

COMMUNICATIONS  
FROM THE  
UNIVERSITY OF LONDON  
OBSERVATORY

No. 77

REPORT ON THE PRESENT STATE OF ASTRONOMICAL EDUCATION  
IN THOSE COUNTRIES REPRESENTED ON COMMISSION 46  
OF THE INTERNATIONAL ASTRONOMICAL UNION

by

D. McNALLY

July 1976

## C O N T E N T S

<u>Individual Reports</u>	<u>Page</u>
Australia (A. W. Rodgers) .....	1
Belgium (L. Houziaux) .....	1
Canada (J. L. Climenhaga) .....	2
Czechoslovakia (J. Kleczek) .....	3
France (V. Kourganoff) .....	3
German Federal Republic (H. Scheffler) .....	12
Greece (L. N. Mavridis) .....	12
Italy (M. Rigutti) .....	14
Japan (N. Owaki) .....	18
Mexico (P. Pişmiş) .....	20
Nigeria (S. E. Okoye) .....	21
Norway (Ø. Elgarøy) .....	22
Poland (C. Iwaniszewska) .....	22
Portugal (J. Osorio) .....	24
South Africa (A. H. Jarrett) .....	24
Sweden (Aa. Sandqvist) .....	28
Switzerland (B. Hauck) .....	31
United Kingdom (A. J. Meadows) .....	32
United States of America (T. L. Swihart) .....	33
Union of Soviet Socialist Republics (E.V. Kononovitch) .....	34

## INDIVIDUAL REPORTS

### AUSTRALIA

A. W. Rodgers

In Tertiary and Post-graduate levels, astronomy training in Australia has not changed since the last I.A.U. held in Sydney. The only specific astronomy taught is in post-graduate schools which depend entirely on the excellence of the mathematics and physics taught at undergraduate level as a basis for astrophysics training.

Progress has been made in several directions though, in our efforts to have astronomy used as a vehicle for the teaching of natural science in schools. Wilkinson, the Australian consulting member of Comm. 46 has been a prime mover in this field but unfortunately his efforts have been thwarted by professional radioastronomers who do not seem to understand the immediacy of impact of natural optical phenomena on the minds of primary and secondary school children. Nevertheless, the newly created Education Council in the Australian Capital Territory is persevering with professional astronomical help and is currently producing a syllabus for astronomy training at senior high school level and we hope this will find acceptance in other Australian states.

\* \* \*

### BELGIUM

L. Houziaux

Astronomy is taught in Belgium at undergraduate level in the sections of mathematics and physics at nine universities. At Graduate level, Astronomy is generally optional and one can estimate that about 25 students specialize each year and write a short research memoir in astronomy. Doctor degrees are granted at an average rate of 3 per year. Since 1973, efforts have been made in order to get the students more acquainted than in the past with practical work at the instruments. Students in several institutes are systematically sent to well equipped observatories where they take part in routine observing programmes. Since 1975, under the banner of the National Foundation for Scientific Research (FNRS), a Committee set up by the Belgian National Committee for Astronomy (CNBA) has organized on an inter-university basis, post-graduate courses (called "third cycle studies") in astronomy. 34 courses have been established, but 4 or 5 are actually organized each year. The lectures take

place at the professor's University and travel expenses of the students are reimbursed by the National Foundation for Scientific Research, which also pays for the administrative fees. In order to be accepted, students must hold a degree of "Licencié" either in mathematics or in physics (4 year university courses). A certificate is delivered to the student who has attended all the lectures and passed successfully the examinations. These certificates are recognized by the universities as a prerequisite for presenting a Dr. Sc. thesis.

The response of post-graduate students to this initiative has been quite encouraging and the first certificates were delivered in February 1976. It is foreseen that the teaching of astronomy at graduate level will be organized more and more on an inter-university basis in the future.

In parallel to this action at University level, a great deal of effort has been devoted by the "Commission belge de l'Enseignement de l'Astronomie" to the introduction of lectures in elementary astronomy in secondary schools. After several years of constant endeavour, astronomy has been accepted as part of the course in geography, mathematics (optional) and physics (optional). In order to enable the teachers to face their new duties, astronomers have been asked to deliver lectures to interested teachers in secondary schools. These lectures have been quite successful, so that in 1976, the Ministry of Education and French Culture has organized a three-day session at a special centre for "recycling" teachers. It has been followed with enthusiasm by about 50 teachers selected among 150 applications. Ten instruments were available for night sky observations. Lectures have been given by professional astronomers, while practical work (construction of an astrolabe) enabled the teachers to get acquainted with the subjects taught during the session. This type of activity will be pursued in subsequent years.

\* \* \*

CANADA

J. L. Climenhaga

A Sub-committee on Education, chaired by Dr. David DuPuy, Astronomy Department, St. Mary's University, Halifax, Nova Scotia, has been formed by the N.R.C. associate Committee on Astronomy which is working with the Canadian Astronomical Society. It is hoped to improve liaison between different parts of

Canada and to provide a more co-ordinated effort for stimulating teaching of astronomy at universities, colleges and schools. A teaching package is being prepared for distribution to all physics and mathematics departments, community colleges and planetaria in Canada. The package will include a list of elementary textbooks and laboratory manuals with comments on the usefulness of each, a list of slides, films and tapes applicable to teaching of astronomy, suggestions of experiments that might be performed with inexpensive telescopes, etc. A special paper session on "The Teaching of Astronomy" has been arranged for the Canadian Astronomical Society meeting to be held in June.

\* \* \*

CZECHOSLOVAKIA

J. Kleczek

At Prague we have at present only one student of Astronomy. There are a few students in Bratislava - capital of Slovak Socialist Republic.

What is excellent in our country, however, is the popularisation of astronomy at all levels - from kindergarten to special courses in astronomy taught by astronomers. There are different competitions for students of secondary schools. There are two good journals (one in the Czech, the other in the Slovak languages) devoted only to Astronomy. There are several other journals where astronomical articles are regularly found.

\* \* \*

FRANCE

V. Kourganoff

Dans certains secteurs l'enseignement de l'Astronomie en France, entre 1973 et 1976, a subi d'assez profonds changements, et des changements plutôt favorables. Un point noir, cependant: tous les enseignements de l'astronomie restent optionnels (facultatifs). Certes l'on pourrait penser que cela présente l'avantage de sélectionner des "enseignés" fortement motivés, mais la concurrence d'autres enseignements intrinsèquement intéressants, et beaucoup d'autres facteurs, ont pour effet de limiter très sévèrement la portée et le recrutement de tout enseignement facultatif.

Il est naturel de décrire séparément la situation au niveau de l'enseignement secondaire et aux différents niveaux de l'enseignement supérieur.

### Enseignement secondaire.

L'enseignement de l'astronomie au niveau du "secondaire" a subi, au cours des trois dernières années, une évolution assez favorable grâce à l'effet jumelé des circonstances suivantes:

1. L'introduction, en France, dans les lycées et les Collèges d'Enseignement Secondaire (CES), de l'autorisation donnée aux professeurs de consacrer 10% de leur enseignement à des "activités libres", hors des programmes officiels, choisies par les professeurs après consultation des élèves.

Or, un sondage effectué en 1975 par l'Association des Professeurs de Mathématiques, a montré que l'Astronomie est la discipline la plus appréciée et la plus "demandée" dans le cadre de ces activités optionnelles. Les élèves demandent que l'on consacre les 10% à l'Astronomie parce que "on y apprend des choses passionnantes et qu'en plus l'on peut faire des expériences et construire soi-même de petits instruments".

2. La formation en France, sous l'égide du Comité National Français d'Astronomie, d'un groupe spécialisé (GS 12) se consacrant aux problèmes d'enseignement de l'Astronomie, dont une des préoccupations majeures a été jusqu'ici l'organisation d'une participation d'Astronomes professionnels (bénévoles) aux 10% d'activités libres du secondaire.

Le GS 12 s'est préoccupé de canaliser les demandes vers une trentaine de (jeunes) astronomes, volontaires pour se rendre dans les établissements secondaires, pour s'y livrer à une "animation" d'activités astronomiques. (L'ampleur de la demande a été telle qu'elle n'a pas pu toujours être satisfaite, surtout en ce qui concerne les "visites d'observatoires", moins bien équipés, que les observatoires russes ou américains, pour cet usage).

