with UNESCO and the University of Maryland. It will be held at the University of Maryland (U.S.A.) on April 3-13, 1973. It is to be a two-weeks working conference designed to develop models for training teachers of integrated science. The participation is limited to about 200 delegates coming from all parts of the world.

The third main activity of the Committee was to advise the UNESCO Division of Science Teaching in its programme on integrated science teaching and the publication *New Trends in Integrated Science*. It is hoped that Volume II of this publication will be available for the Maryland Conference in April 1973.

For the next few years it is intended to give special attention to the need for a closer collaboration among the individual subject teaching committees. One of the problems of today's undergraduate student is that he often does not see the relevance of one science to another. The question then is: "What should be taught to general science students, integrated science or co-ordinated science?" One should, of course, keep in mind that 'integration' does not replace 'scholarship'.

The Committee intends to organize discussion groups or workshops on specific areas of interdisciplinary interest in science and on the relationship between science teaching and social responsibility. Topics such as the following are being considered: (a) Integration, co-ordination or isolation of scientific disciplines; (b) Order and disorder, and its implications in science and society; (c) History and philosophy of science. Another topic which integrates a number of scientific disciplines is The Universe and Life.

It is very important for astronomy education that *also in future years the Commission continues to take an active part in the discussions of the above mentioned problems, and continues to collaborate actively in the work of the ICSU Committee on Science Teaching.*

B. UNESCO

For several years the UNESCO Department of Environmental Sciences had allocated some funds to the IAU for the organization of International Schools for Young Astronomers. Unfortunately, since 1971, these funds are no longer available. The Commission President then approached the UNESCO Division of Science Teaching. The following proposals (shortened version) were submitted to the Division with a request for financial support:

i. *The international schools for young astronomers (ISYA)*

"The Commission proposes to organize each year an ISYA of about 8 weeks duration for promising young scientists from developing countries and institutions."

"The purpose of these schools is to give a concentrated expert instruction and training in special topics of modern astronomy to a number of selected young astronomers or physicists with or without a graduate degree who otherwise would not have such opportunities available to them."

"The schools would be organized at a regional basis. They would be held at a suitable equipped Observatory in a location of good atmospheric conditions, thus allowing ample time for the practical training of the students at the telescope. The most convenient period of time for holding a school would be fixed by the host observatory."

"The teaching staff would be supplied mainly by the host Observatory, but some outstanding specialists from other countries would be invited to teach a course during a limited period of time. The number of participating students would depend on the available teaching facilities (astronomical instruments, assistants and teaching staff)."

"The activities of the schools would consist in regular lectures, practical training, seminars, informal discussions, and study hours."

"As in the past, our Young Astronomer Schools would be financially supported by the host country for the half of the total expenditure if UNESCO provides for the other half."

"There is a great need for expert concentrated training of this kind in astronomy, and we sincerely hope that we will be able to continue organizing these IAU/UNESCO schools for the benefit of many young scientists in developing countries."

The sum of \$8000.- was requested for one ISYA of 8-weeks duration.

ii. *The science teachers' courses in astronomy*

"The Commission proposes to organize each year some courses in basic modern astronomy for science teachers and future science teachers in developing countries. The science teachers at primary and secondary school levels are expected to be familiar with general science but have little or no knowledge in astronomy."

"The courses will have Astronomy as the only subject. The astronomical observations, facts, and problems, their relation to other sciences and technology, and their humanistic implications will be presented in quite an elementary way. The level of the teaching will be adapted by the astronomy teacher according to the level of the participants."

"Courses of two weeks duration are envisaged, each for some 20 to 30 students depending on the size of the classroom and the availability of laboratory assistants. Each two-weeks course would consist partly of basic lectures in astronomy and partly of discussions concerning teaching techniques including the use of various inexpensive laboratory materials."

"The intention is that the participants would not go back and introduce astronomy courses in the schools but would integrate astronomy in general science or physics courses already in existence."