3. Un début de renouvellement de l'enseignement de la physique dans l'enseignement secondaire, a permis l'introduction dans certaines classes (de très jeunes élèves) d'un "module d'Astronomie" dans le cadre de "travaux pratiques" de technologie. Malheureusement le niveau des connaissances de ces élèves, trop jeunes, ne permet pas un enseignement d'astronomie physique suffisamment intéressant. Une difficulté supplémentaire réside dans l'insuffisance des connaissances en astronomie des professeurs de physique des lycées et collèges, car en raison du caractère

optimal de l'enseignement de l'astronomie à l'Université, ceux qui n'ont pas choisi l'option correspondante ignorent tout de l'Astronomie classique ou moderne. L'on voit sur cet exemple, que le problème de l'enseignement de l'astronomie forme un tout où tous les niveaux d'enseignement sont liés, alors qu'en France l'enseignement secondaire et l'enseignement universitaire dépendent, très étroitement, d'administrations différentes. Fort heureusement certaines commissions chargées de réformer l'enseignement secondaire comprennent généralement des physiciens universitaires, dont plusieurs (mais, hélas, pas tous) sont très favorables au développement de l'enseignement de l'Astronomie, à la condition (très regrettable) que l'Astronomie serve à rendre "plus amusant" l'enseignement de la physique, et ne soit pas enseignée en tant que discipline autonome visant à la connaissance de l'Univers et des objets qui le composent (beaucoup d'astronomes sont d'ailleurs malheureusement d'accords avec les physiciens sur ce point: ici l'idée de "l'enseignement intégré" s'oppose au développement de l'enseignement de l'astronomie).

D'autres activités que celles de la coordination des "animations" du GS 12, ont été également très favorables à l'introduction de l'enseignement de l'Astronomie dans l'enseignement secondaire, Ainsi une liste de "documents pédagogiques" (existants ou élaborés spécialement à cet effet par certains membres du GS 12), tels que livres en langue française, diapositives, films, a été fournie aux professeurs du secondaire intéressés. Les diapositives astronomiques ont été accompagnées d'un livret expliquant leur liaison avec certaines lois physiques enseignées dans le secondaire. Ce travail a été effectué en liaison avec un organisme (OFFRATOME) qui s'occupe de la réalisation de documents radiophoniques ou télévisés à finalité pédagogique et culturelle. Un film sur les éclipses du Soleil est en cours de réalisation dans le cadre de l'OFFRATOME. Dans le même ordre d'idées, le "Bulletin de l'Union des Physiciens" a entrepris, la publication sur la demande du GS 12, l'articles d'astronomie destinés aux professeurs de physique du secondaire.

#### premier cycle (les deux premières années) de l'enseignement supérieur

À la faveur de la récente réforme du "premier cycle" de l'enseignement supérieur, réforme introduisant le "Diplôme d'Etudes Universitaires Générales" (DEUG), un enseignement d'Astronomie a pu être introduit, depuis deux ans, sous la forme d'une option, en première ou en deuxième année des Universitaires. Toutes les universités n'ayant pas répondu en temps utile à la circulaire du rapporteur demandant des renseignements à ce sujet, il

est possible que la liste ci-dessous soit légèrement incomplète. Mais les informations disponibles indiquent déjà qu'un progrès énorme a été accompli, au cours des dernières années, dans ce domaine.

Une option d'Astronomie (ou d'Astrophysique ou d'Astrométrie) existe désormais (en première ou en deuxième année du DEUG) des universités françaises suivantes (par ordre alphabétique); (durée de chaque ens<sup>t</sup>: 1 an):

Beaune:

Introduction générale à l'Astronomie (50 h. par an).  
Les Travaux dirigés sont incorporés dans le "cours magistral".  
Par manque de personnel compétent on a renoncé à des Travaux pratiques. Environ 20 étudiants.

Bordeaux:

Le cours (12 h. par an) porte uniquement sur l'Astrophysique: Faits d'observation sur les étoiles et la matière dans la Galaxie Structure interne des étoiles à la lumière des lois physiques relatives aux gaz, au rayonnement thermique, au champ de gravitation et aux réactions thermonucléaires. Evolution stellaire.

Caen:

Un cours (durée et programme non communiqués) d'Astrophysique et d'Astrométrie. Ici l'enseignement présente aussi l'heureuse particularité d'inclure une option d'histoire de l'astronomie dans le cadre de l'enseignement de l'histoire générale des sciences.

Caen:

Un cours d'Astronomie, "largement suivi" (durée et programme non précisés).

Caen:

Un cours portant sur des notions d'astronomie fondamentale et un cours d'astrophysique (magnitudes, classification stellaire, structure de la galaxie, matière interstellaire, généralités sur les galaxies). Cet enseignement est suivi par 25 étudiants environ.

Caen:

Une option d'Astronomie a été créée en 1974, mais elle a été supprimée en 1975 faute d'"heures complémentaires" pour payer les enseignants.



Paris VI: (Halle aux Vins): Une option d'Astronomie existe (durée des cours et programme non communiqués).

Paris VII: Le cours porte uniquement sur l'Astrophysique: Découverte générale de l'Univers comme grand laboratoire de physique. Il est suivi par 250 étudiants environ. (Egalement "Halle aux Vins").

Paris XI (Orsay): Le cours porte à la fois sur des notions d'Astronomie fondamentale et sur une étude "descriptive" des principaux objets astronomiques illustrant "l'Univers-Laboratoire". (Environ 50 étudiants).

Paris IX: Le cours porte sur "La structure et l'évolution de l'Univers": (Propriétés générales de la matière et du rayonnement; Composition de l'Univers actuel; Evolution de l'Univers; Instrumentation et techniques d'observation terrestres et spatiales.) Durée et nombre d'étudiants non précisés.

Deuxième cycle (troisième et quatrième année) de l'enseignement supérieur.

L'enseignement d'Astronomie optionnel (représentant, en principe, un quart du programme suivi par les étudiants pour l'ensemble du second cycle) s'est maintenu, au cours des années 1973-76, dans l'ensemble des universités françaises, avec cette différence importante que dans certaines universités il a été "dilué" dans d'autres enseignements au point de ne plus représenter qu'un huitième du deuxième cycle. Voici la situation, université par université (dans l'ordre alphabétique).

Paris VI: L'enseignement d'Astronomie (C4) se décompose en deux "unités de valeur", d'un semestre (37 h) chacun. Le programme se compose de la dynamique stellaire (spécialité du professeur responsable de cet enseignement) et d'une "introduction aux principaux thèmes de l'astrophysique" (en quantité limitée, l'assistante du professeur n'ayant aucune formation dans ce domaine). Le nombre d'heures de travaux dirigés est double de celui des cours. Il n'y a pas de Travaux pratiques (manque de personnel compétent).

Orsay:

L'enseignement d'Astronomie (C4) correspond à un total de 120 h. de cours, travaux dirigés et stages à l'Observatoire. Le programme varie d'une année à l'autre. En 1975-76, il a porté sur la matière interstellaire et la formation des étoiles (Techniques d'observation: radioastronomie; Physique du milieu interstellaire: Chauffage, refroidissement, état physique du gaz interstellaire; Formation des étoiles: Contraction gravitationnelle, recyclage, de la matière interstellaire; Structure interne).

Orsay:

L'enseignement d'Astronomie (C4) est "traditionnel".

Orsay:

L'enseignement d'Astronomie (C4) correspond à un mélange d'Astronomie fondamentale et d'Astrophysique.

Orsay:

Le programme du C4 d'astronomie comporte la reprise des questions traitées au premier cycle en les approfondissant et, en plus, la structure interne et l'évolution des étoiles; la cosmologie et l'énergie solaire. Cet enseignement est suivi par 70 étudiants environ.

Orsay:

Le programme du C4 d'Astronomie se décompose en deux "unités de valeur": une de Mécanique Céleste et une autre d'Astronomie.

Orsay:

L'enseignement d'Astronomie est "dilué" dans un enseignement de physique relatif aux "Champs et Particules": il comporte une Introduction à l'Astrophysique (Etoiles denses, Evolution stellaire, Cosmologie, Milieu interstellaire, etc). Il est suivi par 60 étudiants environ.