"Astronomy is particularly suitable for an integrated science teaching. It can give the student a feeling of the nature of scientific discoveries and reveals the way of thinking in physical sciences. Astronomy puts man in its proper place between the atom and the universe and opens his mind to see and understand the world we live in."

"Again it is expected that the host country would pay half of the total expenditure if UNESCO provides for the other half."

The sum of \$2000,- was requested for a series of such courses of a total length of four weeks.

In his answer to the two proposals the Director of the UNESCO Division of Science Teaching, H. A. Foecke, explained that due to its very restricted budget the Division was unable to support the training of young astronomers from developing countries, as proposed in the ISYA. On the other hand he expressed the interest of the Division in the idea of incorporating topics in astronomy into integrated science courses. A financial support was thus given to the 1972 Science Teachers courses in Astronomy which were held in Kenya.

Some basic questions were raised by Dr Foecke such as (a) "Do new materials need to be prepared?", (b) "Is there a need for more widespread distribution of existing materials?", (c) "Is the training of teachers the highest priority task at the moment?". *These questions must be seriously considered by the Commission in its future work.* Dr Foecke's questions were answered, at least in part, by R. J. Chambers who taught the astronomy courses in Nairobi (see his report in §3). His comments are: "Astronomy books were conspicuous by their absence on book counters I visited. Astronomy texts from the supply taken to Kenya were left for the libraries of each of the teachers' colleges in Nairobi, but that was a mere token compared to the requirements if the science and its contributions to modern life are to be disseminated to the student population of even that one nation. An inexpensive paperbound pamphlet, in a format large enough to permit printing usable monthly star maps, is badly needed. Such a publication should be a self-contained introductory text on astronomy and space, as well as on observing. Cost should be low, but paper and printing quality should not be sacrificed. Widespread distribution should be a primary objective. *It would therefore be very desirable for preparation of suitable materials to be sponsored by UNESCO and the IAU.*" Dr Chambers urges that "*this matter be given immediate attention.*"

2. *The international schools for young astronomers (ISYA)*

The last ISYA was held at the University of Córdoba (Argentina) during October and November 1970. The director of the school was Prof. J. Sahade. The main purpose of the school was to provide theoretical and practical knowledge in Stellar Astronomy according to the present needs of Astronomy in Latin America.

A total of 21 students attended the courses regularly. They came from Argentinian, Bolivia,

Brazil, Colombia, and Uruguay. Some difficulties arose due to the fact that the background of the participants was not sufficiently uniform. Emphasis was placed on practical work with the 1.5 m telescope and other available equipment at Bosque Alegre.

Most of the teaching was done by the Argentine astronomers. In addition, one lecturer from Brazil and three from Chile were invited to teach on some specific topics related to the main theme of the school. Furthermore, the Secretary of the ISYA, J. Kleczek, – the only lecturer coming from outside Latin America – gave a series of lectures on elementary particles and evolutionary processes in the universe.

The organization of the school was made possible through UNESCO funds (\$8000.-) on the one hand, and on the other through the generous financial support of the following institutions in Argentina: the Argentina National Research Council, the University of Córdoba, the Government of Córdoba, and the car factory Ika-Renault.

The Commission President thanks UNESCO and the institutions in the host country for their generous financial support. Our thanks and deep appreciation go both to J. Kleczek for his efforts in planning a Latin American ISYA, and to J. Sahada for the excellent work he did in organizing and directing the Córdoba school. Our thanks also go to all lecturers and assistants who took part in the teaching and contributed to the success of the school.

During the Brighton General Assembly plans were developed for an ISYA to be held at the *Observatoire de Nice* (France) in 1971. It was hoped to bring to this school young astronomers from all countries around the Mediterranean and from neighbouring countries such as Bulgaria, Portugal, Roumania. The plans could not be developed further, however, due to lack of funds.

Invitations to host an ISYA were received from the following observatories:

- The *Bosscha Observatory*, LEMBANG, Java (Indonesia) – director Dr B. Hidayat;
- The *Observatory of Trieste*, TRIESTE, Italy – director Dr Margherita Hack.