Orsay (Orsay):

L'enseignement d'Astronomie (C4) comporte 3 heures de cours d'Astrophysique et 1 heure de cours préparatoire aux techniques spatiales (cette dernière heure facultative) et 2h30 de Travaux Dirigés hebdomadaires pendant un an. Le tout accompagné de 18 séances de 3 h. de Travaux Pratiques. Le programme porte essentiellement sur l'Astrophysique Générale; La Cosmologie élémentaire (newtonienne et relativiste); La Théorie du Transfert du rayonnement;

La Physique des Intérieurs stellaires; L'étude théorique et observationnelle des Quasars, Pulsars, Etoiles à Neutrons, Sources-X, Sources du rayonnement Gamma; Masses des Etoiles. Il est suivi par un nombre d'étudiants qui varie entre 40 et 50 suivant les années. L'enseignement utilise une méthode pédagogique particulière: les étudiants sont dispensés de la prise de notes mais a la fin de chaque cours son contenu est distribué aux étudiants sous la forme d'un polycopié gratuit, rédigé par le professeur.

Le Mans:

L'enseignement du C4 d'Astronomie comporte 3 h.de cours et trois heures de Travaux Diregés ou pratiques par semaine. Il porte par moitié sur l'Astronomie Fondamentale et par moitié sur l'Astrophysique.

Orléans:

L'enseignement d'Astronomie est "dilué" dans un C4 de géophysique générale, et en représente la moitié. Programme (2 h par semaine pendant un an): Astronomie générale; Mouvement des corps célesta et des satellites artificiels; Astrophysique générale; Génèse et évolution des étoiles et des galaxies; Physique des relations Soleil-Terre. (Le nombre d'étudiants n'est pas précisé).

TROISIÈME CYCLE (5<sup>e</sup> et 6<sup>e</sup> année): ENSEIGNEMENT SPECIALISÉ PREPARATOIRE A LA RECHERCHE

Pour ne pas trop disperser les efforts, et pour rapprocher cet enseignement des centres de recherche, l'enseignement de "troisième cycle" est limité à un petit nombre d'universités et au Collège de France.

Paris VI:

Au niveau du 3ième cycle l'Observatoire de Besancon fonctionne simplement comme un "laboratoire d'accueil" pour l'université de Paris VI (Halle aux Vins). Il se consacre exclusivement à la dynamique stellaire (spécialité du professeur). Il n'y a pas de préparation générale à un Diplôme d'Etudes Approfondies (DEA), mais on y prépare des Thèses de Troisième Cycle.

Paris VII:

On y prépare un Diplôme d'Etudes Approfondies "traditionnel" (?)

Université de Paris VII:

L'enseignement porte sur les théories mathématiques avec application à la cosmologie: groupes d'isométries, théorie des distributions et application à la théorie des ondes gravitationnelles, théorie de la morphogénèse et de la stabilité structurelle. Il n'est suivi, cette année (1975/76) que par 3 étudiants.

L'enseignement de 3<sup>ème</sup> cycle d'Astrophysique a été supprimé dès 1970 faute de débouchés suffisants pour les étudiants. Cependant un enseignement de 3<sup>ème</sup> cycle intitulé "Traitement de l'Information Optique" mention "Application à l'Observation Astronomique" a été créé en 1975. Il porte sur la Formation des images (12h); l'Acquisition et traitement de l'information dans les images (18 h.); Optique statistique classique (24h); Application de l'Optique statistique au traitement des images (6h); Traitement de l'information optique en infra-rouge (12h). Il y a en 1976 sept étudiants. On espère que ces étudiants trouveront des débouchés en dehors de l'Astronomie (étude des ressources terrestre; microscopie électronique: biologie; télécommunications; technologie des tubes-images; technologie infra-rouge).

Université de Paris VI:

Il existe un DEA d'Astronomie et de Mécanique Céleste.

Université de Paris XI:

Il existe un DEA d'Astrophysique. Cet enseignement est suivi par 15 étudiants environ. Il est rattaché au Laboratoire d'Astrophysique de Meudon (LAM).

Collège de France:

L'enseignement dispensé au Collège de France ne prépare à aucun examen et n'est sanctionné par aucun diplôme. Il est toutefois suivi par de nombreux auditeurs et ses séminaires comptent de nombreux participants. Les principaux thèmes abordés au cours des années 73-76 ont été: Les abondances des éléments dans l'Univers; Les propriétés dynamiques des régions H II; Problèmes posés par les champs de vitesse dans les atmosphères stellaires; La Physique des étoiles Ap; La constante de Hubble.

Annexe:

L'enseignement d'Astronomie fait partie d'un DEA de "Géophysique et Sciences spatiales" et comprend un enseignement d'astrophysique générale; un cours sur le Champ de gravité et structure interne de la Terre et des Planètes; un cours de Physique stellaire et un cours d'Astrophysique des hautes énergies.

ANNEXE DIVERS

En plus des enseignements d'Astronomie mentionnés ci-dessus il convient de signaler:

- Les enseignements dispensés en vue de la formation des enseignants des lycées et collèges. Ces enseignements sont dispensés par l'université de Paris VII (Halle aux Vins). Il s'agit essentiellement d'un "recyclage", suivi par 30 "étudiants" environ. Un enseignement analogue existe à l'université de Lyon (où il n'est pas annuel).
- Les enseignements d'astronomie dispensés sous la forme de "cours libre" d'initiation à l'Astronomie. Cet enseignement est organisé par l'université de Paris VII (Halle aux Vins).

ANNEXE

Comme on le voit les enseignants français ont déployé au cours des trois dernières années une très grande activité, saisissant toutes les (rares) occasions offertes par diverses réformes de l'enseignement secondaire et supérieur en France. Ces efforts ont été contrecarrés par le caractère facultatif des enseignements. Il faut aussi regretter le caractère nettement "pointilliste" de la plupart des enseignements du second cycle, insuffisamment généraux, et reflétant par trop la "spécialité de recherche" du professeur. On peut se demander également si l'absence de "troisième cycle" dans certaines universités sous le prétexte du manque de débouchés dans la conjoncture actuelle se justifie dans une perspective à long terme. Dans ce contexte l'initiative de l'université de Nice est particulièrement intéressante. Il faut enfin souligner l'admirable dévouement de certains maîtres du GS 12 qui se sont mis à la disposition de l'enseignement

\* \* \*

GERMAN FEDERAL REPUBLIC

H. Scheffler

Teachers' Training

Education in the German Federal Republic is in the responsibility of the federal states. Therefore, success of efforts to include Astronomy in the training of future secondary school teachers varies from one federal state to another. In Nordrhein-Westfalen, Astronomy is now accepted as a regular subject for students of the teachership. Astronomers of the Ruhr-Universität Bochum have developed a detailed study plan. (For further information see: Th. Schmidt-Kaler and R. H. Giese, Sterne und Weltraum, Vol. 12 (1973) p. 217). In other federal states (e.g. Baden-Württemberg; Niedersachsen) the introductory courses in Astronomy and Astrophysics for Physics teachers mentioned in the report of 1970-73 were continued.

Secondary Schools

Curriculae for Astronomy at secondary school level were worked out by teachers and professional astronomers in Baden-Württemberg and in Nordrhein-Westfalen. In the secondary schools of Nordrhein-Westfalen Astronomy now can be taught as a regular subject while the pupils of the higher classes at secondary schools e.g. of Baden-Württemberg may choose Astronomy as an optional subject. Also at some private schools Astronomy has been introduced in a similar way for higher classes.

Lectures and courses for secondary school pupils are offered continuously at the public universities and, in particular, at the planetaria of the cities.

General Public

Educating of the general public in Astronomy has been continued by the planetaria and the public universities.

\* \* \*

GREECE

L. N. Mavridis

Greece has a very long tradition in Astronomy. This fact is clearly reflected in the very wide representation of Astronomy in the entire Greek educational system.

## 1. Elementary and Secondary Schools.

In the Elementary Schools Astronomy is included in the Integrated Science Courses.

In the Secondary Schools on the contrary there is a compulsory one-hour per week course in Astronomy during the last year. This course is taught by the mathematics or physics teachers.

## 2. Universities.

A total of seven Departments of Astronomy existed in the Greek Universities in the year 1975, i.e.:

- 2.1 University of Athens, Faculty of Sciences
  - 2.1.1 Department of Astronomy
  - 2.1.2 Department of Astrophysics
- 2.2 National Technical University of Athens, Faculty of Rural and Surveying Engineering.
  - 2.2.1 Department of Astronomy
- 2.3 University of Thessaloniki, Faculty of Sciences
  - 2.3.1 Department of Astronomy
- 2.4 University of Thessaloniki, Faculty of Engineering, Division of Rural and Surveying Engineering
  - 2.4.1 Department of Geodetic Astronomy
- 2.5 University of Patras, Faculty of Sciences
  - 2.5.1 Department of Astronomy
- 2.6 University of Ioannina, Faculty of Sciences
  - 2.6.1 Department of Astronomy

Besides these Departments of Astronomy the following Astronomical Research Institutions existed in Greece in 1975:

- 2.7 National Observatory of Athens, Astronomical Institute
  - 2.7.1 Athens Observatory
  - 2.7.2 Penteli Observatory
  - 2.7.3 Kryonerion Observatory
- 2.8 Academy of Athens
  - 2.8.1 Research Center for Astronomy and Applied Mathematics
- 2.9 University of Thessaloniki, Faculty of Engineering, Division of Rural and Surveying Engineering.
  - 2.9.1 Stephanion Observatory.

All undergraduate students of the Faculties of Sciences with major in Mathematics or Physics have to take one or more courses in Astronomy. Also all undergraduate students of the Faculties of Engineering with major in Surveying have to take one or more courses in Astronomy. No first degree with major in Astronomy is awarded by the Greek Universities. On the contrary all Greek Universities award PhD degrees with major in Astronomy. The necessary research work is being carried out in the corresponding Departments of Astronomy or in the Astronomical Research Institutions mentioned above.

### 3. Adult Education.

Many measures have been taken for the astronomical education of the public including:

- 3.1. The open houses of the Evgenidion Planetarium in Athens, a Modern Zeiss Planetarium,
- 3.2. The open houses of the different observatories,
- 3.3. The public lectures on Astronomy through the radio and television,
- 3.4. The public lectures on Astronomy organized all over the country by the numerous local educational societies.

\* \* \*

## ITALY

M. Rigutti.

### The University.

The number of position of professor in astronomical subjects has been considerably increased (from 15 to 24). This number will be increased again during next years. This is not the total number of persons involved in teaching astronomy at the university level because there are many more people engaged on a temporary basis (usually, they are researchers of astronomical observatories).

### Elementary and Secondary Schools.

Very little astronomy is taught at the elementary school level, just a bit more during the first years of secondary school. Some astronomy is taught at the last years of secondary school as part of geography and physics. No special courses in astronomy are given in these kind of schools.

However, the curricula of the secondary schools are now under consideration for change. It is very likely that the structure of the Italian



secondary School will be changed, including a shift from 14 to 16 for the upper age limit of compulsory education

This fact is, of course, a matter for many discussions at political and trade-union levels, and among teachers of the universities and secondary schools to find out appropriate curricula. Some of the schemes already prepared as proposals take into account astronomy also at the secondary school level. Astronomy is usually seen as a good way to teach some parts of physics but it is also considered as an optional subject.

In the last years astronomy was introduced in the curriculum of an experimental secondary school in Rome. It was an optional subject. Some fifty (25% of the total number) of students chose this subject. The Harward Project Physics Course was taken as a basis for that course.

Astronomy is also currently taught in other secondary schools, e.g. at Rovereto (Trento), Modena, Pontedera (Pisa), Turin, etc., but only as a personal choice of the teachers. The Eratosthenes method for measuring the radius of the Earth was used by two teachers working at Rovereto and in Rome respectively; a pyrhelimeter was built by students at Mantua and measurements of the solar constant was used to introduce stellar energy; an astrolabe was built at Modena; several sun dials were constructed in schools of different cities, and several simple instruments for basic astronomy were built at Cagliari and Naples.

In conclusion the interest in astronomy seems to be growing among secondary schools teachers. This is due, at least partially, to an increased interest in astronomy among the young students. As a consequence a larger demand for astronomical knowledge comes from teachers to universities and observatories.

In September 1974 the Naples Observatory organized a summer school in astronomy for science teachers of secondary schools which had very good success. This opened many Neapolitan schools to astronomy. Since then the observatory is visited, almost every school day, by groups of students accompanied by their teachers and the observatory has become a spot for one afternoon meeting of teachers to discuss teaching problems. At present, a possible programme of activities in 1976 is under consideration.

Similar activities are developed at the Cagliari Observatory. Meetings with secondary schools teachers to discuss astronomy teaching problems were

organized. Suggestions were given to clearly divide science in secondary schools into biological and a-biological sciences, and to organize special courses to prepare teachers. A programme of science teaching for pupils at the elementary and first years of secondary school level was prepared. This programme is based on some few centres of interests (the Sun and its influence, motion problems, structure of matter, motion of the Sun, seasons).

Activities of this kind, even if not so heavily, are developed also by other Observatories and some university physics Departments (e.g. the ones at the University of Pavia and Turin).

An experiment of astronomy teaching at the elementary school level (pupils aged from 8 to 11) began in 1975 in Naples. M. Rigutti and M. A. Santaniello (a secondary school teacher of mathematics) interested in this experiment three classes of the third grade (age: 8 years), about seventy pupils in all, boys and girls, with different kinds of cultural background and coming from different family conditions. Neither the three teachers nor the pupils are asked to work extra time. Astronomy is put into the normal school activities. The programme is very simple (motion of the Sun) and has to be developed through three years. However, it is used also as a point of interest and starting from it many other activities, like mathematics, geometry, geography, botany, drawing, painting, written reports, etc., are developed. Observations, data collections, and discussions are used to reach knowledge together. The response of the pupils has been enthusiastic. The teachers assure that the average performance of their pupils is substantially raised and that also pupils with difficulties in writing came out and actively took part in discussions and, generally, in the work.

In this two last years the activity in this field of the Italian Astronomical Society is very considerably increased. The I.A.S. organized:

- i) a round table at the University of Bologna to discuss general astronomy teaching problems (April, 1974);
- ii) a meeting in Rome for university teachers and astronomers to discuss astronomy teaching at university level (June, 1974); about fifty persons were present;
- iii) a two days meeting with more or less the same subject (what to teach, how to teach) at the planetarium in Milan; (April, 1974) more than one hundred persons were present;

- (iv) a three day seminar at Torre del Greco (near Naples) to discuss the same subject in view of a possible reform of our secondary schools; about sixty persons from many regions of Italy attended the seminar (June, 1975);
- (v) a five day workshop at Soresina (near Cremona) for secondary school teachers; about sixty persons attended this meeting (September, 1975) groups were formed which will develop particular experimental teaching projects during the current school year.

In the seminar of Torre del Greco and in the workshop of Soresina the Ministry for the Public Education was also involved.

Besides these activities, the I.A.S. together with the Italian Physical Society organized a round table (at least two hundred people present) on the problem of the inclusion in some way of astronomy in the curricula of secondary schools. The round table was in the programme of the annual meeting of the I.P.S. (October, 1974).

The activity and the initiatives of the I.A.S. in the field of teaching was also discussed at a national meeting of science teachers of secondary schools (Salice Terme - near Pavia - May, 1975). During this meeting the role of the university was considered and discussed. More than three hundred persons attended this meeting.

In this way, i.e. involving many people in different parts of Italy and through the organization of national meetings and workshops, the I.A.S. hopes to really spread the interest to astronomy and to call the attention of teachers on the various aspects of astronomy which can be used to teach mathematics, physics and other natural sciences.

Besides that, from 1975, the I.A.S. has published a new journal (the "Giornale di Astronomia) which is directed especially to teachers, students and amateurs. Many secondary schools and other cultural institutions have already subscribed.

Other activities in favour of astronomy in the School have gone ahead. In particular, the construction of a public astronomical observatory at Soresina (near Cremona) is to be mentioned. All the schools of the area have the opportunity of using this observatory as one of the school facilities. Of course, also the general public may visit the observatory and look to the sky. Various cultural activities are organized at the observatory. This is the first Italian

institution of this kind for which public money was used.