Furthermore, the following places were suggested for holding a future ISYA:

- *New Zealand*: University of Canterbury, CHRISTCHURCH – proposed by C. de Jager;
- *Spain*: University of Laguna together with the observing station of the Imperial College London in TENERIFE, Canary Islands – proposed by D. McNally;
- *Uruguay*: Department of Astronomy and Physics of the University of Montevideo, MONTEVIDEO – proposed by J. Kleczek;
- *Venezuela*: The National Observatory (under construction) and the University of Los Andes, MÉRIDA – proposed by H. Moreno.

In view of the importance and usefulness of the ISYA, the IAU Executive Committee decided to make available a certain sum which would allow the organization of one ISYA during the 1970–1973 period, with preference in a developing country. The organization of a school at the Bosscha Observatory is now under consideration. The available funds, however, are appreciably smaller than those for the previous ISYA. Therefore, the number of students, the number of teachers, and the duration of the school must be drastically reduced as compared to previous ISYA.

The Commission President is most grateful to the IAU for any financial support it is willing to give for the ISYA and recommends that, in future years, *a provision is made of a sufficiently large sum for the organization of the schools which are to give the young astronomers of developing institutions a good and thorough theoretical and practical training. At the same time the Commission President urges the host institutions to try their utmost to obtain for the ISYA financial support from government and private sources.* As the Secretary of the ISYA bluntly puts it: “No money – no schools!”

3. *The Kenya science teachers courses in elementary astronomy*

With the financial support of the IAU and the UNESCO Division of Science Teaching the Commission organized two courses in Elementary Astronomy for Kenya Science Teachers in Nairobi during August 1972. R. J. Chambers of Pomona College, Claremont, California (U.S.A.) was delegated by the Commission to teach the courses. The following is Dr Chambers' report (shortened version) on the courses:

"The courses were held at Kenya Science Teachers College approximately six kilometers from the center of Nairobi. Dr Olaf Eklöf, principal of KSTC, was very cooperative and provided both classroom and housing space for the participants and the tutor. Dr Eklöf has a Ph. D. in astronomy from Upsala University in Sweden, and his understanding of the needs and problems of the courses was particularly helpful."

"The courses were organized by Mr M. A. Quraishy, Physics Inspector of the Kenya Ministry of Education Inspectorate. This dedicated and hardworking official left no detail unattended, and his efforts contributed in greatest measure to the successful conduct of the courses."

"In addition to the funds provided by UNESCO for the courses, \$500.- were contributed by Mrs. John Wescott Myers of Beverly Hills, California. These funds were used to purchase supplementary materials and to transport them to Kenya. Mrs. Myers' generous gift made possible the shipment to Kenya of some 30 astronomy textbooks donated by students at the University of California in Los Angeles and at El Camino College, Torrance, California."

"The courses were officially opened in a ceremony held at Kenya Science Teachers College at 9 a.m. on 13 August 1972. Principal speakers were Mr. P. Mbai, Assistant Minister of Education for Kenya; Dr Olu Ibukun, Head of the UNESCO Field Science Office for Africa; and Mr Peter W. Muthoka, Secretary General of the Kenya National Commission for UNESCO. This meeting was chaired by Mr Quraishy, who pointed out that special thanks were due to Mr Muthoka for his fundamental work in seeing that the courses were held in Kenya."

"The two courses had different objectives. The first course was for science tutors of primary teachers colleges. While not all the 26 participants fit into this category, a sizeable fraction did, and the course content emphasized subject matter appropriate to primary school teachers, together with discussion of methods of presentation to children. In the practical aspects of this, the writer is particularly indebted to his wife, whose master's degree is in primary education, and whose ten years of classroom experience proved invaluable."

"When the weather permitted, the participants were instructed in the use of the telescope, both for stellar and for solar observing. The 4½ in. professionally-made reflector which was brought to Kenya for the courses was used along with a 6 in. amateur reflector available at Kenya Science Teachers College. The latter instrument was repaired by the writer. It had not previously been usable. The 4½ in. instrument will be made available on a loan basis to the schools where participants of the two courses teach."