General public.

Various elementary courses in astronomy have been broadcast on radio and TV. Several observatories organize visits and lectures for the general public.

\* \* \*

JAPAN

N. Owaki.

The University.

Advanced courses of astronomy and astrophysics are given in departments of astronomy of three universities and in some of the departments of physics of other universities. Most of them have both graduate and doctorate courses. In most general education courses, and in most universities of education (teachers college, of which students are to become teachers of elementary and secondary schools) basic astronomy is presented. Some students to become teachers of science can select more advanced course. Situations of astronomical education in the general course and teachers college were surveyed by K. Kiyonaga, Osaka Education University (Astron. Herald, Astron. Soc. Japan, 67, 382, 1974; in Japanese).

Elementary and Secondary Schools.

1. Nationally formulated "Course of Study" defining the minimum standards for public education was revised. The revision came into effect for elementary schools in 1971, for lower and upper secondary schools in 1972 and 1973, respectively. At the revision emphasis was laid on development of scientific concepts in children and pupils by having them acquire scientific methods and attitudes through their own inquiry on nature from daily observation or experience.

1) In elementary school the subjects are: light, heat, figure and diurnal motion of the sun; motion, figure and phase of the moon; position, diurnal motion, brightness and colour of stars; figure and motion of the earth. 2) In lower secondary school the subjects (The Second Field of Science) are: the universe surrounding the earth, i.e., figure, dimension of the earth, moon and sun; their distances; apparent and real motion of the sun, earth and planets; universe inside and outside of the solar system. 3) In upper secondary school, pupils can select the courses either "Earth Science I", "Earth Science I and II", or

Basic Science". In the course I basic concepts of celestial environment, i.e. motions of the earth, structure and evolution of the solar system, of stars and of the universe are included, while in II more advanced study is to be made by pupils to deepen their systematic understanding of the subjects. "Basic Science" was introduced in 1973 for pupils, learning from broad standpoint, to understand the natural world integrally. The curricula are more integrated and related to the other field of science. Also "Intensive Mathematics-and-Science" course has been established and opened in some schools to develop more scientific ability for capable pupils. In this course the courses I and II are comprehensively organized.

2. The Science Education Promotion Law established in 1954 for national subsidies for science education was revised in 1973. The quantity per school, quality or standard and items of astronomical teaching equipment have been enriched to meet the development of astronomical education. For example, the numbers of small telescopes for children's use have been increased and a simplified pyrhelimeter has been newly introduced as an item of the subsidy.

#### Science Education Centres.

There are many municipal and prefectural centres of education, most of which have section of astronomical education. The function is to carry out research of improvement of scientific education and in-service training of teachers, and in some cases staffs of centres teach astronomy to children by using planetarium and various models and equipment in relation to school lessons.

#### Activities for Education of Astronomy in Scientific Societies.

A Meeting on astronomical education is held at each annual meeting (twice a year) of the Astronomical Society of Japan. A theme discussed recently is astronomical education in the general course and in teachers college of universities.

At every annual meeting (once a year) of Japan Society of Earth Science Education, a session for astronomical education is held, and lectures by school teachers are presented and discussed by teachers themselves and astronomers.

#### Other Activities.

Study of astronomy and earth science curriculum development for upper secondary school as an integrated earth science course has been carried out

since 1974 by a group of eight astronomers and geoscientists under a subsidy from the Ministry of Education.

General Public.

Basic and popular astronomy lectures are given by several astronomers as regular programme on TV at the levels of upper secondary school and general course of university. Also most science museums and some of children's centres and science education centres are taking part in astronomical education for general public.

\* \* \*

MEXICO

P. Pişmiş.

At the elementary level the astronomy material has been updated and is part of the primary textbooks. It is planned to repeat this effort every few years.

At the secondary level and the primary and secondary teachers' level no new development have been made and the teaching of astronomy is unsatisfactory.

College level - Astronomy is taught to some of the Physics majors (in optional courses). (~ 100 students/year).

Graduate level - At the Universidad Nacional Autonoma de Mexico (UNAM) there is an option of granting M.Sc. and Ph.D. degrees in Physics with most of the curriculum devoted to Astrophysics. At present this channel has not been fully used; only one M.Sc. has been granted under this program.

So far our graduate students in Astronomy have obtained their training at Universities in developed countries and are supported financially through government grants.

Conferences. The Institute of Astronomy of the National University of Mexico has continued its weekly astronomical Colloquia given by local and foreign scientists. This program benefits essentially professional astronomers and advanced students.

As part of the program for adult education, the new founded Museum of Science "Chopo" of the National University of Mexico has carried through a series of 10 lectures covering a wide variety of astronomical topics. These lectures, illustrated by slides have been delivered by the staff of the Institute of Astronomy. The response of the public has been most encouraging.

\* \* \*

NIGERIA

S. E. Okoye.

Astronomy was taught in the University of Nigeria, Nsukka, as part of the Degree requirements in the Departments of Mathematics and Physics between 1960 and 1967 (in the period 1967/70 there was an outbreak of Civil War in Nigeria). No Degrees were, however, offered in Astronomy either as a single or combined degree subject. During this period also, the total number of practising Astronomers consisted of four with three based at the University of Nigeria and one at the University of Ibadan. The Department of Mathematics also possessed a teaching 8" Refractor Optical telescope which was destroyed during the period of hostilities in Nigeria.

At the end of the civil war in 1970, the Departments of Mathematics and Physics in the University of Nigeria were unable to continue with the Astronomy courses owing to lack of staff. This undesirable situation is now being tackled and serious efforts are being made to resuscitate an Astronomy Programme in the University of Nigeria. This time, the programme is to be sponsored by the Department of Physics and it is hoped that actual teaching will begin either in October 1976 or October 1977. The new programme envisages a compulsory introductory Astronomy course for all Physics majors in the penultimate undergraduate year together with a series of courses for Physics majors who wish to take an Astronomy option. Service courses are also being planned for other Departments such as Surveying. Already, arrangements are being made to construct a teaching Radio-Telescope in collaboration with the Mullard Radio Astronomy Observatory at the University of Cambridge in summer 1976 and it is proposed that in due course, an optical telescope will be acquired.

Contacts have also been made with the Federal Ministry of Education in connection with introducing the teaching of Astronomy at the secondary school level. The objective here is to integrate a reasonable amount of Astronomy into the school certificate physics curriculum. A similar approach will also be made to the West African Examinations Council for the consideration of their Syllabus Committee and if all works out well, it is proposed that an orientation course for science teachers would be held in due course for would-be Secondary School Astronomy teachers not only to serve Nigeria, but possibly the entire West African Region.

\* \* \*

NORWAY

Ø. Elgarøy.

In elementary schools astronomy is integrated with the earth sciences, and astronomy is given a limited amount of attention.

A reform has taken place in the secondary schools. Previously lectures in astronomy covered one hour per week during one year. The astronomy course was compulsory for students who had their main subjects in science. Now the course in astronomy will be optional. However, more time is devoted to it, i.e. 2 hours per week during one year.

At the university level a course "Introductory astronomy and astrophysics" was started up in 1972 and has been successful. The course is intended for students who have their main subjects in other fields of science (mathematics, physics etc.) and is most valuable for those who later become teachers in secondary schools. The course is given twice each year and attracts many students. Some astronomy courses are now also given at the University of Tromsø.

Members of the staff at Institute of Theoretical Astrophysics will organize a course for teachers of astronomy in secondary schools in the autumn of this year. The course is intended for those who feel that some after-education is desirable.

In addition to the above activities our professional astronomers frequently act as lecturers for seminars for physics teachers and others, and they also take action to present astronomy in a popular form to a larger public.

\* \* \*

POLAND

C. Iwaniszewska.

The University.

The organization of university studies has been in the last few years strongly connected with teachers training. In view of the re-organization of secondary schools in the near future, all teachers will be obliged to obtain their Master's Degree in different university departments. Many additional undergraduate courses, evening courses, or holiday courses are given for teachers now working at secondary schools, even, if they are already forty or fifty. Astronomy - a basic course - is taught to those who are studying



physics, mathematics or geography; there are however no general courses in astronomy for those who are studying history, chemistry, biology, a.s.o.