"The field trip to the Longonot Satellite Station was a feature of both courses. Because of space limitations, only 15 from each course could go. These were selected by lot. The Longonot radio telescope is operated by the East Africa Communications Commission. It provides inter-continental telephone service for East Africa via the Telstar III satellite in orbit over the Indian Ocean. This is a first class facility. The operating personnel are, for the most part, Kenya nationals. They are highly competent, and gave a very thorough and understandable tour, which covered every aspect of the facility."

"The second course was for science teachers of secondary schools and for tutors in secondary teachers colleges. This program ran from 21 August through 31 August. The lecture material in this longer course was expanded to cover a full university level introductory astronomy course. The only exception is that the usual elementary discussion of optics and instrumentation was eliminated, since all participants had taken college level physics. The practical observational work, the discussions on radio and solar astronomy, and the lecture on amateur telescope making more than compensated for the omitted material. Observational aspects usable in secondary teaching were emphasized, and evenings were used for observing, particularly in the latter part of the course, when the weather was much more cooperative."

"Participants in both courses were given a considerable body of materials to retain for use in their teaching. Each received a set of star charts, a list of objects for observation with the unaided eye and with the telescope, a lunar map, an inexpensive replica transmission grating, and an introductory level astronomy text. Dr Eklöf presented participants of the second course with a set of books on space science, provided by a USIS program, for the libraries of their schools".

"The 4½ in. telescope was left with the Instrument Loan Unit of the Kenya Institute for Education. This institute is one of the facilities for higher education of the Kenya Ministry of Education. The Instrument Loan Unit has standard procedures for the circulation of equipment which either because of cost or purpose would not be continuously available at schools throughout Kenya. The telescope is therefore assured of widespread use and of adequate care and maintenance. Along with the telescope there are a finder, two eyepieces, a barlow lens, a solar projection screen, a light mounting, an extensive instruction manual, and a good sky atlas. The box in which the instrument was shipped overseas is being used for its storage and protection now."

"The response to the courses and to the availability of the telescopes was very positive. Participants have initiated organization of a Kenya Astronomy Society. The Ministry of Education, through the Director of Education for Kenya, Mr Kamura, has promised sponsorship and support for the society. Without doubt, the eventual impact of these courses depends on the continued interest of the participants in astronomy. The key to maintaining this interest appears to be the Kenya Astronomy Society. Staff from Kenya Science Teachers College, from the Kenya Institute of Education, and from the Ministry of Education Inspectorate are personally interested. A good proportion of the participants come from four separate regions of Kenya, but with sufficient concentration within each region so that local meetings will be feasible. The writer has undertaken to contact amateur astronomical groups in the U.S.A. and U.K. to request interested persons to advise and encourage development of astronomy in these regional areas. This will probably be the most important follow-up for the courses."

"In addition to the lectures and observational work of the courses, the writer had four occasions to bring the subject of astronomy to public attention. Two newspaper articles were printed, one in each of the Nairobi newspapers. At the request of Dr Olu Ibukun, the writer prepared an article entitled 'Why Teach Astronomy? A Matter of Priorities'. This article will be printed by UNESCO and distributed by Dr Ibukun's office. Finally, the writer appeared on television with Dr Ibukun and with Mr John Steward of the Kenya Ministry of Education Inspectorate. The total solar eclipse of 30 June 1973 will pass through northern Kenya, and has captured considerable public interest. The television program centered on that, and on the question of why astronomy should be taught in schools."

"The courses closed Friday, 31 August 1972. On Thursday evening, 30 August, a closing dinner was held. In his remarks on behalf of the participants, Mr Hezron Watindi, of Sigalagala Technical Secondary School, thanked UNESCO and the IAU for making the courses possible. His statement were direct, and memorable, particularly 'We have seen Scorpio, the Milky Way, and the moons of Jupiter. They were always there, but we never even saw them until someone pointed them out to us and told us about them. Now we can teach our students...'. He went on, but these words remain as the authentication of the purpose of the courses."

The Commission is most grateful to everyone quoted in Dr Chambers report for their contribution to the success of the courses. They helped in the planning and organization of the courses, made the local arrangements, hosted the participants, or made donations for astronomical materials for the benefit of the Kenya science teachers. The Commission's deepest gratitude goes to Dr Chambers for his excellent tutoring, and his devotion and enthusiasm with which he fulfilled his assignment. The Commission expresses its sincere thanks to the IAU and to the UNESCO Division of Science Teaching for providing the financial support. A very special thanks goes to Mrs. Sheila Haggis, of UNESCO Paris, for her constant interest in the project and for procuring the UNESCO funds.

M. Minnaert first realized the need for such courses in developing countries, and the Kenya courses resulted from his original idea. *The Commission sincerely hopes that financial support will be provided also in future years for similar courses to be organized in other developing countries.*

4. *The visiting professors project*

In the December 1970 issue of the *IAU Information Bulletin* (No. 25) the Commission made the following announcement:

“The President of Commission 46 wishes to call attention to the Visiting Professors Project aimed at helping astronomical institutions in countries remote from the main centres of astronomical research. Several institutions have already announced their interest in hosting a Visiting Professor for a limited period of time. The Visiting Professor’s duties will be to give up-to-date courses on different chapters of astronomy and to guide advanced students in research. Competent astronomers with good teaching experience who are willing to work for some time as a Visiting Professor at one of the interested institutions are invited to contact the Commission President. The applicants should state their teaching experience, their fields of research, the period of time they would be willing to teach at the remote institution and the languages in which they could teach.”

The address of the Commission President was given. It should be pointed out that the Commission has no funds for paying the living and travel expenses or the salary of the visiting professor. Some, but not all, of the institutions requesting visiting astronomers are able to provide their living expenses for the duration of the teaching period. The travel expenses must be obtained from other funds. So far almost no response was received to this announcement.

The following institutions have expressed their interest in hosting a visiting astronomer:

- *Brazil*: Observatorio Astronómico, Instituto Tecnológico de Aeronautica (Dr S. Ferraz-Mello), Sao José dos Campos, Estado Sao Paulo.
- *India*: Centre of Advanced Study in Astronomy (Dr R. V. Karandikar), Osmania University, Hyderabad, Andhra Pradesh.
- *Indonesia*: Bosscha Observatory (Dr B. Hidayat), Lembang, Java.
- *Uruguay*: Departamento de Astronomía y Física (Dr F. Cernuschi, Dr Sayd Codina Landaberry), Facultad de Humanidades y Ciencias, Universidad de la República, Cerrito 73, Montevideo.
- *Venezuela*: Instituto Venezolano de Astronomía (Dr Wayne Osborn), Apartado 264, Mérida.

Astronomers going on an observing mission to Africa, Australia, or to one of the large international observatories in Chile, are urged to stop on their way for a stay of a few weeks or months, if possible, in one of the institutions requesting visiting astronomers.

There are several difficulties in this program, however. (1) Most astronomers going on an observing mission have very tight schedules, and the limited time they have available they wish to use as much as possible for their observing and research programs. (2) It takes sometimes months until an answer is received from an institution which expressed interest in hosting a visiting professor. By that time the visitor has made other plans or is already back home from his observing mission. (3) Astronomy professors are usually overloaded with work and duties, and cannot find the time to devote several weeks or even months to the teaching at some remote observatory or institution. This difficulty may be overcome, if capable young astronomers who have specialized in a particular field of astronomy, are accepted as visiting astronomer and are encouraged to go to astronomical institutions in developing countries. This could be very stimulating and instructive both for the students of the host institution and for the visiting astronomer. Such an exchange was carried out very successfully during the first four months of 1970, when a young Danish astronomer, J. O. Jensen, on his way to Australia served as a visiting astronomer at the Bosscha Observatory.