#### Elementary and Secondary Schools.

A new organization of basic educational system is being proposed and worked out. In the next few years all children will have to pass through a ten-year obligatory schooling (for pupils aged 6 or 7 till 16) of a general character. Later on they may have some technical training, to be prepared to work in different branches of industry, or do more modern farming, or they can enter two-year preparatory classes before studying at universities. Astronomy will be taught as a separate course one hour per week in the last year of the ten-year school. The programme introduces much modern notions, strongly related to the programme of physics. The final programmes of various subjects in the ten-year school are widely discussed by members of various Polish scientific societies. One ought to add here that all schools in Poland are free of charge and the teachers are being paid by the government. All Polish university observatories try to arrange a closer contact with astronomy teachers in their respective region. Some easy exercises for the pupils are prepared, some lectures are being given. "Urania", a monthly popular magazine of Polish Amateur Astronomers, publishes a series on methodical advice for the teachers as well as practical exercises.

Outside of the national astronomical competition organized each year by the Silesian Planetarium, some smaller, local ones are being organized. Pupils from a region can write some essays on a chosen astronomical subject, and the best papers are being read on a session organized by the Amateur Society.

#### General Public.

The best work in popularization of astronomy for the general public is always done by the Planetaria. The largest of these, Silesian Planetarium in Chorzow, exists now already 20 years; some smaller ones have come into existence quite recently. They have all a large yearly audience, consisting not only of pupils, but also of grown-up people, working in neighbouring institutions, or even tourists visiting the region. All these planetaria are municipal cultural enterprises, not connected with any astronomical departments or universities.

The Polish Astronomical Society organizes, almost every year, astronomical summer schools for students, postgraduate astronomers and - of course - all professional astronomers interested in the selected topic.

\* \* \*

PORTUGAL

J. Osorio.

University.

A few optional courses in Astronomical Subjects exist at university level for students of Mathematics and Physics.

Astronomy remains as a compulsory subject for the degree in Surveying. However, the number of students is rather small.

Elementary and Secondary Schools.

A few aspects of Astronomy are taught as included in regular programmes of Geography.

The number of high school students visiting the Observatories has increased in recent years.

Observatories also collaborate in the preparation of high school teachers through the organization of Vacation Courses.

General Public.

A Planetarium is in operation in Lisbon which is used for Astronomy education of the general public.

Also, Portuguese Television has been used on some occasions to introduce Astronomy to the general public.

\* \* \*

SOUTH AFRICA

A. H. Jarrett.

The current situation regarding the teaching of astronomy in South African Universities is as follows:-

1) Professor E.E. Baart of the Physics dept. at Rhodes informs me that no undergraduate courses in astronomy are available but an astrophysics course is given as part of the Honours degree. There is also a seminar course in astrophysics for M.Sc. students doing radio astronomy. Apart from these intra-

mural courses members of our Department give lectures to schools on astronomical topics as part of the Rhodes School Science Lecture series.

The only astronomical film that we have in our Department is POWERS OF TEN which we obtained from the American Association of Physics Teachers. This film is used quite frequently.

2) Dr. Barry, Planetarium, S.A. Museum, informs me that Planetarium lectures in the S.A. Museum are arranged for school children and the general public. School classes in the age group 11-13 years attend set lectures from January to September. The topics are:-

- (1) The Night Sky - Summer
- (2) The Night Sky - Winter
- (3) Astronomy and Geography.

Lectures to the general public are given over weekends throughout the year and daily during school holiday periods. Lectures to students are normally only by special request. A staff of twelve part-time lecturers is available.

3) Prof. Ellis, Department of Applied Mathematics, University of Cape Town informs me that his department of Applied Mathematics teaches many courses relevant to astronomy. The only direct teaching in astronomical areas is an honours course which deals with understanding of (a) cosmology, and (b) gravitational collapse situations.

4) Dr. B.L. Fanaroff, Department of Physics, University of the Witwatersrand, Johannesburg informs me that astronomy teaching at the Witwatersrand University is offered as two courses. There is a one year undergraduate course which is open to all students. This is taught by members of both the Applied Mathematics and Physics Departments, under the auspices of Applied Mathematics.

The undergraduate course covers:-

- (a) Mathematical astronomy
- (b) Elementary astrophysics (e.g. atomic physics, electromagnetic radiation).
- (c) Modern astronomy (e.g. star and galaxy formation; galaxies, cosmology, stellar evolution).
- (d) History of astronomy.
- (e) Planetarium courses on recognition of stars and constellations. This is taught by the planetarium staff and covers one double lecture per week for the whole year. Incidentally a 5-inch refractor, with a dome, is being renovated and will be available for use by students and lecturers.

The Honours course in 1976 will be on High Energy Astrophysics. It will deal with theoretical results in high energy physics and the situations in which they are of interest.

The Planetarium houses a Zeiss Mark 3 projector. Lectures are given to the public on five nights and two afternoons each week. Additionally there is a five lecture course on basic astronomy available to the general public each year. Also there are approximately nine talks given each week to school groups - these cover various aspects of basic astronomy at a level appropriate to the age group. Courses in direction finding and basic astronomy are given to youth groups approximately twice per year.

5) Prof. Stoker, Physics Department, Potchefstroom University, informs me that although there are no astronomy courses as such in any of the Departments at Potchefstroom University, there are courses related to astronomy given in his Physics department. For example in the Physics III a ten-hour course is given on cosmic rays, the sun, the interplanetary medium, and the interstellar medium, as far as these are related to the propagation of cosmic rays and their origin.

For honours and post-graduate, there is a thirty-hour course on plasma physics, which in its applications, is heavily biased towards astrophysics.

The research activities of the department concern the modulation of cosmic rays and is partly aimed on studies of propagation of cosmic rays through the interplanetary medium. Already significant contributions in this respect have been made to the parts of astrophysics related to the spatial region of interplanetary space in our immediate vicinity.

6) Prof. Warner, Astronomy Department, University of Cape Town informs me that the following courses in astronomy are given in his department.

(1) Second year level: (to follow Physics 1 and/or Maths 1)

Half course: Astronomy (a) - Historical, physical and descriptive

Half course: Astronomy (b) - Mathematical.

(2) Third year level:

A half course in astrophysics, starting in 1976, which can be taken as an option with Physics III. The subject matter of this course will be Stellar atmosphere and structure, interstellar matter, radio-astrophysics.

(3) Fourth year (Honours) level:

This is a one year advanced level course comprising topics selected from options in Physics, Applied Mathematics and Astrophysics.

(4) M.Sc.:

This is a one to two year course with advanced lectures. However it is generally examined by research thesis.

(5) Ph.D:

Examination by thesis.

Planetarium activities:

Two members of the department staff have participated in the programme of popular shows presented at the Planetarium of the S.A. Museum in Cape Town.

Extramural Lecture Courses:

Prof. Warner delivers twenty evening lectures each year. In addition he presents five - ten public lectures during Summer Schools.

Dr. A. P. Fairall has given ten lectures on "Extragalactic Astronomy".

Extramural Activities:

All the staff members of the Department of Astronomy play an active role in the Astronomical Society of Southern Africa:-

Prof. B. Warner: Vice-President - July 1975 -

Dr. P.A.T. Wild: Editor of MNASSA, the Society's journal 1968-1975  
Editor, MNASSA Summary Volume, 1973 -  
Vice-President, July 1974 - July 1975  
President, July 1975 -

Dr. A.P. Fairall: Editor of Society's Handbook, 1965-66, 1971-75  
Council Member 1971-72  
Chairman of Cape Centre of the Society, 1965-66

Prof. A.D. Thackeray: President 1951 - 52  
Council member 1951 -  
Editor of MNASSA 1975 -

7) Department of Astronomy, University of the Orange Free State.  
Undergraduate courses are given by Prof. A.H. Jarrett to Physics students at third year and Honours levels on selected topics of astrophysics. Additionally courses of lectures have been given by Prof. Jarrett in the Physics Department

on physical optics.

Post-graduate course: Ph.D: examination by thesis.

Extramural Activities:

Each year a course of lectures on popular astronomy has been given by Prof. Jarrett which is open to all members of the University and the general public. From time to time courses on selected aspects of popular astronomy are given - e.g. "Old Thoughts and Recent Developments in Astronomy" delivered to the medical faculty of the University.

Prof. Jarrett was President of the Astronomical Society of Southern Africa 1971 - 72.

\* \* \*

SWEDEN

Aa. Sandqvist.

Elementary and Secondary Schools..

The child in Sweden normally begins school when he is seven years old, often having spent a year or more in some sort of kindergarten beforehand. In his first three school years he takes a course in "regional studies". This is an integrated course dealing with the child's experience of science and society. Astronomy comes into the picture through simple presentations of the seasons of the year, the clock, the almanac and so on. In school years 4 through 6, the child takes "natural science", amongst other courses. One seventh, or 37 hours, of this integrated course deals with physics and here a slight amount of astronomy is also taught, the actual amount depending mainly upon the interest of the teacher. In school years 7 through 9, about 20 hours of astronomy is taught inside the frame of physics. Teachers are encouraged to teach natural sciences in form of an integrated science curriculum, but presently only 20% of the teaching takes place in the form of integrated science due to psychological resistance amongst the teachers and the threat of more work. In school years 10 through 12, which are not compulsory, astronomy is amply represented through examples of application of physics.

Both radio and television are being used to introduce astronomy into the schools and programmes have proven to be popular. Also, we have in Sweden an "apprentice" system in which students at both the middle and high school level have the opportunity of working at an observatory for a couple of weeks, if they choose astronomy as their field of "apprenticeship". This is so popular that we have had to put limits on the number of students that may choose astronomy.

The University.

In the fall of 1977 a major reform of the Swedish University system will take place. It is hoped that this reform will effect an equalization of the possibilities that members of different social classes may have of attending universities and furthermore strengthen ties between society and higher learning. To accomplish this the universities are being reorganized administratively and at the same time are being opened up to everyone who is at least 25 years old and has four or more years working experience (includes housewives and househusbands). A major emphasis is placed on the possibility of returning to university several times during a lifetime for the updating of knowledge or the continuation of a course of study. Also, job- or career-oriented curricula will receive high ratings of importance.

With a watchfull eye towards these developments, the institutes of astronomy in Sweden enacted in the fall of 1975 their own countrywide reform of the astronomy courses offered at the university undergraduate level. The previous system, described in the First IAU Commission 46 Report (ed. E. A. Müller, 1970), emphasized a course of study which lead mainly to graduate studies in astronomy, but the new system (which can be used to reconstruct the old system) opens up astronomy in package-format to (i) other disciplines such as physics, chemistry and mathematics (ii) other faculties such as arts and the social sciences and (iii) the general public.

The system consists of 21 courses each of which is worth 5 points (one point corresponds to one week of full-time studies and one year's full-time study normally results in 40 points). A course is most often given at half-speed, lasts 10 weeks and can be read in parallel with another course. The student may acquire anywhere from 5 to 60 points of astronomy depending upon his interests and completed prerequisites; to begin graduate studies in astronomy an undergraduate degree of 120 points, containing 60 points of astronomy (which may not include courses 19-22), must first be obtained. The courses and their prerequisites are given in the following table:

<u>No.</u>	<u>Name</u>	<u>Prerequisites in Mathematics &amp; Physics</u>	
		secondary school	
1.	Outline of astronomy	"	"
2.	Introduction to astronomy	"	"
3.	Instrumental technique	"	"
4.	Astrophysics	"	"
5.	Galaxies	"	"
6.	Spherical and practical astronomy		
		university	
7.	Advanced instrumental technique	"	
8.	Celestial mechanics	"	
9.	Physics of the planetary system	"	
10.	Stellar atmospheres	"	
11.	Stellar structure and evolution	"	
12.	The Milky Way system	"	
13.	Physics of the interstellar medium	"	
14.	Stellar dynamics	"	
15.	Cosmology		
		variable	
16.	Special topics 1	"	
17.	Special topics 2	"	
18.	(Administrative jugglebox)		
		no prerequisites at all	
19.	Orientation in astronomy		
20.	Historical development of concepts of the universe	"	
21.	The structure of the universe	"	
22.	Special topics 3	"	

Course 1 is intended predominantly for school teachers of physics and astronomy, course 16, 17 and 22 have flexible content and may deal with topics of special or current interest e.g. origin of the elements, a research project, or life in the universe. The prerequisites in mathematics and physics at the university level are generally 20 and 40 points, respectively, but the astronomy courses may usually be taken without any other course in astronomy being a prerequisite. (This excepts the astronomy student who wishes to take 60 points and go on to graduate studies; he is advised to take the courses in a loose order.) The aspired result of this scheme is e.g. that an advanced physics student may take course 11, a chemistry student course 13, or a mathematics student course 8.

The new system is still in its first term of existence and it is thus



too early to draw any conclusion about its success. Furthermore, we must wait for the more general university reform to take place in the fall of 1977 before we can really assess the long-range effects of our astronomy reform. However, we can report a tripling of the number of university students in astronomy in Sweden since 1974, - mainly as a result of the introduction of courses 19-22, - which is certainly a good start.

The graduate program in astronomy has not changed significantly since 1970 and I refer the reader to the First IAU Commission 46 Report (ed. E. A. Müller, 1970) for a description of this program.

#### General Public.

Attempts to reach the general public on a large scale are under way through present negotiations with Swedish Television for the creation of an elementary course in astronomy consisting of about 10 half-hour programs. This kind of extension course is especially desirable in a country like Sweden with its large regions of sparse population. Strenuous efforts are also being made to bring a major planetarium to Stockholm. Public showings of all the observatories are extremely popular and in a number of places "folk observatories" have been constructed for the sole purpose of satisfying the curiosity about the universe latent in all of man - and woman.

\* \* \*

#### SWITZERLAND

B. Hauck.

#### The University

The Swiss Society of Astronomy and Astrophysics has continued to organise advanced courses each year at Saas-Fee. The courses on specific topics are mainly intended for European graduate astronomers and physicists. The following courses were held:

1. Dynamical Structure and Evolution of Stellar Systems

2-7 April 1973

Lecturers: G. Contopoulos, M. Henon, D. Lynden-Bell.

2. Magneto-hydrodynamics

1-6 April 1974

Lecturers: L. Mestel, N.O. Weiss, F. Meyer (text not published).

3. Molecular astrophysics

17-22 April 1975

Lecturers: A. Dalgarno, R.W.P. McWhirter, S. Sahal.

The proceedings of these courses are published (1, 2) or are in preparation (3). They may be obtained from the Geneva Observatory. The 1976 course will almost certainly be devoted to the following topic: External Galaxies.

#### Elementary and Secondary Schools

A great effort for the "formation continue" of teachers of both degrees was undertaken both at Geneva and Lausanne.

An elementary course on astrophysics was given at Lausanne and Geneva for primary school teachers. Courses for teachers of physics were given in 1973 and 1975 at Lausanne and in 1974 at Geneva. At Geneva, a course for geography teachers was given in 1973 and one for biology teachers was given in 1975. The principal part of this course was devoted to problems in connection with the origins of life and life in the Universe.

At the national level, the "Centre suisse pour le perfectionnement professionnel des professeurs de l'enseignement secondaire" at Lucerne organised a course in 1974 (Radioastronomy, lecturers: M. Grewing and J. Lequeux).

A leaflet ("Quelques applications simples des lois physiques en astrophysique") was prepared by Dr. A. Maeder, Geneva Observatory, for teachers of physics.

Other courses were given, principally in the form of practical work and seminars, at the Calina Observatory at Carona (Tessin).

Finally, mention should be made of the work of W. Meier, Aarau, who has prepared a leaflet on "Astronomie auf der Oberstufe der Volksschule".