Most of the contact for visiting professorships are made directly, and the Commission encourages this procedure. However, in some instances the intermediary of the Commission is required to obtain information and to establish the contacts between host institutions and astronomers willing to serve as visiting professors for a limited period of time.

In the first part of 1973, during his sabbatical leave, D. G. Wentzel will stay as Visiting Professor for some time at the following institutions in *India*: Tata Institute, Bombay; Madras Institute of Technology, and Madras Christian College, Tambaram; and in *Indonesia*: Bosscha Observatory in Lembang.

Recently S. Ferraz-Mello (Brazil) explained that it would be very helpful for him to have a list of astronomers who travel from Chile to Europe or the U.S.A., or from South Africa to U.S.A. From such a list he could select the astronomers working in the fields that his observatory is particularly interested in. He then could send invitation to these astronomers. Dr Ferraz-Mello says that some funds are available for paying the living expenses of the visiting professor during

his teaching assignment. It would be desirable if, in addition to Brazil, the visiting astronomer also could lecture at the interested institutions in Mérida and Montevideo. The Commission President contacted the directors of the ESO, KPNO and CTIAO, and South African Observatories and transmitted the suggestion by Dr Ferraz-Mello. It is hoped that soon direct contacts can be established and some astronomers be recruited as visiting professors to Brazil, Uruguay, and Venezuela.

A number of astronomers will be in Africa in June/July 1973 for the total solar eclipse of 30 June. They are encouraged to take the time after the eclipse for giving a couple of lectures on the solar eclipse or on Astronomy in general at various African universities or colleges. The Commission President is in contact with UNESCO to obtain a list of colleges or other institutions along the eclipse path that might be interested in some astronomy lectures. This list will then be distributed to the heads of the eclipse expeditions.

5. *Astronomy educational material*

The worldwide list of Astronomy Educational Material (AEM), prepared for the 1970 General Assembly of the IAU, was mailed to institutions and astronomy teachers that requested a copy. The interest for such a list appears to be very great. The supply was quickly exhausted, and several new series of mimeographed copies had to be produced. The Commission President constantly receives orders for a copy, from all parts of the world.

For the 1973 IAU General Assembly an Addendum to the AEM is being prepared which will list the recent up-to-date material useful in the teaching of astronomy. The following Commission members are in charge of editing this addendum:

- E. V. Kononovich: material in Russian and other slavic languages,
- V. Kourganoff: material in all languages with the exception of English and the slavic languages,
- T. L. Swihart: material in English language.

All Commission members were asked to prepare a list of good and useful teaching material which appeared in their respective countries and languages. These individual lists are then to be sent to the appropriate Commission member mentioned above. These in turn are responsible for assembling and editing the final list and for its worldwide distribution.

After the 1970 IAU General Assembly, P. V. Sudbury (Liverpool, U. K.) prepared a list of manufacturers and agents of planetarium projectors for classroom use in schools and colleges. He mentioned that he included in the list "some instruments with fixed star spheres that are valuable for classroom use, but which are not planetaria in the modern sense of the word." The list was mailed to all Commission members and to anyone interested.

6. *The contratype project*

For teaching Astronomy, it is essential to have good observational material with which the students can work. Many institutions do not have such material on hand. Therefore, the project Contratype was created and developed by M. Gerbaldi, E. V. Kononovich, and D. G. Wentzel.

Dr Wentzel reports the following:

"A collection of photographic materials, positives and negatives, films and prints, is available for borrowing by mail for reproduction at the borrowing institution. The collection is intended primarily for use in developing countries; it is not a replacement for commercially available pictures from the major observatories. However, several groups of pictures in this collection, such as series showing time developments of various phenomena, are not otherwise easily available and may be of interest in all countries."

"Ultimately the collection will be available in a central office. However, until discussion at the IAU meeting in Sydney in August 1973, the pictures are at the following three locations:

- Miss Michèle Gerbaldi, Institut d'Astrophysique, 98 bis Boulv. Arago, Paris 14e, France;
- Dr E. V. Kononovich, Sternberg Astronomical Institute, Moscow V-234, U.S.S.R.;

– Dr D. G. Wentzel, Astronomy Program, University of Maryland, College Park, Md. 20742, U.S.A.

Of the several dozen institutions asked to contribute, seventeen responded.”

D. G. Wentzel prepared a list of the complete collection. This list was distributed to all Commission members and to anyone interested. The collection contains material on the Sun, the Solar System, Normal Stars, Novae and other Variable Stellar Objects, Nebulae, Galaxy, Other Galaxies and Cosmology, Observatories and Equipment.

The Commission is indebted to all astronomers and institutions who contributed to this collection. It is hoped that it will serve for the training of many Astronomy students throughout the world.

7. *The book project*

This project, proposed by D. McNally, is intended to help institutions that need good basic astronomical publications but lack the money to buy them or have currency exchange problems. Large institutions may have double copies of astronomical publications useful in teaching and/or research which they might be willing to send to a needy institution. The Commission tries to put needy institutions and people wishing to help them in contact with each other. Some such transactions could be arranged as a consequence of the Commission sessions held in 1970 in Brighton.

All Commission members were asked to inform the President if they knew (a) of institutions which are in need of basic astronomical publications but have financial problems, and (b) of individuals or institutions who would be willing to donate books or journals to needy institutions. It was envisaged that if sufficient requests and offers were received, a clearinghouse could be organized which would establish contact between the needy and the donating institutions. There was no response to this inquiry.

D. McNally reports the following:

“Out of the project arose a scheme for making known Library Desiderata through the *IAU Information Bulletin*. A list of Library Desiderata sought together with the requesting institutions will be published from time to time in the *IAU Information Bulletin*, in the hope that institutions having such material for disposal will enter into direct negotiations with the requesting institution regarding terms of sale, exchange, gift, long or short term loan.”

Such list of Library Desiderata could also be published in major astronomical journals which get a worldwide distribution.

In connection with this project the Commission President was informed by F. M. Flinsh, Vice-President of the International Union of Amateur Astronomers, that the IUAA distributes free of charge astronomical texts and publications to organizations that do not have the funds for the purchase of this type of material. The IUAA is funded to the amount of \$2500.– per year, by a bequest, for this purpose.

8. *Exchange of equipment*

The XIV IAU General Assembly resolved to create a Joint Working Group of Commissions 9 and 46 for Exchange of Equipment. The Organizing Committee of Commission 46 proposed G. Abell and D. McNally for Commission representatives in the Joint Working Group which is chaired by N. N. Michel'son (see his Report).

9. *National activities in astronomy education*

In 1969 the Commission members were invited to prepare a report on the new trends and developments of astronomy education in their individual countries. These reports were collected by the Commission President who edited the final document which was presented at the 1970 IAU General Assembly. A similar report on national activities in astronomy education is planned for the 1973

IAU General Assembly (*National Reports*, 1973). Again it will be distributed in mimeographed form to all Commission members and interested astronomy teachers. It will be available upon request to anyone interested.

The problems of the astronomy teaching activities are quite different in developed and developing countries. In countries where astronomy departments are well established, the astronomers interested in the teaching are very much concerned with the astronomy education at the primary, secondary, high-school, and college non-science levels (i.e. the U. K. or the U.S.A.). On the other hand there are many institutions both in developed and developing countries which are starting to organize an astronomy department and who wish to train future astronomers. So their main concern is to provide a good graduate training. In some countries efforts are being made to raise the standard of astronomy education so that their qualified students can compete with astronomy students of higher standard astronomy departments. The Commission must try to help in all these situations by disseminating information as much as possible and by developing its current projects and adding some others whenever necessary.