\* \* \*

#### UNITED KINGDOM

A. J. Meadows.

A most significant advance during the past three years has been the establishment of the RAS Education Committee. During its initial period, this Committee has been concerned both with enhancing the quality of astronomical education and with increasing the amount of cooperation between different groups interested in educational aspects of astronomy. Under the first heading, especial note may be made of the award of a grant by the Nuffield Foundation to the RAS for the preparation of unit courses in astronomy. These courses, which

are being developed by a number of groups at U.K. institutions of higher education, are intended to be used in the training of future school-teachers. The courses are designed to help encourage the ever-growing interest in astronomy at the school level. It has become equally evident that many students welcome the introduction of some astronomy in degree-level courses; so there has been an appreciable recent increase in the amount of astronomy taught in institutions of higher education, too.

Collaboration has manifested itself in a number of ways. One of the most valuable has been the initiation of occasional meetings between representatives of all the national societies in the U.K., both professional and amateur, that are primarily concerned with astronomy and space science. It is clear that such meetings will be especially useful for the exchange of ideas on education. A beginning has also been made on collaborative discussions with museums concerning their astronomy exhibits, and the role of planetaria in education is receiving more attention than hitherto.

The overall impression of educational activity in U.K. astronomy must be that it has increased in amount and has widened in scope since the last IAU meeting.

\* \* \*

UNITED STATES OF AMERICA

T. L. Swihart.

Astronomy education in the United States takes many forms and is conducted by many individuals and organizations. Many hundreds of planetariums are in operation in connection with high schools, colleges, municipalities, and private corporations. Every population centre has one or more astronomical groups, and there are a number of professional-amateur organizations, such as the Astronomical Society of the Pacific, which offer educational opportunities to teachers and to the public.

The main professional organization, the American Astronomical Society (AAS), also sponsors education in astronomy at all levels. It provides funds for the Harlow Shapley Visiting Lectureship programme, in which astronomers spend two days consulting and giving lectures at colleges which have no regular astronomy programme of their own.

Most of the educational activities of the AAS are carried out by the Task Group on Education in Astronomy (TGEA). This was established by the AAS

in 1972 to replace an earlier Committee on Education in Astronomy. TGEA has been under the direction of Dr. D. Wentzel of the University of Maryland, and its activities have included the following: putting out an annual newsletter, setting up special AAS sessions on education, establishing and publicizing a roster of astronomers available for consulting on education matters, printing an astronomy course syllabus booklet, writing special brochures on astronomy for high schools (supported by NASA), obtaining a grant from the National Science Foundation for a number of educational projects, plus the encouraging of astronomy education in as many ways as possible.

\* \* \*

UNION OF SOVIET SOCIALIST REPUBLICS

E. V. Kononovitch.

After this report had been completed an unexpected and sad event came to pass. On the 19th of November 1975 Professor S.B. Pikelner suddenly died at the peak of his brilliant and fruitful scientific career. The world had lost one of the most productive astrophysicists. It also lost a brilliant teacher. Formally, Prof. Pikelner was not a member of the Commission 46, but a very large part of his activity directly concerned the problems of astronomy education. His lectures combined informativity and simplicity, his popular books treated the most difficult problems in ordinary words and his scientific papers, we dare to say contrary to many others, were easy to understand.

His interests comprised the most serious problems of modern astrophysics concerning properties of all cosmic plasma species from the solar corona up to coronae of distant galaxies. Cosmic electrodynamics, physics of interstellar medium, star formation, evolution of galaxies, cosmic rays and even quarks are only part of his successful work. And above all this he had proved better than anyone else - H. Plaskett's words: "A proper study of astronomy - kind is the Sun". Never did he forget to return to the most important solar problems: dissipation of the corona, structure and heating of the chromosphere, nature of active regions, origin of spicules and prominences, mechanism of flares. That is why his personal activity in various fields of astrophysics has high pedagogical significance. Although he had been teaching for less than two decades he succeeded in educating a large number of students and young astrophysicists.

Report of the National Committee.

Educational problems are of prime importance in the Soviet Union and Astronomical Education is not the least among them.

Astronomical Education is the purpose of activity of several public national organizations, the main of which are:

1. Astronomical Educational Council (Soviet Podgotovki Kadrov = SPAK, academician V.V. Sobolev being President). The main purpose of this council is the University Astronomical Education, but it also includes sections of Pedagogical Institutes and Schools.
2. Commission on astronomy of Ministry of Education for Pedagogical Institutes (Prof. V.V. Radsievsky being president).
3. Astronomical Commission of Educational Ministry for Schools (E.V. Kononovich being president).
4. National Society of Astronomy and Geodesey (Vsesojousnoe Astronomo-Geodezicheskoe Obshestvo = VAGO). This society is under the auspices of the Academy of Science and comprises both professional and amateur astronomers. VAGO has a section of Education and methodology in astronomy (Prof. V.V. Radsievsky is President of it).
5. Society "Znanie" (Knowledge), running a net of Planetaria in all large and some small towns of the Country.

As to professional organizations besides Universities and Pedagogical Institutes there is Academy of Pedagogical Sciences developing main problems of physical and astronomical education.

A. School Astronomy.

In the Soviet schools astronomy has been a separate item of the curriculum terminating the physical and mathematical cycle of middle education. The main difficulty is a growing discrepancy between the permanent enlarging of fundamental scientific information and small teaching time (only 35 hours) allotted to astronomy in the last school class. The increasing of importance of astronomy in our days is enthusiastically acknowledged by our Ministry Authorities but the other sciences also have their own problems and it seems impossible to revise the distribution of teaching time.

Soviet teachers are trying to find the solution of this problem in enlarging and strengthening interscience connections in the school programme.

Possibilities of certain items of the school programme should be used

to help others make a system of mutual help between different sciences, to incorporate more necessary information, to concentrate special attention on the most fundamental problems of modern science. As for astronomy, now it is just the time to revise the classical type of astronomy school programme to make it adjustable to modern explosion process of astronomy development of our days. All parts of human life seriously need some knowledge of modern astronomy, its ideas and conceptions.

The School commission has begun to solve this difficult problem. Some improvements have already been introduced into the current school programme.

Several draft programmes are being discussed. A similar discussion was initiated in 1975 by some periodicals e.g. "Zemlia i Vselennaia" (Earth and Universe).

The School commission also discussed the problem of text book improvement. A special symposium on this problem was organized on the occasion of the 400 years anniversary of the first Russian printed text book (it was an ABC). The standard school astronomy text book was revised and prepared for a 2nd edition. It will be published in 1976.

A collective monograph on school astronomy methodology has been published. It covers concrete lesson plans, recommendations for teachers, difficult topics, typical problems and some additional material very plausible for teachers.

There is also a concise course of astronomy in our professional technical colleges. Methodology for such a course was published in 1974 by E.P. Levitan.

Overall Chapters on Universe and chief astrophysical ideas are included in the programme and text book on physics for technical high schools.

Besides the compulsory standard astronomy course in the 10th class of the high school, in some cases optional courses have been introduced. "Physics of Kosmos", "Astronautics". The latter is covered by the book on Beginnings of astronautics published by A. D. Marlenskiĭ.

#### B. University Astronomy.

An impressive description of traditional specialized astronomy education

system has been prepared by Professor V.V. Ivanov for the West German Journal "Exact". About 20 Universities in our country give to about 200 of students the possibility to become astronomers. Other students of Physics departments of Universities usually have a general course of Astronomy or Astrophysics. For them SPAK has compiled a new programme.

Different discussions of General Astronomy Course programme have suggested that its general form depends specifically on modern astronomy as science and should be identical for all levels of education. The main differences lay in the volume of information. The university Text book on General Astronomy was published in the 3rd edition, and translated into French. B.A. Vorontsov-Veljaminov published the 6th edition of his famous Astronomical Problems.

#### C. Astronomy in Pedagogical Institutes.

Up to now specialisation in physics and astronomy exists only in Gorky Pedagogical Institute thanks to Professor Radsievsku's activity. But it was decided to open such specialisation in about ten other pedagogical Institutes in the near future. So the educational plan compilation, programme development and text-book revision are the main tasks of Ministry of Education, Pedagogical Institute commission.

The 2nd part of recently (1975) late B.A. Volunsku' "A Short General Astronomy Course" is published.

#### Commission 46 projects.

Contratype Project was realised in the end of 1975 through limited number of a 35 = mm slide series, consisting of 6 original solar items, including stratoscope pictures of granulation, sunspot spectroheliograms in hydrogen and ionised calcium, faculae. The next series is in preparation.

\* \* \*