A. *Advanced courses in astronomy*

In many countries astronomers have been aware of the need for advanced courses concentrating on some selected subjects for pre- and postdoctoral and established astronomers. These advanced courses can be held during university vacations on a national, regional, or international scale. Examples of such courses are those offered by the United States National Science Foundation, or by the CNES in France; those at Varenna organized by the Italian Society of Physics; the Saas-Fee Schools, organized by the Swiss Society of Astronomy and Astrophysics; the courses sponsored by the NATO Science Program, and so on. Such courses are extremely useful and highly recommended by the Commission.

B. *Basic modern astronomy courses for school science teachers*

In most countries Astronomy is not a regular subject of the curriculum in secondary and high schools. In some countries efforts are being made to introduce an optional course of astronomy at the secondary and/or high school level. Another way of introducing astronomy in schools is to integrate it in general science or physics courses. In order to do this it is necessary to offer to the science teachers (a) an in-service training by means of short concentrated courses in modern astronomy, (b) teacher's guides on selected topics of modern astronomy, (c) information on available astronomy teaching material.

Concerning point (a) astronomers in various countries have organized, quite successfully, such courses for their school science teachers. This is most valuable and should be continued and extended as much as possible.

Point (b) was already discussed during the Commission sessions at the last IAU General Assembly, and it was mentioned that some such teacher's guides are already in existence such as the Harvard Project Physics, the Nuffield Physics Project, and others. Various Commission members reported that they are involved in preparing teacher's guides or 'leaflets' on astronomy for school science teachers (see *National Reports*, 1973).

As to point (c) G. Abell and E. P. Levitan independently suggested that the Commission should consider a regular publication – News Sheet or Magazine – that would contain information needed by teachers. Information could also be disseminated by means of already existing publications such as journals of national teacher's associations and/or amateur astronomers. This matter must be discussed further during one of the Commission sessions in Sydney.

C. *Conferences*

The national astronomical societies of several countries have each formed a special committee which is concerned with the development of astronomy education in the particular country. Local conferences and meetings were held and projects and programs were proposed for improvement of astronomy education (see *National Reports*, 1973).

The following two conferences may be quoted because they are of interest to the international community:

i. *The international conference on education in and history of modern astronomy*

This Conference was held in New York on August 30 and 31 and September 1, 1971. The Conference was dedicated to the memory of Marcel G. J. Minnaert. This very successful conference was chaired by R. Berendzen who also edited the Proceedings (*Annals of the New York Academy of Sciences*, Vol. 198, August 25, 1972). It was co-sponsored by the American Astronomical Society and The New York Academy of Sciences.

ii. *The conference on demonstrations in astronomy for classroom use*

This conference was held at the Michigan State University (U.S.A.) on August 1972. It was sponsored by the Committee on Education in Astronomy of the American Astronomical Society. An exhibit of astronomy teaching materials was connected with this conference. It showed photographic materials, laboratory exercises, demonstration equipment and self-paced astronomy education. Details may be obtained from D. G. Wentzel.

10. *Recommendations for future activities*

Some of the important tasks of the Commission have already been mentioned and underlined in the preceding paragraphs (see the ends of paragraphs 1A, 1B, 2 and 3).

High priority should be given to both the ISYA and the astronomy education of science teachers in developed and developing countries. Due to the existing difficult financial conditions, a new concept of the ISYA may have to be worked out. In addition there is a pressing need for Visiting Professors in Africa, Asia, Latin America, and New Zealand.

A very useful and realistic task of the Commission is the dissemination of information on available astronomy teaching aids such as laboratory exercises, photographic materials, equipment, astronomy teaching methods etc., that have been successfully used, for the benefit of all astronomy and science teachers throughout the world. This does not necessitate financial support. It requires, however, the cooperation and efforts of *all* Commission members in *all* countries. They should communicate to the Commission President any such information they know of and disseminate in their respective countries the information received from him (or her).

Finally the Commission recommends the preparation of inexpensive multi-lingual text and manual publications on astronomy for teaching and research. The materials should be excellent but of low cost so that anyone can buy them.

EDITH A. MÜLLER
President of the Commission